Ceramics production and trade across the Great Hungarian Plain: Chemical analysis of Bronze Age ceramics from Békés 103 in Eastern Hungary

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ABSTRACT

Fig. 1. Vessels excavated from HB8 that are very similar stylistically, but are different chemically. The larger vessel was found to be local, while the small vessel is characterized as being non-local. Image provided by László Gucsi.

The Bronze Age in Europe is noted for an increase in foreign interaction and trade, yet some areas show few signs of receiving non-local goods. Using chemical analysis of Bronze Age ceramic pastes from the cemetery of Békés 103 and nearby clay sources, this poster seeks to investigate trade networks and exchange between the people of the site and other areas of the Great Hungarian Plain. Using LA-ICP-MS, we examine the extent of trade and the degree to which the community participated in the exchange of goods compared to other areas of the Great Hungarian Plain. Combining new data with information from previously excavated ceramics, this project further explores the movement of ceramics on the Great Hungarian Plain by examining whether or not there are differences between graves in terms of acquisition and use of local versus non-local ceramics.

BACKGROUND

In 2011 the Bronze Age Körös Off-Tell Archaeology Project (BAKOTA) embarked on a project seeking to learn more about the trade and movement of people that lived on the site of Békés 103 (Duffy et al 2014: 1). The Bronze Age cemetery of Békés 103 (~1600-1200 BC) is located on the edge of the modern town of Békés in Eastern Hungary. Additionally the site is currently located on agricultural fields close to the rivers Fekete and Fehér-Körös rivers (Duffy et al 2014: 1). More specifically both the settlement and cemetery are located along the Kettős-Körös paleomeander.

The natural landscape and the close proximity would have allowed the residents of Békés 103 to engage in the exchange of goods, both local and international. Exploitation of the water and creation of boats would have permitted the inhabitants to travel around the Great Hungarian Plain and trade goods, such as funeral urns and other grave goods. Additionally the water ways would have made it possible for foreigners to come into the settlement. Even though these modes of movement and trade may have been possibilities for the populace, it is currently unclear how the site of Békés 103 fits into the trade network of the plain (Duffy et al 2014: 2).

Using both fabric based analysis and chemical analysis, studies have already been conducted studying vessels that were unearthed from Békés 103 and around the Great Hungarian Plain. From 2003-2011 the Benta Valley Project excavated Bronze Age settlements in the Benta Valley and then used petrographic analysis and instrumental neutron activation analysis (INAA) to identify the number of ceramic producers and the extent of the ceramics trade (Earle, T., Kreiter, A., Klehm, C., Ferguson, J., and Vicze, M. 2011: 2). In 2012 Timothy Parsons used petrography to study the immigration of people into the Great Hungarian Basin through ceramics (2012). Additionally in 2014, Danielle Riebe used ICP-MS to analyze the composition of Early to Middle Bronze Age ceramics in order to learn about the various cultural groups, their boundaries, and trade networks in Eastern Hungary. Most recently, Attila Kreiter has been using petrography to study a group of ceramics from Békés 103 to establish the typical fabric makeup of the ceramics found at the site, and consequently found a few ceramics that vary from the rest, such as containing an amphibole grog and mictric carbonate (2015; Earle, T., Kreiter, A., Klehm, C., and Ferguson, J. – Vicze, M 2011). This study utilizes the results of both Riebe and Kreiter to identify ideal ceramic samples to be tested by ICP-MS.

OUR QUESTIONS

Fig. 2. A mug included in a human burial that is likely of non-local production. Drawing by Dorottya Kékegyi.

Fig. 3. "The Swedish Helmet" bowl. Drawing by Dorottya Kékegyi.

- By using ICP-MS, what can we learn about the ceramics production at Békés 103 and the trade networks that were established by the inhabitants?
- What kind of relationship does the chemical makeup have with the shape of the vases and grave goods contained in the burial?
- Do the accompanying vessels derive from the same location as the burial urns or do the smaller accompanying vessels originate from foreign location compared to the urns?
- Where were the inhabitants of Békés 103 obtaining their clay from?

METHODS

By using Inductively Coupled Plasma Mass Spectrometry (ICP-MS), archaeologists can essentially learn more about the chemical makeup of artifacts, such as bronzes and ceramics. This archaeological method is used for identifying elements from the periodic table, with some restrictions, that are present in the samples and additionally showing the quantity of each.

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Fig. 4-6. Taking clay samples using an auger. Images provided by the BAKOTA Project.

To compare with the ceramic samples, clay core samples were first taken from the site of Békés 103 and the surrounding area around Békés County in order to learn more about the production of ceramics and trade within the Körös Region (Figure 7). Additionally samples were taken from around the Mureș River in Romania (Figure 7). The locations as to where the clay samples were taken from were strategically picked based off the modern and ancient locations of old paleomeanders and the amount of modern pollution affecting the water and surrounding soil. A small team composed of experts and students used an auger to remove clay, measure the depth of the hole, record the location of where the samples were taken from, and test the quality of the material. A total of twenty-nine samples of clays were taken, bagged, and labeled.

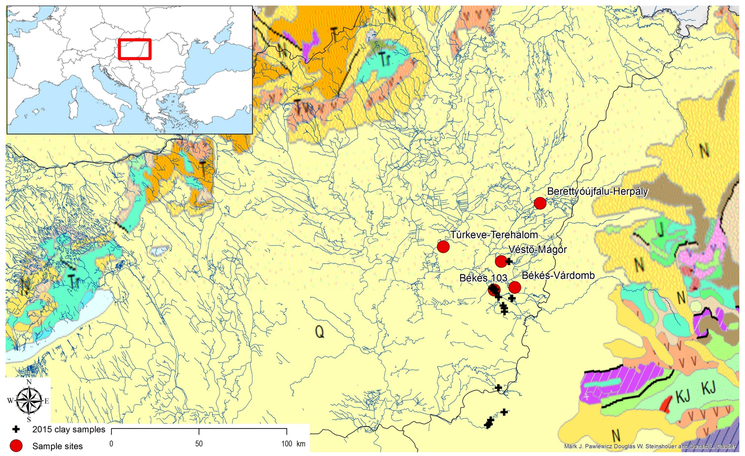

Fig. 7. Geological map of the Hungarian Plain and surrounding uplands showing clay samples that were taken for this study as well as sites from which ceramics have been analyzed.

A total of 25 ceramic samples taken primarily from burials at Békés 103 were analyzed at the Field Museum Elemental Analysis Facility (EAF) using published procedures (Golitko 2015) to generate concentrations for 58 major, minor, and trace elements. In most cases, these ceramics represent paired sets of mugs and urns from individual burials, although other forms including two so-called "Swedish Helmet" bowls were also included in the sample. These ceramics were compared to a sample of 155 ceramics and soil samples previously analyzed by the same method (Riebe and Duffy 2014), drawn from five sites on the Hungarian Plain (Fig. 7) including Békés 103.

Due to time constraints and installation of new instrumentation at the EAF, the clay samples collected during 2015 have not yet been analyzed. These samples will be run by both XRF (as powder) and in select cases as fired briquettes by LA-ICP-MS. This analysis will shed light on sources of chemical variability on the Hungarian Plain, which is geologically very homogeneous. However, rivers may potentially transport material eroding out of the more variable geology of the mountains that surround the plain, which could account for the chemical variability observed in prior studies of Neolithic, Copper Age, and Bronze Age ceramics from the region (Duwe 2005; Earle et al. 2011; Michelaki 1999; Riebe and Duffy 2014; Riebe and Niziolek 2015).

RESULTS

The 2015 ceramic samples were compared to an earlier set of samples run during 2013 (Riebe and Duffy 2014) from Békés 103 and five other sites on the Hungarian Plain (Fig. 7).

A Hierarchical Cluster Analysis (HCA) of the 2015 ceramic samples indicates that three of the samples are outliers from the rest (Fig. 8), including samples run during 2013. One of these sherds comes from a so-called "Swedish Helmet Bowl," while the others come from typical burial vessels—an urn and a mug from separate burials). These sherds can be differentiated from the rest of the ceramics analyzed on bivariate elemental plots (for instance, Al and Eu as shown in Fig. 9) and likely were obtained from more distant production locals.

Comparing the most recent sherd samples from Békés 103 to other sites (Fig. 7), does not provide an immediate indication as to where these vessels may have come from, although SS355 (Fig. 8) is similar to ceramics from the site of Túrkeve-Terehalom and might originate closer to the Tisza river valley.

Unfortunately, analysis of clay samples collected during 2015 has not yet been completed, but may shed further light on the production locations of these sherds. Soil samples (surficial loess primarily) analyzed during 2013 do not provide good matches for individual site chemical signatures (Fig. 10), suggesting that more detailed analysis of clay samples in the vicinity of individual sites on the Plain may provide a better explanation for chemical variance on what is overall an extremely geologically homogeneous environment.

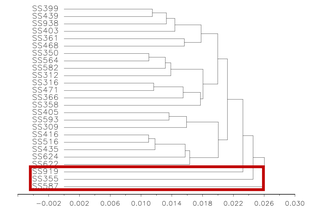

Fig. 8. Hierarchical Cluster Analysis of chemical measurements on ceramic samples from the Békés 103 cemetery. Outlier samples are indicated with a red box.

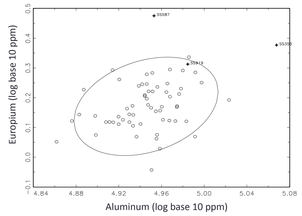

Fig. 9. Bivariate plot of Aluminum and Europium (log base 10) concentrations showing separation between local sherds and outlier samples from the Békés 103 cemetery. 90% confidence ellipse for 2015 analyses indicated.

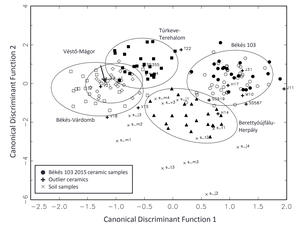

Fig. 10. Canonical discriminant function analysis of ceramic samples from five sites on the Great Hungarian Plain. 2015 ceramic samples are indicated, as are outlier samples and soil samples analyzed to date. Ellipses represent 90% confidence intervals.

CONCLUSIONS

With the data and analysis that we have so far, we cannot confirm that the people were sourcing clay from the nearby water sources. We can only assume that the people were most likely doing so. If the people were in fact using local clay, then they had no need to obtain any foreign-made ceramics, since they could produce their own. Three of the ceramic samples that were taken had a chemical signature that does not match the other samples. Even though the people had a nearby source of clay, these sherds demonstrate that trade was occurring and few people were in fact obtaining foreign-made goods. Our present assumption may change with further analysis, especially including more ceramic and clay samples in our data set.

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