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KRAP 2001
July 29, 2001

Ceramic Technology at Vésztő 20

Introduction:

There has been a long tradition in the study of ceramics of the Old World. This study has its roots in the fields of art history and “*non-anthropological*” archaeology and has primarily focused on the final product, or simply viewed a ceramic piece as an object (Hester 1997). This has led to an incredibly detailed cultural chronology, based upon diagnostic characteristics, which goes back well into the prehistory. This chronology has greatly simplified the processes of identifying and determining the relative age of sites and cultural regions. Even though this provides such a wealth of information, it is only one aspect of anthropological archaeology; where the focus is on reconstructing past lifeways through artifacts, not on the artifacts themselves.

For somebody, who until this point, has focused primarily on the Eastern Woodlands of North America, where ceramic technology only goes back briefly into the prehistory and where preservation makes ceramics few and far between, it has been very exciting to excavate Vésztő 20, an Early Copper Age settlement of the Tiszapolgár Culture (Parkinson, 1999). With the sheer quantity of ceramics, ranging from nearly complete vessels to barely unidentifiably small sherds, it has been difficult to not be completely wowed by the quality and quantity of our discoveries as well as the remarkable preservation. Besides the “superficial” beauty of Vésztő 20 pottery, each ceramic is much more than just the final product of what we see.

Ceramic Technology:

Each recovered ceramic sherd is a product of a long line of social and technological events. According to Kostalena Michelaki, ceramic technology can be broken into four aspects: Raw material collection and preparation, construction and forming, drying and finally firing of the completed vessel (Michelaki, 2001). Even after firing, it is important to remember that each successfully completed vessel was utilized for an intended or even unintended purpose and then ultimately destroyed. This paper will focus on the forming stage, specifically the role and use of different tempers, and also provide a methodology for future research that will attempt to further reconstruct the three other stages of manufacture.

The first stage in the production of ceramics is to collect and prepare the necessary raw materials, such as clay and temper. This would include either using what is locally available or importing the required components. Vésztő 20 is located in strata made up nearly entirely of clay, therefore until further analysis can be done, all ceramic reconstructions are based on the hypothesis that the majority of ceramics found in situ were constructed from locally available resources. Two possible methods can be used to confirm this theory--petrographic analysis and Instrumental Neutron Activation Analysis (INAA). Petrographic analysis observes and compares the minerals found in the cross sections of ceramic sherds "*by their optical properties, or... their behavior under the microscope when a beam of light is passed through them* (Michelaki, 1999)." This method allows for sherds collected from the site to be compared to samples taken from potential clay sources. INAA can be used to detect impurities in sources of clay which occur in incredibly small numbers, in quantities of less than 1,000ppm (Michelaki, 1999). These impurities fingerprint clay and can be used either in comparison to present sources

or other sherds. This comparison between clay samples and sherds can also be used to determine if certain vessel types used different sources of clays. It is possible that some clay is better for cooking or storage vessels, or may be used particularly for finer ceramics.

The second stage of ceramic production is that of construction and forming. During this stage clay takes shape from its initial powder form to its final shape. There are three methods in the production: Pinching, coiling, and slab building. Determining which method was employed can be done both indirectly and directly. Indirect analysis can be done through the study of lithic or bone tools used in ceramic manufacturing. In the absence of any tools, direct analysis can be done through the surface markings, such as the depressions left by tools, hands, wheels, or molds, or through the use of burnishing and decoration, to determine the relative quality and quantity. (Michelaki, 1999) Certain construction methods may lend themselves to different types of ceramics. It would be possible to determine if there is a relationship between rim diameter or ceramic function to type of construction method. This would allow us to see how consistent and specialized Vésztő potters were

The drying stage is the most difficult to view archaeologically. This is the stage where the complete but unfired ceramic is allowed to dry, so that any remaining moisture will evaporate off and not cause cracking during the firing stage. If any moisture were to be present during firing, the resulting steam would cause pressure inside of the vessel and cause destructive cracks. If any vessels were to crack during this stage, it would be impossible to discover any prefired sherds, as they would have just dissolved into the surrounding matrix. Therefore it would be impossible to see any of these “failures” or any

of their trial-and-errors. Only vessels that crack during or after firing would be visible in the archaeological record. (Michelaki, 1999) This being the case, it is important to remember that any sherds recovered were essentially the final product and it would be impossible to determine how proficient the Vésztő “ceramic builders” actually were through solely archaeological means. It would be possible to determine the ratio of successfully to unsuccessfully dried ceramics without inferring it from ethnographic analogies.

As with drying, the firing stage can be seen both directly and indirectly. If fire pits containing remnants of sherds, or kilns are present at a site, it then may be possible to infer which were used. As of July 2001 no evidence of kilns or fire pits have been discovered at Vésztő 20. How the vessels were fired will have to be determined through indirect means. The color variation (and lack thereof) can be used to determine the type of atmosphere the ceramic was fired in and whether or not organic materials were present. To determine the firing temperature, Scanning Electron Microscopy can be used to view the “*structural changes in the clay fabric that accompany sintering* (Michelaki, 1999).” Refiring tests can be conducted by firing samples to known temperatures and then comparing them to sherds found at the site. Because there are limits to temperature control in open fires, if it is determined sherds were fired above or below this threshold, we can ascertain whether or not a kiln was used. The presence of kilns would be significant as it would indicate a certain degree of specialization. It would also be interesting to see if copper-smelting technology would transfer over to that of ceramic manufacturing. That is, if specialized kilns were used for copper, the question would be if they would also be used for ceramics.

Reproduction:

Based upon the hypothesis that the Vésztő 20 ceramics were by-and-large constructed from local clay sources, the forming stage is one of the more reproducible aspects of production. Unfortunately, it is not quite as simple as it may seem. In an unscientific test, a sample of approximately 12 liters of clay was collected from the upper stratum at Vésztő 20 and was subsequently pulverized into a powder, where visible organic contaminants were removed. This powder was wetted and a group of fifteen individuals, using a variety of forming methods, constructed ceramics. All but one significantly cracked during the drying stage and the remaining piece didn't survive firing. There are three theories regarding this setback in our experiment. First, organic contaminants created inconsistent drying and as a result different portions of the ceramics cracked at different rates. Second, the ceramics cracked as a result of a significant temperature change, as they were dried in the sun and subsequently cracked from differential drying (outside drying more quickly than inside) when the temperature dropped in the evening. Third, lack of temper resulted in the plastic clay to contract significantly during drying. It is my hypothesis that all three scenarios played a role but the third possibility was the most critical. To test this hypothesis, a variety of tempers were utilized and the other two variables, temperature and contaminants, were controlled for.

Initially, approximately 4 liters of clay, collected from the upper stratum of Vésztő 20 was collected and crushed into a powder. To remove any contaminants and to control the consistency of the sample, the powder was sieved through a 1mm screen. Any clay pieces >1mm were removed and collected and any visible organic materials

were destroyed. Water was gradually added to the clay powder and the moistened clay was kneaded to ensure consistency. Four sample “cakes” of clay were constructed. One contained no temper, another with larger pieces of clay from the screen (between 1mm and 3mm), daub, and finally one with a larger quantity of clay temper. Three balls were also constructed, one with no temper, another with clay, and lastly with daub. Diameter and thickness was recorded for comparison between different stages. The daub used for temper was collected from unneeded lab samples, which were previously discarded and were without provenience or any contextual integrity. The daub was crushed by a stone hammer until it was the same consistency of the clay temper. The seven samples were then allowed to dry (in a shaded environment) and the thickness and diameter of each were recorded every 24 hours. The final measurements were then taken when each sample was completely dry. Due to a lack of any controlled means of firing, they were not fired, as consistent temperatures could not be guaranteed for each sample.

Results/Conclusion:

There appears to be no clear correlation between temper and degree of shrinkage of the ceramic samples. The prediction that clay temper would prevent cracking during the drying stage is at best inconclusive. The daub-tempered sample was the first to crack but it actually shrunk less than other samples. The samples which contained either no or clay temper did not shrink at significantly different rates. This would imply that other factors play a larger role in cracking when local clay sources are used. To confirm this, it may be necessary to reproduce experiments but with more samples under the same controlled variables. It would also be beneficial to go through all sherds and analyze what ratio of each temper was used by the people of Vésztő. It is highly possible that

Table 3.1: Changes in Diameter and Thickness after two days(in cm)

#	Type	Diameter		Thickness		Temp
		Change	% Change	Change	% Change	
A	Cake	0.88	9 %	0.14	9%	None
B	Cake	0.62	6 %	0.33	16 %	Clay
C	Cake	0.60	6 %	0.21	11 %	Daub
D	Cake	0.68	7 %	0.24	13 %	High
A	Ball	0.17	7 %	-----	-----	None
B	Ball	0.30	11 %	-----	-----	Daub
C	Ball	0.21	8%	-----	-----	Clay

Table 3.0: Sample sizes after three days of drying (in cm)

#	Type	Diameter				Thickness				Temp
		N/S	E/W	Mean	North	East	South	West	Mean	
A	Cake	8.31	8.43	8.36	1.16	1.16	1.54	1.30	1.29	None
B	Cake	8.40	8.89	8.64	1.36	1.89	1.76	1.59	1.65	Clay
C	Cake	9.22	8.37	8.79	1.79	1.78	1.72	1.45	1.69	Daub
D	Cake	8.87	8.76	8.82	1.44	1.82	1.55	1.72	1.63	High
A	Ball	2.31	-----	-----	-----	-----	-----	-----	-----	None
B	Ball	2.38	-----	-----	-----	-----	-----	-----	-----	Daub
C	Ball	2.43	-----	-----	-----	-----	-----	-----	-----	Clay

Table 3.1: Changes in Diameter and Thickness after three days(in cm)

#	Type	Diameter		Thickness		Temp
		Change	% Change	Change	% Change	
A	Cake	1.06	11 %	0.19	13 %	None
B	Cake	0.86	9%	0.40	17 %	Clay
C	Cake	0.73	8 %	0.26	13 %	Daub
D	Cake	0.78	8 %	0.28	15 %	High
A	Ball	0.22	9 %	-----	-----	None
B	Ball	0.33	12 %	-----	-----	Daub
C	Ball	0.26	10 %	-----	-----	Clay

Table 4.0: Final % changes (diameter + thickness)

Sample	Average % change	Temper
A	12 %	None
B	13 %	Clay
C	11 %	Daub
D	12 %	High Clay
A (ball)	9 %	None
B (ball)	12 %	Daub
C (ball)	10 %	Clay

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