Prehistoric Clay Sources: A Forensic Exercise in Geoarchaeology

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ABSTRACT

The prehistoric Oneota culture of the Upper Mississippi River Valley relied on pottery for storage, cooking and ceremonial purposes. Oneota pottery shards recovered from archaeological sites in the La Crosse area are composed of clay presumed to be from a local source. Un-tempered clay balls have also been found at archaeological sites in the La Crosse area. The un-tempered clay samples from archaeological sites provide the opportunity to compare clay collected by Oneota people to local clay sources. The focus of this research is a "forensic" exercise in which prehistoric clay samples are compared to samples recently collected from La Crosse area ridge-top and terrace clay sources. Comparisons are made on the basis of color and magnetic susceptibility. Magnetic susceptibility measurements are used to "fingerprint" the clay samples from archaeological sites and match them with the samples collected in the field.

INTRODUCTION

Throughout the La Crosse area several sites have been found which were inhabited by people of the prehistoric Oneota culture. Prior to the Oneota, people of the Woodland and Mississippian cultures lived in the area. Each of these cultures produced pottery from local sources of clay (Figure 1). The earliest pottery was tempered with grit, had thick walls and flat bottoms. As time progressed techniques changed and the walls of the pots started to become thinner and the overall shape was quite round. Another change was that temper added to the clay was no longer grit, but crushed shell (Perry, 1996). Adding the temper promoted even drying of the pots, lessened the amount of shrinking, and prevented the pot from cracking (R. Boszhardt, personal communication, 2004). Prehistoric people relied on clay pots for many everyday uses, including cooking, storage, and trade and for ceremonial purposes as well. In order to produce a sufficient quantity of pottery these people had to have an abundant source of raw clay. Clay is a heavy wet material before it is fired and is too heavy to carry long distances when in large quantities. Because of this, archaeologists assume that the clay must have come from a local source. This study examines the possible locations of clay sources used by the Oneota people for the construction of pre-historic pottery. Archaeological excavations have shown that some Oneota archaeological sites contain both untempered clay and shards of pottery. The untempered clay found at these sites is reddish in color and similar to clay found in both stream terraces and ridgetop locations in the La Crosse area. This study attempts to identify clay sources used by Oneota people by comparing clay collected on a stream terrace and a ridgetop location in the La Crosse area to clay collected by the Mississippi Valley Archaeology Center from Oneota archaeological sites.

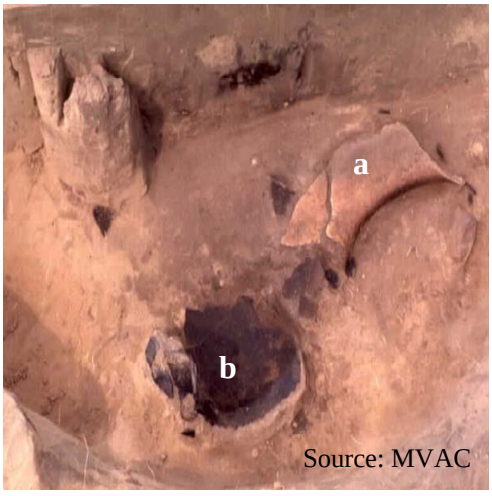

Figure 1. Oneota pottery shards (**a**) and a raw clay sample (**b**) at Meier Farm site.

BACKGROUND

There are two primary sources of clay found in Wisconsin, residual clay and transported clay. Transported clays are more extensive than the residual clays and have been removed from their place of origin by weathering, erosion and deposition at new locations. Transported clays are frequently found in valley bottoms and in stream terraces. Significant amounts of clay found in the valleys of the La Crosse Area were transported from the Lake Superior region by glacial meltwater during the Wisconsin glaciation. These transported clays are abundant on the

Mississippi River Valley terraces. In particular, clays located on the Savanna (or Zwingle) Terrace tend to be reddish in color, very uniform and usually contain very little sand or silt (Flock, 1982).

The residual clays are composed of remnants of weathered rock. The clay is formed from the decomposition of bedrock and is located on slopes and ridges (Reis, 1903). Buried residual clays occasionally cover dolomite uplands in southwestern Wisconsin, often with chert pebbles intermixed in the clay (Frolking, 1982). All of the clay tends to be a reddish color. This color comes from iron which is weathered from the dolomite and stains the clay (Reis, 1903). These clays are usually not at the surface, but instead are buried by loess (Lively, 1985). Both transported clay locations in stream valleys and residual clay locations on ridgetops hold the potential as possible sites where Oneota people gathered clay in the La Crosse Area.

METHODS

Samples of clay were collected from two field sites in the La Crosse area. Clay samples collected from Arcadia Ridge (Figure 2) represent residual clay weathered from dolomite bedrock (Sample identified as: Ridge 1, 2, 3). This site is significant as a locality where prehistoric people collected chert for the manufacture of lithic artifacts and where they could easily have collected clay. Samples of a transported clay (Figure 3) came from a Pleistocene-age terrace in La Crosse County (Sample identified as: Terrace 1, 2, 3). This clay was derived from glacial outwash sediment transported from the Lake Superior region. It is this clay that archaeologists believe is the source of clay for Oneota pottery (R. Boszhardt, personal communication, 2004).

The Mississippi Valley Archaeology Center (MVAC) provided three samples of clay from Oneota archaeological sites. The first clay sample was from the Meier Farm site and was un-tempered (Sample identified as: Meier Farm 1, 2, 3). Two samples were from the Gundersen archaeological site. One of these samples was un-tempered (Sample identified as: Gundersen 1, 2) and the other was tempered with shells (Sample identified as: Gundersen (T) 1, 2). The samples from MVAC went through the same process of drying, grinding and sifting as the samples collected in the field.

Figure 2. Arcadia Ridge clay sample site.

Figure 3. Terrace clay sample site.

All of the samples were dried for 24 hours in a 40 degree Celsius oven. Dry samples were crushed using a mortar and pestle, sieved to remove coarse fragments, and placed into 40 mL beakers. Color comparisons of the clay samples using a Munsell Soil Color book were made and indicated by color that there are some similarities in clay samples. The method used for "fingerprinting" each clay sample was magnetic susceptibility (Dearing, 1999). The Magnetic susceptibility is a measure of the concentration of magnetic materials, or the "magnetization," of a sample as a dimensionless number. Each clay sample was measured using a Bartington MS2 magnetic susceptibility meter. The process involves zeroing the meter prior to and after measuring the air to account for any thermally induced sensor drift. The probe was then immersed into the sample up to a collar located approximately ¾ of an inch from the tip of the probe (Figure 4.). A continuous set of 25 measurements were taken, noting the high and low values and the average. The average magnetic susceptibility is used here to "fingerprint" each clay sample.

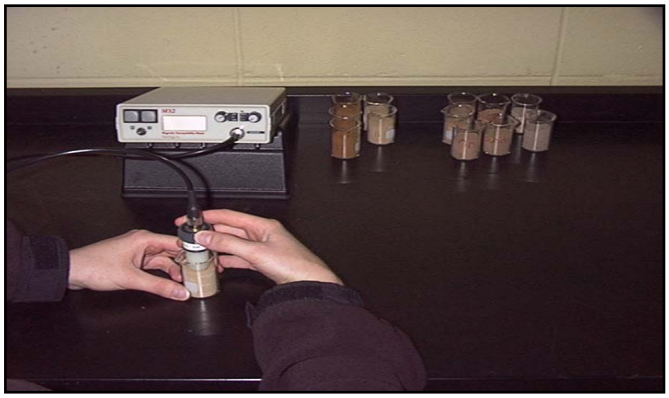

Figure 4. Magnetic susceptibility meter.

RESULTS

The Munsell color comparisons reveal that the clays closest in color are the terrace clay sample and the Meier Farm clay. The magnetic susceptibility readings also reveal a close match between the terrace clay sample and the archaeological sample from Meier Farm. There is also a somewhat lesser match between the terrace sample and the other archaeological samples. The results are shown below in Table 1 and displayed in Figure 5 for interpretation of the comparison of Arcadia Ridge and Terrace samples to clay samples from Onoeota archaeological sites.

Table 1. Magnetic Susceptibility Measurements.

Clay Sample Site	High	Low	Average
Arcadia 1	99	96	97.5
Arcadia 2	101	95	98.5
Arcadia 3	95	92	93.5
Terrace 1	49	44	46.5
Terrace 2	44	39	41.5
Terrace 3	49	44	45.5
Meier Farm 1	50	45	46.5
Meier Farm 2	51	45	47.5
Meier farm 3	53	49	51.5
Gundersen 1	59	54	55.5
Gundersen 2	60	54	55.5
Gundersen (T) 1	47	44	45.5
Gundersen (T) 2	23	19	20.5

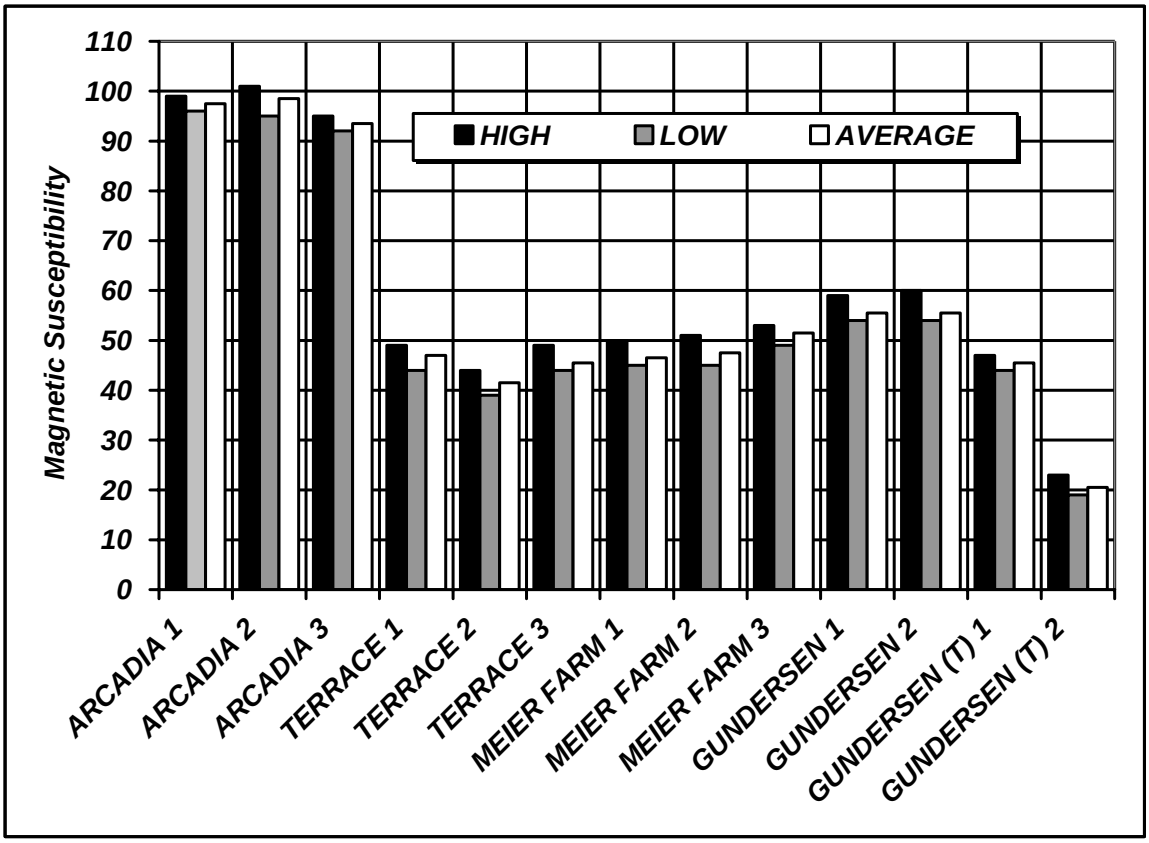

Figure 5. Comparative results of magnetic susceptibility measurements. Note similarity of the measurements for Terrace 1, 2, 3 and Meier Farm 1, 2, 3.

Table 1 and Figure 5 both display a match of one of the collected clays to one of the archaeological clays. This match is between the clay gathered at the terrace site and the archaeological clay from the Meier Farm site in Onalaska. The other clays from the archaeological sites are quite close to the terrace clay, but the Meier Farm clay is the closest match. The clay collected from Arcadia Ridge is definitely not a match to any of the archaeological clays. The Munsell color comparisons also reveal that the clays closest in color are again, the terrace clay and the Meier Farm clay (Figure 6). The un-tempered clay from the Gundersen site is also a close match. The tempered clay from the Gundersen site is slightly lighter in color due to the shell temper. The Arcadia Ridge clay is significantly darker in color and has a more red hue compared to the rest of the clays.

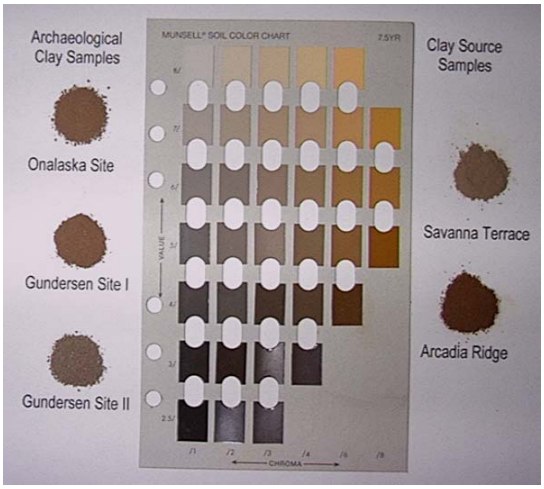

Figure 6. Munsell color comparisons.

CONCLUSIONS

The study results show that there is a close relationship of magnetic susceptibility for two of the samples. The clay obtained from the Savanna terrace site in La Crosse County matches most closely with the archaeological clay from the Meier Farm site in Onalaska. Not only did they have similar magnetic susceptibility readings, but the colors of the clays are also very similar as well. The other archaeological clays had similar readings to that of the Meier Farm clay, but the readings are just slightly higher and lower, not yielding the close results obtained with the

terrace clay and the Meier Farm clay. The clay gathered from Arcadia Ridge shows that it does not match any of the archaeological clay samples tested. This supports thoughts of archaeologists at the Mississippi Valley Archaeology Center that Oneota people gathered their clay from terrace sites. Since this was the very first attempt to match clay samples from their sources in the La Crosse area with clay samples collected from archaeological sites, I believe that with more samples, refinement of the susceptibility measurement techniques, and the possible use of x-ray diffraction to identify clay mineral types, one could obtain several possible matches of Oneota clay sources.

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