A Research Proposal:

The Chemical and Petrographic Analysis of the Ceramics and Architectural Clay of the Tiszapolgár

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SECTION ONE: BACKGROUND INFORMATION

Ceramic analysis plays an important and multi-faceted role in the interpretation of an archaeological site, despite the often time consuming process of examining table after table of individual sherds. Perhaps more then any other aspect of an excavation, ceramic remains allow the researcher to not only gather data about how a group of people lived their day-to-day lives, but can also serve as a "fingerprint" for a site—a permanent diagnostic record of a settlement's time period, length of occupation, economic system, and social structure.

As a whole sphere of research, the Körös Regional Archaeological Project is intended to examine the change in settlement patterns and material culture between the Late Neolithic period and the Early Copper Age, at which point for reasons yet to be fully understood areas of inhabitation changed from "large aggregated settlements" to "dispersed…small coherent settlements" (Sherratt 1982: 256). The earliest Körös settlements were linear and up to a kilometer in length along riverbanks, with single family rectangular dwellings spaced at about fifty meters apart. Materially, the ceramics produced were not regionally specific and relatively unsophisticated as compared to later phases. According to Sherratt, this pattern persisted throughout the sixth millennium until the fifth millennium BC, at which point both settlement patterns and material culture underwent marked changes. Both the Tisza and Szakálhát cultures emerged during this time period, and true tells—meaning more aggregated settlements—became the norm (Sherratt 1982: 256-258). Ceramic production underwent changes as well; as ceramics were divided "clearly into specific local styles in different parts of the [Hungarian Great] Plain and surrounding areas" (Sherratt 1982: 258). It is clear that both raw and worked materials such as chirt and obsidian were being imported from great distances, and that decorated pottery was widely traded. The stability of the age was catalyzed in no small part by this large scale trade from areas as distant as the Aegean and beyond the alluvial plain (Sherratt 1982: 258).

In stark contrast to the changes of the Late Neolithic, the Early Copper Age (later fifth millennium BC) is characterized by very dispersed settlement patterns and the lack of regional specificity in ceramic production. Figurines are almost absent during this period, as opposed to the large number of figurines and anthropomorphic vessels of the Neolithic (Sherratt 1982: 259). Although the reversal of many seemingly advanced practices and techniques would seem to indicate a dark age of sorts, “the large number of substantial sites indicates that this period was stable and prosperous, and there is no evidence for declining fertility, even though materials from outside the Plain were not imported in such quantity” (Sherratt 1982: 259).

So how then does the analysis of pot sherds fit into the overall picture, and why would chemical ceramic examination explain the changes that occurred in the early Copper Age? As discussed above, the examination and classification of ceramics can act as a “fingerprint,” with each settlement having its own distinguishing characteristics as well as features that link it to other sites of the same time period or geographic region. Additionally, through careful research and examination it is hoped that determinations can be made regarding clay sources, the architectural use of clay, and whether or not pots were imported and/or exported. Each of these will be discussed in greater detail below.

SECTION TWO: PROPOSAL AND METHODOLOGY

Complications of Ceramic Analysis at Vésztö

Although the methods of analysis (which will be discussed in more detail later) for ceramic remains are relatively standardized and accurate, this does not necessarily mean that the process is cut and dried. At Vésztö, for example, the petrographic analysis of pottery sherds may or may not prove useful. In many cases, a settlement will make use of a specific clay source from which to gather the materials for pot making. This could be due to many factors, but is most likely the result of necessity—speaking generally, clay occurs at specific geological locations. At Vésztö, however, as well as in many places throughout the Carpathian Basin, clay is literally everywhere and is almost completely uniform in appearance and inclusions. This makes it difficult for researchers to determine a specific clay source, if pot makers did indeed return time and time again to the same location.

Analytical Proposal and Sample Collection

In order to develop a well-rounded understanding of the ceramics produced by the Tiszapolgár culture, a good deal of chemical and microscopic analysis will need to be conducted. Obviously, it would be difficult to carry out this research in the field as more time than is available during a field season is necessary for the job to be done to satisfaction, and equipment is needed that is simply not available in the area. As a result of these limitations, most of the chemical and petrographic analysis to be conducted on samples collected from the Vésztö 20 site this year will be carried out in the United States over the course of several months after the conclusion of the 2001 field season. Before the actual research can begin, several preliminary steps must be completed. First, of course, samples from the plethora of ceramic sherds must be chosen for examination. At this point, it is most likely that the sherds of pedestal bases will be our examination samples. Pedestals are a good option for several reasons, the most obvious being that they are easily identifiable as Tiszapolgár are definitely datable to the Early Copper Age by visual examination alone.

The process of gathering data regarding clay sources is moderately more complicated. The ancient people of this area had a wealth of options in choosing their clay for ceramic production—clay is literally everywhere, as mentioned earlier. One could just as easily dug a hole outside of his or her front door and made a pot from the spoils as trekked back and forth to a specific source. Assuming that the ancient people of the area were not committed to gathering clay from one source, the more important question is what soil in the natural stratigraphy of the area was preferred; that is, did the Copper Age people of Vésztö use surface soil, sub-soil, soil from riverbanks, or a variety of different clays in their pottery. Additionally, it would be interesting to note the composition of daub samples collected from the site. In some cases it would appear that ceramics and daub collected from the same site differ in chemistry or petrography, as described by Kostalena Michelaki in her 1999 dissertation (Michelaki 1999: 207-213). In order make these determinations, the following steps have been or will be carried out:

First, likely sources must be identified by either pedestrian survey or the careful examination of geographical features such as ancient river beds or marsh areas on maps. Luckily, detailed topographical maps of Vésztö and the surrounding area have been made available to KRAP, and prospective areas have been identified. Additionally, a geomorphological expert has lent his expertise to the project and has taken core samples of a number of these sites. Although no positive assignments of ancient river courses could be directed toward any of the so-called "meanders," it is highly possible that any or all of them could have at one time been the path of the Körös River. His samples can be analyzed along with the samples discussed below.

A total of 12 clay samples have been taken from the Vésztö 20 site and the surrounding area, including two plow-zone samples and two sub-soil samples gathered from three locations where sherds have been collected for petrographic analysis and comparison; these locations are: Vésztö 20, one plow-zone and one sub-soil sample taken from each trench (two and three); Köröसladány 14, one plow-zone and one sub-soil sample taken from each trench (north and south); the area of the Vésztö-Mágor tell site, two samples of plow-zone soil and two samples of sub-soil.

Research Methodology

After gathering the samples and returning them to the United States, in-depth chemical and petrographic analysis can begin. Some of this research is to take place at Millsaps College in Jackson, Mississippi, where I will be working with Dr. Mike Galaty in an independent study program during the fall semester of the 2001-02 academic year. The methodology of the analysis will likely resemble that of Kostalena Michelaki's research focusing on the ceramics of the Early Bronze Age Maros culture of southeastern

Hungary. This is due to the fact that the soil (clay) of the area closely resembles the clay present at Vésztö.

Petrographic analysis will be one of the first lines of research undertaken on samples taken from the Vésztö site. This method, borrowed from geology for the examination of rocks, consists of analyzing thin sections of pot sherds with a polarizing microscope. Minerals present within the clay matrix of the pottery "are identified by their optical properties, or in other words by their behavior under the microscope when a beam of light passes through them" (Michelaki 1999: 95). This process is useful for identifying substances such as calcite, mica, sand, and other inclusions.

It is often standard procedure to carry out a point-count analysis of the thin sections, meaning that each section is to be examined, the mineral inclusions identified and categorized as either natural or intentional temper, and then counted within the thin section at 1mm intervals. If we choose to follow Michelaki's analysis exactly, "The observations at each point are assigned to one of five mutually exclusive categories: clay matrix, silt, sand, temper, and void" (Michelaki 1999: 96). Individual minerals are then noted within each of these categories. Additionally, "each thin section is described according to four basic properties: 1) kind of temper, 2) temper size, 3) temper amount, and 4) paste [aggregate of natural materials in the ceramic vessel]" (Michelaki 1999: 96).

Additionally, clay samples gathered from around the site can be fired, broken, thin sectioned, and petrographically analyzed in order to compare clay from possible sources with ceramics from Vésztö 20. This could help determine if ancient peoples of the area were exclusive regarding their sources of clay. First, the samples will be shaped into round, flat disks appx. 10 cm in diameter and 2 cm in thickness. They will then be treated like any other ceramic piece—allowed to dry, then fired. The disks will be fired at differing temperatures which are yet to be determined, thin sections will be taken, and they will be compared with then sections from "real" ceramics gathered from the three sites—Vésztö 20, Körösladány 14, and the Vésztö-Mágor tell site.

Not only will petrographic analysis allow us to identify and categorize characteristics of ceramic and daub samples independently, but we will hopefully be able to compare the two in order to determine if architectural clay and ceramic clay were obtained from different sources. Examined and fired clay samples gathered from the Vésztö 20 site area could also shed light on the location of ancient clay sources that the ancient people of the area utilized. Of course, other methods of examination will also be utilized.

It could also be useful to re-fire pot sherds gathered from Vésztö 20 as Michelaki did for her dissertation research. Information regarding what caused ceramics to turn color from "raw" clay to the color of a finished pot could be gathered from such research, as "two major factors affect the color of ceramics: paste composition and firing conditions (atmosphere, temperature, and length of firing)" (Michelaki 1999:104). Re-firing could also be useful in determining if more than one source of clay was utilized, assuming that more than one source was actually used.

Michelaki re-fired sherd samples at a constant 950˚ C for 30 minutes, left the sherds to cool overnight, then color coded according to the Munsell chart. She states that the temperature of 950˚ C was chosen in order to minimize or neutralize differences due to iron content. If the differences were not neutralized, they would become evident and would not skew the results of the research (Michelaki 1999:105).

Daub samples taken from Vésztö 20 and Körösladány 14 could also be re-fired and analyzed. Michelaki noted that the color of daub samples from Kiszombor and Klárafalva looked very different after being re-fired at 850˚ C for one hour than did the re-fired pot sherds gathered from the same site. Researchers expected the daub and ceramics to look alike, and so "the same 13 daub samples were re-fired again at 950˚ C, for half an hour, in an oxidizing atmosphere…so that the daub and sherds would be comparable" (Michelaki 1999:105). By comparing the daub and ceramic sherds in this way, we could possibly determine if sources for the substances are mutually exclusive, or if their origins are the same.

Next, it may prove useful to conduct instrumental neutron activation analysis (INAA) on some of the daub and ceramic samples. INAA will allow us to identify very subtle chemical characteristics within the clay. Minor impurities within the clay (that is, elements other than the primary components of aluminosilicates and water) "such as the oxides of calcium(Ca), iron (Fe), potassium (K), magnesium (Mg), sodium (Na) and titanium (Ti)…are considered characteristic of the specific parent material from which the clay was derived, and as such they provide a signature for clay sources" (Michelaki 1999: 97). The value of neutron activation is obvious—if noteworthy chemical differences exist between ceramics or ceramics and daub, it would be likely that the clay is intentionally modified for different purposes or that different clay sources were exploited depending on what physical characteristics of the clay were considered necessary.

SECTION 3: HYPOTHESES & SYNTHESIS

Generally speaking, the analysis of clay and daub and the identification of clay sources in the area surrounding Vésztö 20 and Körösladány 14 will be a process that continues as long as excavations are taking place on the sites. Although at this point it is impossible to say for certain what results this research will yield, I have several hypotheses in mind. Regarding pottery, given my knowledge of soil in the areas of Vésztö 20 and Körösladány 14, it appears that clay in the region is largely homogenous. Hypothetically, the pottery sherds should share this characteristic with the clay, given that no obvious inclusions or temper are included within the clay matrix of the ceramics. Differences in pottery color are probably the result of firing conditions, i.e. atmospheric conditions, temperature, and the length of the firing process. Therefore, I feel that ancient people of this area were not limiting themselves to a certain clay source; rather, they were more than happy to use whatever source was most readily available.

It seems likely that at the very least, a different clay source may have been utilized for the making of daub than for the construction of pottery. As Michelaki pointed out in her research, naturally occurring shell may be left within architectural clay, as the calcium content might have "improved the durability of unfired clays" (Michelaki 1999: 213). She adds that shell is almost always left out of ceramic clays, as the calcium would cause cracking during the firing process. Although it is impossible to say for certain, it would appear that the Bronze Age culture examined in her dissertation gathered clay from at least two distinct sources: one containing natural shell inclusions, and one without. It seems reasonable to hypothesize that the same could be said about the Early Copper Age Tizapolgár people at Vésztö 20 and Körösladány 14. Hopefully, the research to be carried out in the coming months will either confirm or nullify these hypotheses, with either result paving the way for more examination and experimentation.

References Cited

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