Comparative Geochemical Assay of Napier and Connestee Ceramic Sherds as a Means to Evaluate Composition and Raw Materials Sourcing

By: Wesley Parrish, Dr. Brett Riggs, & Dr. Shane Schopfer

Faculty Sponsor: Dr. Brett Riggs

Abstract

The Late Woodland period (ca A.D. 650-1000) ceramic ware, Napier, is a consistent, but small minority element of archaeological ceramic assemblages found in southwestern North Carolina. These wares are often used to identify obscure Late Woodland period archaeological components in southwestern North Carolina. This rare distinctive ceramic ware was originally defined and identified in central Georgia, and the origin of Napier sherds found in North Carolina sites remains unclear.

This study takes a geochemical approach to identify the composition of Napier Ceramic sherds and compares the elemental composition of them to more obviously local wares found within the same assemblages. This approach allows for evaluation of the similarities and differences in the clay bodies and aplastic content to be used to distinguish between Napier and Connestee ceramic sherds found within the same archaeological assemblages and identify whether they are composed of geochemically similar materials. Elemental-scale geochemical assays performed with pXRF (portable X-ray fluorescence) on 44 ceramic sherds from two sites (31JK32 [Cullowhee, NC] and 31MA36 [Otto, NC]) are compared using descriptive multivariate statistical techniques to determine if material composition effectively separates Napier sherds from the more common Connestee ceramic ware sherds. A Local (nonarchaeological) clay sample is introduced to serve as a control for clay composition. Discrete compositional classifications for Napier versus Connestee ceramic sherds are evaluated to deduce the origins for Napier ceramic vessels in southwestern North Carolina archaeological contexts.

Parrish, W., Riggs, B., & Schopfer, S. (2022, March). *Comparative Geochemical Assay of Napier and Connestee Ceramic Sherds as a Means to Evaluate Composition and Raw Materials Sourcing* [Poster presentation]. 2022 Research and Scholarship Conference. Western Carolina University, Cullowhee, North Carolina.

Comparative Geochemical Assay of Napier and Connestee Ceramic Sherds as a means to Evaluate Composition and Raw Materials Sourcing

Wesley Parrish, Brett Riggs Ph.D., Shane Schopfer Ph.D.

Department of Anthropology and Sociology and Department of Geosciences and Natural Resources, Anthropology and Geology, and College of Arts and Sciences

ABSTRACT

The Late Woodland period (ca A.D. 650-1000) ceramic ware, Napier, is a consistent, but small minority element of archaeological ceramic assemblages found in southwestern North Carolina. These wares are often used to identify obscure Late Woodland period archaeological components in southwestern North Carolina. This rare distinctive ceramic ware was originally defined and identified in central Georgia, and the origin of Napier sherds found in North Carolina sites remains unclear.

This study takes a geochemical approach to identify the composition of Napier Ceramic sherds and compares the elemental composition of them to more obviously local wares found within the same assemblages. This approach allows for evaluation of the similarities and differences in the clay bodies and aplastic content to be used to distinguish between Napier and Connestee ceramic sherds found within the same archaeological assemblages and identify whether they are composed of geochemically similar materials. Elemental-scale geochemical assays performed with pXRF (portable X-ray fluorescence) on 44 ceramic sherds from two sites (31JK32 [Cullowhee, NC] and 31MA36 [Otto, NC]) are compared using descriptive multivariate statistical techniques to determine if material composition effectively separates Napier sherds from the more common Connestee ceramic ware sherds. A Local (nonarchaeological) clay sample is introduced to serve as a control for clay composition. Discrete compositional classifications for Napier versus Connestee ceramic sherds are evaluated to deduce the origins for Napier ceramic vessels in southwestern North Carolina archaeological contexts.

INTRODUCTION

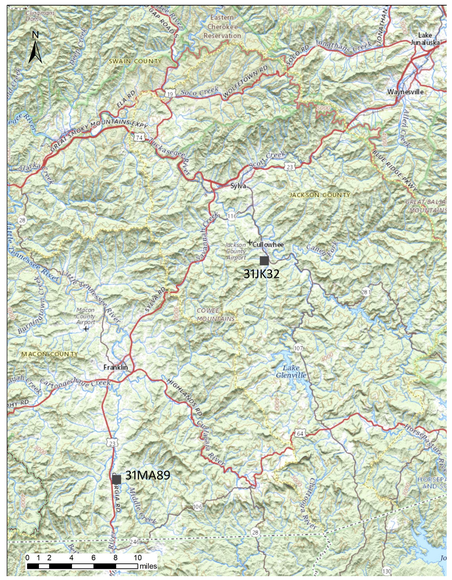
Napier Complicated Stamped ceramic wares are minority elements of Late Woodland period (ca. A.D. 650-1000) archaeological assemblages from southwestern North Carolina. This ware is more common at sites outside of Appalachia in northern and central Georgia. The regional scarcity of Napier ceramic wares might indicate nonlocal production and transport into southwestern North Carolina—evidence of interregional connections. This proposition can be evaluated by comparing the composition of clays used to manufacture Napier ceramic vessels with those of more commonly occurring ceramic wares believed to be of local origin. Because naturally occurring clays from different localities and regions often exhibit markedly distinctive elemental signatures (as a function of different parent materials), gross-scale interregional differences in the composition of ceramic raw materials should be readily apparent to assay.

In this study, we employ pXRF (portable X-Ray Fluorescence) technology to perform rapid geochemical assays of ceramic sherds from two southwestern North Carolina archaeological assemblages. By comparing the elemental compositions of Napier wares with those of locally produced Connestee ceramic wares, we can infer whether these Napier ceramic wares derive from local or non-local sources.

METHODS

The first step of this study involved identification and selection of samples of ceramic sherds from two southwestern North Carolina sites, 31JK32 and 31MA89 (see map). Sherds were assigned to their respective archaeological types based on surface treatments, ware body thickness, and aplastic (temper) composition and density following descriptive definitions of Napier wares provided by Wauchope (1966) and definitions of the Connestee ceramic series provided by Keel (1976). Twelve Napier Complicated Stamped sherds and twelve Connestee series sherds were selected from 31MA36, while ten Napier Complicated Stamped sherds and ten Connestee series sherds were selected from 31JK32.

Additionally, a raw clay sample from Cullowhee Creek adjacent to 31JK32 was introduced into the analysis as a control for a local clay composition. These samples were then subjected to multi-elemental assay using a Niton XL5 pXRF (portable X-ray fluorescence) machine. All the sherds were placed onto a table with the interior surface up. The pXRF was set to mining mode. The pXRF assay of the interior surface of each sherd collected data for 140 seconds.



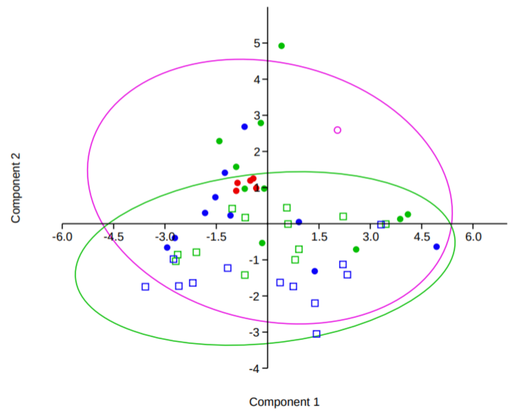
(Figure 1. Map of Western North Carolina Showing the location of 31JK32 and 31MA36)

(Figure 2. Pictures of Napier [Top] and Connestee [Bottom] sherds from 31JK32 and 31MA36)

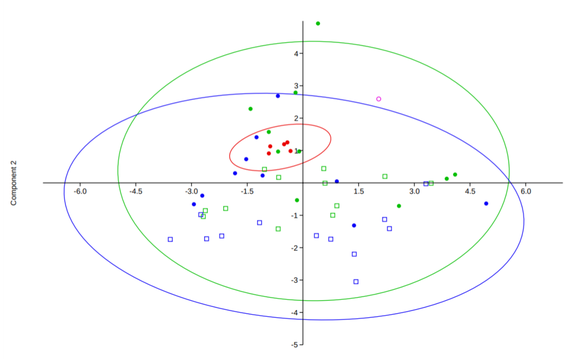
These assays produced a data sheet expressed as proportional representation of constituent elements. Elements read at <LOD (limit of detection) were excluded from subsequent analyses. Remaining detectable elements were selected for further analysis as recommended by Dr. John Millhauser[1] (North Carolina State University) who suggested elements "reliable" for discrimination of clay geochemistry. These elements were identified as Al, Ba, Ca, Cr, Cu, Fe, K, Mg, Mn, Ni, P, Pb, Rb, S, Si, Sn, Sr, Th, Ti, V, Y, Zn, Zr. The multi-elemental data was then subjected to Principal Components Analysis (PCA) using the PAST statistical package to delineate multivariate patterns of clay composition.

Results

Two different biplots graphs illustrate the results of principal components and discriminate analyses used to reduce dimensions of elemental variation. Each form of analysis rendered two primary components of positive and negative correlations. Component 1 strongly correlates with elements K, Rb, and Th which would be a strong representation of clay composition. Component 2 is strongly correlated with elements Ti, Fe, and Mg, these metal elements are associated with the tempering material within the ceramic sherds. The PCA biplot (Figure 3.) is sorted by site. This biplot illustrates significant overlap between the assays from both sites but there is still variation between the two components. This biplot shows that discriminate analysis can identify the correct site of each assay 95% of the time. The purple circle is representative of 31JK32, and the green circle is representative of 31MA36. The large overlap of the two circles indicates both general regional similarity of samples, but specific distinctions at local levels.



(Figure 3. PCA biplot sorted by site. Round dots represent 31JK32, squares represent 31MA36, blue represents Napier, green represents Connestee, pink represents the Cullowhee Creek raw clay sample. The green circle represents the 95th percentile for 31MA36, the purple circle represents the 95th percentile for 31JK32)



(Figure 4. PCA biplot sorted by ceramic type. Round dots represent 31JK32, squares represent 31MA36, blue represents Napier, green represents Connestee, pink represents the raw clay sample. The blue circle represents the 95th percentile of Napier sherds, the green circle represents the 95th percentile of Connestee sherds, and the red circle represents the 95th percentile of undecorated sherds)

The PCA biplot (Figure 4.) is sorted by ceramic type. There are three types represented in the data set, Napier, Connestee, and undecorated. This biplot shows the same orientation for each sherd within the two components but instead shows discriminate analysis results on the differences between the different ceramic types. The discriminate analysis plots illustrates that there is much similarity between the different ceramic types suggesting that all 3 of the ceramic types represented are produced using the same or similar sources of clay.

The result from our experiment indicates that the clay used in the Napier complicated stamped sherds is geochemically similar to the clay used in the Connestee series sherds at both sites, indicating that the clays are not being sourced from extra-local clays.

CONCLUSIONS

pXRF assay and analysis is useful for defining differences and similarities in the clay composition of ceramic sherds. These results provide a proxy measure for similarity or difference in the clay source localities, and can be interpreted to determine if Napier Complicated Stamped ceramics derive from the same sources as demonstrably local wares. With this tool we can generate data that can be used to create PCA biplots that can show the correlations of elements within the ceramic sherds to help determine if clays used in Napier vessels are elementally distinct from those used to make Connestee series vessels. but there is more work to be done to determine whether Napier ceramic sherds are being manufactured from the local or extra-local clay sources. pXRF does a good job of taking geochemical assays of homogenous material, but results can be swayed when looking at nonhomogeneous material such as ceramic sherds. Ceramic sherds by their nature are constructed using two primary materials, clay and aplastic temper. The pXRF assay of sherds reads both clay and tempering materials (primarily quartz and hornblende) and yields a composite result. This conflation can be resolved by separating clays from temper particles as the next phase of analysis.

References

Keel, Bennie
1976 *Cherokee archaeology : a study of the Appalachian summit*. University Of Tennessee Press, Knoxville.

Wauchope, Robert
1966 Archaeological Survey of Northern Georgia with a Test of Some Cultural Hypotheses. *American Antiquity* 31(5).

Acknowledgements

I want to thank Dr. Jane Eastman for her knowledge and use of the Tali Tsisqwayahi Archaeological Collections Facility, and Dr. John Millhauser at North Carolina State University for his knowledge on pXRF analysis. I also want to thank my parents Robert and Melissa Parrish for all their support. Finally, I want to thank Gracyn Webb for pushing me to do my best work every day and supporting me in my journey to become an archaeologist.

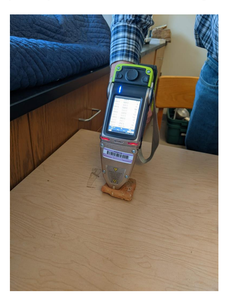


Figure 5. [left] Conducting an elemental assay of one of the sample sherds using the Niton XL5 pXRF device.