Instrumental Neutron Activation Analysis (INAA) of Shell-Tempered Ceramics in the Ancestral Caddo Region: Rethinking Methods

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Caddo INAA and Shell Temper

Pertula et al. (2012) have shown from stylistic and technological analyses of ceramic assemblages across the southern Caddo area that the principal—of not exclusive—manufacture and use of shell-tempered Caddo pottery in prehistoric and early historic times is confined to three areas: (1) the middle Red River (between Oklahoma and Texas), (2) below the Great Bend of the Red River in northwestern Louisiana, and (3) in the Ouachita River basin in southeastern Arkansas. Thus, the occurrence of plain, red-slipped, and decorated shell-tempered ceramics in Caddo ceramic assemblages outside of these three regions should constitute some of the most compelling evidence for the trade and/or exchange of ceramics from one sub-region to another, but only if the provenance of these sherds can be reliably and consistently identified. We examine the question of ceramic provenance employing the Caddo INAA data base (n=1388 sherds at present) by exploiting the geochemical findings from a significant sample of shell-tempered ceramic vessels, primarily due to the limited production of shell-tempered Caddo ceramics within few areas, their identification, employing geochemical data, outside of those production areas constitutes evidence of interaction with Caddo groups residing in neighboring and distant parts of the ancestral Caddo area.

OBJECTIVE

We use the INAA data for 88 shell-tempered Caddo sherds from 26 Caddo sites to explore whether the geochemical contribution of shell temper inclusions—identified as Ca, Mn, Na, and Sr—can successfully discriminate between key production areas in the Red River basin known to differ on the basis of stylistic and technological analyses.

RESULTS

The standard calcium correction (see Stupnaišs et al., 1996) was applied in version 3.0.1 of R (www-project.org), and the log-10 transformation calculated for each element, after a value of one was added to each shell element in the database, effectively replacing all missing values with a zero. Since we are concerned only with the contribution of shell temper to the ceramic paste for this endeavor, only those values associated with Ca, Mn, Na, and Sr—as identified by Cogrell et al. (1996)—were used in this analysis. We explored a range of cluster numbers from two to 15 using the NbClust package in R. Almost half of the methods (11) recommend three clusters. The next most recommended number of clusters was 15 (4 methods). The geochemical data were then analyzed using a levens cluster analysis wherein three chemical composition groups were identified, then illustrated in a 3D scatterplot.

ABSTRACT

The geochemical analysis of shell-tempered ceramics in the ancestral Caddo region has been a matter of confusion since the mid-1990s. While Caddo archaeologists have long persisted most or all of the shell-tempered ceramics in East Texas to have originated from two different areas within the Red River basin, the geochemical data and interpretations remain inconsistent with that idea. This paper takes another look at this dataset, and considers an approach that was initially put forth by MURR, and then seemingly abandoned. Using only the geochemical data from shell-tempered sherds, we take a closer look at the contributions of calcium (Ca), strontium (Sr), sodium (Na), and manganese (Mn), and illustrate the spatial and temporal consistencies that can be used to establish and expand arguments for the trade and/or exchange of shell-tempered ceramics from multiple locations in the Red River basin.

METHODS

The results of this analysis indicate that the use of Ca, Mn, Na, and Sr as a proxy for shell-tempered inclusions in Caddo sherds yields results consistent with recent stylistic and technological analyses of Caddo shell-tempered sherds, and point to geographically distinct production areas in several portions of the Red River basin. The NbClust function indicates that there are three groups present within the dataset, one in southeast Oklahoma, a second in the lower Red River basin in northwest Louisiana, and the third in middle Red River basin between southeast Oklahoma and east Texas. Sites that form the potential production areas include Clement (34ME8), 34ME32, and 34ME57 for Group 1, 34EB380, Lov Adams (16N186) and Point (34N554) for Group 2, and HOG Lake (34CH132, 34CH133, Dan Holdeman (4RR11), Roith/Earl Kufman (4RR16), and Sab Wd Slough (4RRB24) for Group 3. Since previous studies (Cogrell et al., 1998; Peacock et al., 2007) have indicated the potential for successful demarcation of shell temper inclusions between different drainage using INAA and LA-ICP-MS data, the INAA data from the southeast Oklahoma production area was examined in more detail, since shell-tempered sherds in Group 1 are from Caddo sites in both the Glover (34ME8) and Mountain Fork (34ME32 and 34ME57) drainages, which are in and immediately adjacent to the Ouachita Mountains. The geochemical results support findings from the Cogrell et al. (1998) and Peacock et al. (2007) studies, in that those elements associated with shell-tempered inclusions can be successfully discriminated between these two drainages. In all, only two sherds (TKP054 and 936 from 34ME8 (Glover) fall within sub-group 1 of Group 1; the other five—and the single sherd from 4RTT003 (E314898)—fall within sub-group 2 of Group 1. Sherds from 34ME32 (TKP095) and 34ME57 (34ME386) both fall within sub-group 1 of Group 1.

CONCLUSIONS

The INAA data associated with Ca, Mn, Na, and Sr can be used as geochemical proxies to explore the potential contributions of shell-tempered inclusions in Caddo ceramics, pointing to an analytical avenue whereby significant gains can be made through a reanalysis of existing data. The results of this effort are consistent with recent stylistic and technological analyses of shell-tempered sherds from the Caddo region that has identified several distinct post-A.D. 1300 production areas, which differs considerably from the interpretation of previous analyses of shell-tempered ceramics in the Caddo INAA dataset. Our analysis of Caddo shell-tempered ceramic sherds points to a new method of analysis that may yield considerable gains with regard to the identification of areas of shell temper procurement and shell-tempered ceramic vessel production, as well as the provenance of shell-tempered sherds that are from sites not in known production area.