Linking Instrumental Neutron Activation Analysis (INAA) with Geology in the Ancestral Caddo Region

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**INTRODUCTION**

Ceramic provenance studies remain the basis of worldwide archaeological research concerned with reconstructing exchange networks, tracing migrations, and informing upon local and regional ceramic economy. Due to the vagaries of Texas geology, traditional geochemical techniques (instrumental neutron activation analysis in particular) have not achieved the degree of success in Texas that they have within other regions.

This analysis deviates from MURR's current method of applying the calcium correction (see Steponaitis et al. 1996:519) to the whole of the Caddo INAA dataset (Ferguson 2007a, 2010c; Ferguson and Glucose 2006; 2007; 2009a, 2009b; 2010c; 2010f; 2012a; Fortes and Ferguson 2010:11), and since the number of shell and bone-tempered sherds remains small, that process is found to be unwarranted due to the overwhelming majority of Caddo sherd being greg-tempered, and "such correction is unnecessary because the greg itself is made of clay, presumably the same clay that composes the rest of the paste" (Steponaitis et al. 1996:519). Certainly one must remain skeptical of shell or bone-tempered greg within the sherds, and the inclusion of ceramic petrography can assist in highlighting shell or bone-tempered greg in ceramic paste (particularly when petrography and INAA are conducted on the same sherds). While the standard suite of multivariate statistics are employed within this analysis, these are augmented with 3D graphs and geographic representations that illustrate the distribution of geochemical data across space.

**RESULTS**

Employing the Geologic Database of Texas via the Texas Natural Resources Information System as a proxy, these data were plotted atop several geologic maps, and it appears that the following elements (lutetium [Lu], dysprosium [Dy], europium [Eu], samarium [Sm], lanthanum [La], lutetium [Lut], tantalum [Ta], terbium [Tb], neodymium [Nd], samarium [Sm], erbium [Er] and zinc [Zn])—all but Ti and Zn are lanthanides—correlate with a spatial division between the Wilcox Group to the northwest and the Claiborne Group to the southeast. In particular, it appears that Claiborne Groups components to the southeast, including the Queen City Sand, the Weches Formation, and the Sparta Sand possess higher values for these nine elements than the silty and sandy clay of the Wilcox Group to the northwest.

The division of these data based upon real measures of geologic variability makes it possible to demarcate—one on a broad scale—between those sherds of local manufacture in the Claiborne Group, and those manufactured from clays within the Wilcox Group within clusters that have minimal overlap. Interestingly, these sherds associated with 418K107—strained atop the Rusk Formation—can be manipulated to plot independently of these two groups, highlighting a high degree of local geochemical variability within the region.

**ABSTRACT**

This poster illustrates the success of a novel method of INAA that was employed to reveal geochemical signatures in Caddo ceramic vessel sherds that correlate with local surface geology. The geochemical data from the sherd assemblage were used within an exploration of potential ceramic provenance, which was successful at demarcating sherd from ceramic vessels made from clays in either the Claiborne or Wilcox Groups. Further geochemical segregation was also apparent between the Rusk Formation in the Claiborne Group, and the Weches Formation in the Wilcox Group. These results point to a high degree of geochemical variability within the East Texas region, which stands in stark contrast with the numerous previous studies that seemed to indicate that the clays in the East Texas region were overwhelmingly homogenous. The analytical gains achieved through using this method seem to highlight an area of Caddo research where significant progress can be made with regard to the interpretation of analytical results in the future.

**CLAIBORNE GROUP**

Looking only at those sherds found to be associated with the Claiborne Group, further segregation can be achieved and point to the addition, perhaps in the form of temper or potentially from runoff, of elements associated with the Weches and Sparta Sand formations. The concentration of Zn and C found in Caddo ceramics increases to the southeast of the site, but more research will be needed to highlight which of the Formations—Weches or Sparta Sand—are contributing the bulk of this dynamic. The inclusion of a petrographic study may help to refine these assignments, particularly if glaesis—commonly associated with the Weches Formation—or perhaps the different inclusions known to occur within the Sparta Sand Formation—fine to medium grained, light to brownish gray quartz sand—and the Queen City Sand Formation—fine grained, grayish-orange to pink quartz sand—are included within that analysis.

**WILCOX GROUP**

In an effort to explore the possible provenance of ceramics determined to have been produced within the Wilcox Group, these sherds assigned to that cluster were further subdivided based upon elemental values associated with Zn, Nd and Dy. Again, petrographic analyses may assist in further clarifying these divisions. Geochemical trends associated with the Claiborne Sand Formation are very fine to medium grained, medium gray, that weather to various shades of brown and red quartz sand with—potentially—ironstone inclusions. The undiluted Wilcox Group is characterized by silty and sandy clay with common ironstone inclusions that are various shades of gray.