

A PUNCTATE ANALYSIS USING ONEOTA CERAMICS FROM LA CROSSE,  
WISCONSIN

By

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The Oneota material culture is found throughout the Upper Midwest, clustering around certain areas that supply vital resources, one of these areas being the modern day city of La Crosse, Wisconsin. The La Crosse locality Oneota lived in the area from A.D. 1300-1625. This study looks at punctates on Oneota ceramics to try to identify if the same tool can be identified at two sites in the La Crosse locality. Finding this would imply that communication or interaction was occurring between these two sites.

## **ACKNOWLEDGMENTS**

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## INTRODUCTION

Ceramics are a major part of many cultures and many archaeological sites. They come in a variety of shapes, sizes, functions and with a wide variety of decorations. Whole vessels are rare and most archaeologists find only sherds from broken vessels. Ceramics are important to people living in the past because containers made life a little easier. They were used for storage of food, water or other valuables like tools. Ceramics are also used for cooking food, and in some cultures special vessels were made for ritual purposes. When ceramics are found at archaeological sites, it shows that the people living there were at least semi-sedentary to fully sedentary because making ceramics vessels are a major investment of time and energy and are usually heavy, fragile and bulky, which would not be conducive to frequently moving around the landscape (Arnold 1985).

One thing that researches can learn from ceramics is the sequence of occupation for a particular group in a region. This can be learned by looking at the changes in decoration and shape of vessels in conjunction with stratigraphy and radiocarbon dating. This approach was used for the La Crosse locality Oneota, who occupied western Wisconsin, southeastern Minnesota and northeastern Iowa (Sasso 1993:325). Robert Boszhardt was able to define three separate phases for the La Crosse Oneota based on ceramic designs and radiocarbon dates which point to an occupation in the La Crosse area of A.D. 1300-1650 (Boszhardt 1994). These phases are Brice Prairie from A.D. 1300-1400, Pammel Creek from A.D. 1380-1520, and Valley View phase from A.D. 1530-1600 (Boszhardt 1994). The Oneota were a group of people that lived in

the upper Midwest and Oneota sites have been found in Iowa, Illinois, Wisconsin, Minnesota, Missouri, Kansas, Nebraska and South Dakota (Alex 1980). They lived around water resources, utilizing the typical triad cultigens of corn, beans, and squash as well as other wild plants.

In some prehistoric cultures, the styles that are used to decorate the ceramics may be specific to a family or clan. It is thought that ceramic vessels are made by women in a community, and the decorative motifs are assumed to be learned and passed down from generation to generation through the maternal line (Theler and Boszhardt 2003:98). This relationship between specific designs and a family or clan can possibly lead researchers to determine where the clan lived if the ceramics are found at different sites, showing researchers the distribution of people across the landscape.

Studies have looked specifically at the ceramic designs on vessels. One that inspired the research in this paper was the study on Iroquois ceramics done by James A. Tuck. This study was able to trace the styles across the landscape and show where the people were moving, from site to site (Tuck 1971). This type of study has not been done on the ceramics from the La Crosse Oneota, although other ceramic studies have been done.

This study will attempt a similar analysis as seen in Tuck. I will be looking at the earliest phase of the La Crosse Oneota, the Brice Prairie Phase. Within this phase there are different styles, I will be mainly focusing on Perrot Punctate which is typically comprised of: chevrons, punctates, horizontal and vertical lines. Measurements of punctates were recorded from all rim sherds of Perrot Punctate and body sherds that had punctates from two La Crosse locality Oneota sites. The shape of each punctate was recorded, the width and lengths were measured and unique tool marks were also measured for analysis.

This study will hopefully show that punctates from different vessels can be matched based on their tool shape either from different sites or within the same site. If the same tool was used at two sites, either the same person was at both sites, the tool was passed down through generations and used at the site by another member of the clan or the same method was used to make the punctates. If tools can be identified from different sites it would show that at least communication was occurring between these two sites. This also could show the movement of people from one site to another within the same time period. It is assumed that the La Crosse locality Oneota were communicating within the area, from one location to another inside the region, but substantial evidence supporting this claim is lacking. This study will also gain insight into the shape of tool that is usually used for the La Crosse Oneota.

## **BACKGROUND**

### **Oneota**

The term Oneota is only used by archaeologist; this is not the name of any specific tribe. Oneota simply refers to the general material culture that was left behind. The assemblage of material culture found is only one thing that ties together the different historic tribes found in this area during historic times. It is also thought that the Oneota were related by language. The languages spoken by individual tribes may not have been exactly the same, but similar enough to allow for inter-tribe communication.

The origin of the Oneota is still a raging debate between archaeologists. Some believe the Oneota were a group that migrated here from the Middle Mississippian culture coming out of Cahokia. It is a common belief that there was at least influence from Cahokia. While others say

that the Oneota were a group that developed out of the Late Woodland when these hunters and gatherers settled down, adopted corn agriculture and were also influenced by Middle Mississippian peoples (Alex 2000). These are two extremes about how the Oneota arrived in the Upper Midwest. A combination of Late Woodland people influenced by migrants from Cahokia is the happy medium that may have occurred as well. Historically known tribes from the area and thought to be the archaeologically known Oneota are the Ioway, Sauk, Meskwaki, Ho-Chunk, and Sioux to name a few (Theler and Boszhardt 2003; Holtz-Leith 2006).

### **Distribution across the Landscape**

The Oneota tradition ties together the material culture spread throughout the upper Midwest. Oneota material culture can be found from “Minnesota and Wisconsin southward through Missouri, and from Indiana and Illinois westward onto the eastern Plains” and may have began in this wide area around A.D 900 (Stevenson and Boszhardt 1993:3). There is even evidence of Oneota material found as far north as Ontario and Manitoba (Overstreet 1995). This large material culture distribution was present in this area up to the historic period. Throughout this geographic range, Oneota material culture is relatively stable and unchanging, although there are changes and variations that occur within the Oneota overtime. There are regional variations within the ceramic designs, but overall these designs are still very similar throughout the large geographic distribution. These regional variations change as horizon styles, which draw influence from previous styles.

## **Settlement Patterns**

Oneota settlements were different from earlier settlements because they were permanent, larger and more heavily occupied (Sasso 1993). Sites occur near ecotones, where two separate environmental zones meet, for example floodplain forest, prairie, and upland forest (Sasso 1993; Alex 2000). This puts the site at an optimal location to take advantage of the multiple types of resources that are available. These settlements were close to fertile soils for growing crops. House structures of the Oneota are scarcely represented. When found, houses are represented by postholes which form an enclosure. Many sites do not have postholes because they were destroyed with years of cultivation if they were not covered in sediment. Another reason for the lack of postholes in the archaeological record may be that they did not build permanent structures in general.

One common feature on archaeological sites is the storage pit. These were originally used to store food for the winter, but when emptied of the original contents they were filled with trash. These trash pits are often the main component found at some archaeological sites. These give a good indication of what is used and discarded at the site. These are found more frequently than structures because they are dug deeper into the ground, where the remains of houses, like postholes, were not dug deeply into the ground and therefore did not survive as well.

## **Subsistence**

The Oneota used a wide variety of resources for subsistence. They exploited wild plants, wetland resources, large and small animals, and used agriculture. This form of subsistence needed to be flexible because they relied on many different types of resources. Collecting wild

plants and wetland resources needed to be done seasonally in order to supplement the agricultural products (Holtz-Leith 2006; Alex 2000).

The agriculture of the Midwest consisted of the typical triad of corn, beans and squash. Other possible cultigens included chenopodium, which was a small seed plant and tobacco (Alex 1980). These plants would have been the base of the diet with wild plants, nuts and other seeds as important supplements.

Meat was an essential part of the diet. Hunting large animals like deer or buffalo, where available, makes up a large part of the diet. Hunting of small animals was also essential to the diet when large game was not available. Wetland fauna found at Oneota sites includes many varieties of fish and freshwater mussels. There may be a distinction between western Oneota groups that are closer to prairie landscapes with a subsistence emphasis on buffalo, as opposed to groups around the Mississippi River Valley taking advantage of river and wetland resources (Theler and Boszhardt 2003).

## **Material Culture**

Scattered about this entire area are settlements and other site types that have similar artifacts. The material culture is wide ranging but includes many generalizations across the entire area. Some of this material culture includes shell tempered globular ceramics with geometric designs, thumbnail end scrapers, sandstone abraders, small triangular projectile points, celts, manos and metates (Stevenson and Boszhardt 1993). When these materials are found at sites, it points to an Oneota occupation.

The vast majority of lithics found at sites are waste flakes. These flakes show that the people were using chipped stone tools. Stone tools can take on a variety of shapes and purposes.

Oneota points were small, un-notched triangular points that suggest use on a bow and arrow (Holtz-Leith 2006; Alex 2000; Hollinger 1993). Another common stone tool found at Oneota sites are thumbnail end-scrapers which are used to process hides. Ground stone tools include manos and metates, which were used to grind grains and sandstone abraders for straightening arrow shafts (Holtz-Leith 2006; Alex 1980; Hollinger 1993).

A unique Oneota artifact made of Catlinite, a red pipestone from southwestern Minnesota is usually shaped into disc pipes and tablets (Alex 2000). These artifacts are rare and were probably only used for ceremonial purposes (Theler and Boszhardt 2003; Alex 1980). The widespread distribution of this stone with its source in Minnesota shows that there was contact between groups in this geographically wide area.

Only a limited amount of bone tools have been found, including awls, needles and some antler points, all of which have been found in the La Crosse locality (Holtz-Leith 2006; Alex 1980; Hollinger 1993). Worked antler tips show evidence of cut marks, polish or are snapped which all have been found at La Crosse sites (Holtz-Leith 2006). The most common bone tool is the bison scapula hoe, which was used as a tool in agricultural fields.

Ceramic analysis has dominated the research on the Oneota in the past because of its robust nature in the archaeological record. Finding ceramics at Oneota sites is a common occurrence and has been used to identify the site as Oneota and to date the site to a general time range. Oneota ceramics are shell tempered, globular shaped (Figure 1) with round shoulders, geometric incised or tool trailed designs, with opposing pairs of loop or strap handles and are seen throughout the area the Oneota occupied (Staeck 1995; Alex 2000). The designs on ceramics can be any combination of vertical, horizontal, chevrons or triangles, and punctates. Rims are usually finished off with finger or tool impressions (Boszhardt 1994; Alex 2000).

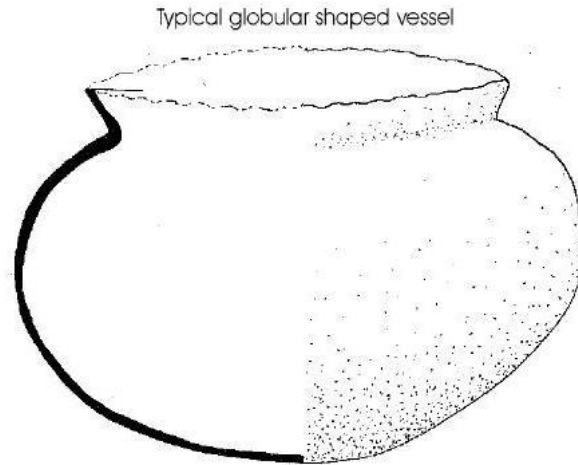


Figure 1. Globular shaped vessel typical of the Oneota (Holtz-Leith 2006: Figure 6-1).

Identifying small groups or clans from the archaeological record is possible if the right types of material are examined, usually ceramics. This identification is not possible in every analysis. Although some researchers, like Tuck, were able to distinguish the changes in settlement patterns over time by identifying changes in small clans. Tuck's analysis formed a sequence of settlement patterns that traced the group from its single community origins to the larger village settlements. Tuck's analysis saw a breakdown of local ceramic traditions which they attributed to the breakdown of matrilocality. Then a transition from a warfare state to a nationhood where groups came together was seen as a blending of ceramic traditions as more intercommunication was occurring between groups. This intercommunication possibly started to occur with the exchange of women as brides which resulted in more peaceful attitudes between warring groups. Eventually these warring groups came together to form the Five Nations of the Iroquois. (Tuck 1971).

## **La Crosse Oneota**

### **Location of La Crosse**

La Crosse Wisconsin is a city that has a deep history that stretches beyond the Oneota. The La Crosse area Oneota occupied the Upper Mississippi Valley, an area approximately 650 square kilometers or 250 square miles (Sasso 1993). Here, the Oneota replaced the Late Woodland people by A.D 1300 and flourished in the area until A.D 1650 (Boszhardt 1994). Oneota occupation in the La Crosse area consists not only of settlements but also cemeteries and agricultural fields. This large occupation in the La Crosse locality has yielded abundant artifacts for analysis and plentiful research opportunities to understand the La Crosse area within the larger Oneota manifestation.

### **Distribution of Oneota within La Crosse**

The distribution of Oneota sites across the La Crosse region seems to be clustered in certain areas. Here the sites are on high-lying terraces, close to fertile soils and wetland resources. This type of site location was probably selected on purpose to utilize the rich available resources that multiple ecological zones offered (Boszhardt 1994, Sasso 1993, Holtz-Leith 2006).

Even within these ecological zones, there seems to be clustering around certain areas. The main areas were a wide portion of the Mississippi trench around La Crosse, and in the Upper Iowa and Root River valleys southwest of La Crosse (Sasso 1993). There also seems to be a shift in settlement locations in the La Crosse area. Earlier sites were located on terraces that overlooked the Mississippi River floodplain, while later settlements had shifted near the bluffs (Boszhardt 1994).

Various sites in the La Crosse locality can be seen in Figure 2. The Olson site can be seen as number three and the Gundersen site as number nine. These are the two sites used in the analysis.

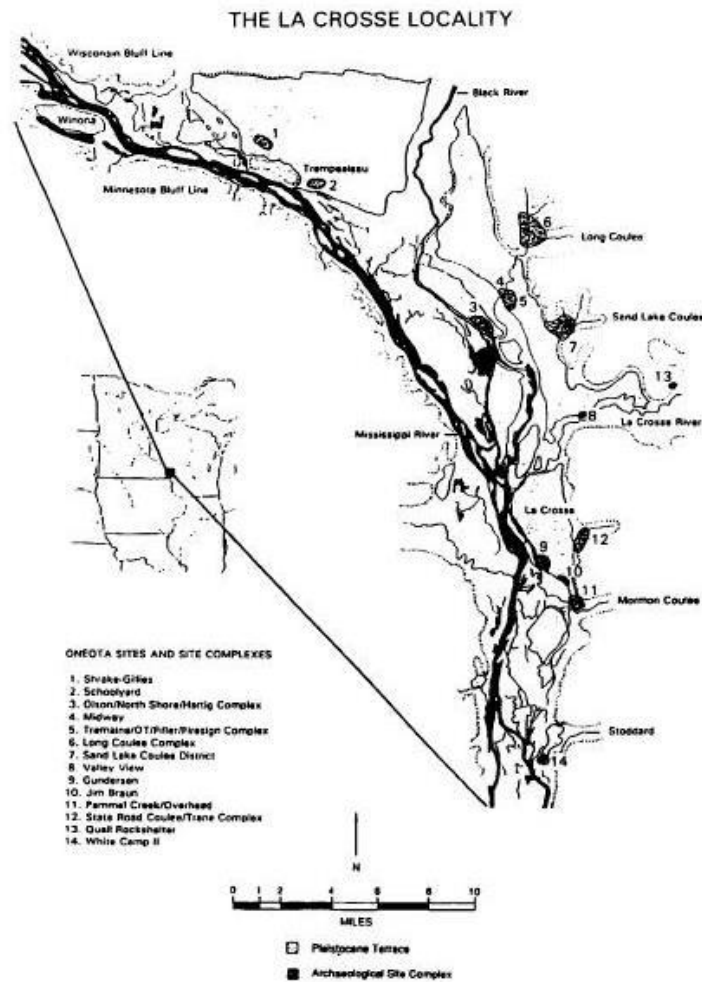


Figure 2. Map of Oneota sites in La Crosse (Boszhardt 1994: Figure 1).

## The La Crosse Oneota

Oneota phases vary according to region. The La Crosse region has a chronology based on radiocarbon dates and ceramic styles. Seventy radiocarbon dates were taken from 13 sites in the La Crosse area to arrive at the general dates of AD 1300 to 1650 (Boszhardt 1994). Before the chronology was established, researchers noticed a difference in three traits, rim decoration, use of punctates on shoulder decoration, and location of handle attachment (Boszhardt 1994). The following is an overview of the three La Crosse Oneota phases based on the chronology defined in the article *Oneota Group Continuity at La Crosse: Brice Prairie, Pammel Creek, and Valley View Phases* by Robert F. Boszhardt (1994). An emphasis in this overview is centered on ceramic motifs that are used to distinguish these three phases.

The first phase is the Brice Prairie phase. These sites are located on terraces that are adjacent to the Mississippi River. Two uncorrected radiocarbon dates from the Olson Site (47Lc76) and North Shore (47Lc185) fall into this time, with dates of A.D. 1390 +/-70 and A.D. 1340 +/-70 respectively (Boszhardt 1994). Ceramics from this phase have inner lip or rim decoration, shoulder designs that have punctate-borders and handles that attach at the lip (Boszhardt 1994). If a vessel has all three of these traits, it is considered Perrot Punctate, mainly due to the punctate border on the shoulder of the vessel. Punctate borders are usually found either above or below either panels of horizontal tool trails or nested chevrons. This design is always separated by panels of vertical tool trails. Other variants of Brice Prairie have been found that have vertical tool trails, nested festoons and nested zig-zags over vertical tool trails (Figure 3). These have been named Brice Prairie Trailed, Brice Prairie Trailed (v. festoon), and Brice Prairie Trailed (v. zig-zag) (Boszhardt 1994).

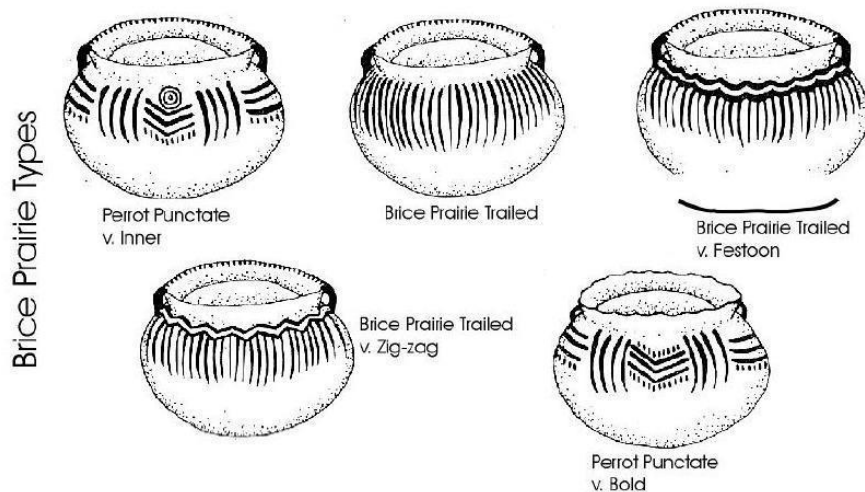


Figure 3. Brice Prairie phase ceramic designs (adapted from Holtz-Leith 2006: Figure 6-3).

The Pammel Creek phase is the transitional phase between Brice Prairie and the Valley View phase. This phase has been dated to A.D. 1380 to 1520 (Boszhardt 1994). Sites dating to this time are located away from the river floodplain and closer to the bluff base. Although they are situated away from the river, they were still using the river as a source of food (Boszhardt 1994). Soils located at the bluff base areas are very fertile and were formed into a ridge field system found at the Sand Lake Site (Gallagher et al 1985). Pammel Creek ceramics reflect aspects of its transitional phase status (Figure 4). What characterizes Pammel Creek ceramics the most are the boldly impressed lips, which uses a finger or tool to notch the lip with the notch being larger than 1.25 centimeters (Boszhardt 1994). Shoulder designs of Pammel Creek include both punctate borders as seen in the Brice Prairie phase, punctate filled zones, oblique tool trails, and vertical finger trails. Handles are a decorated strap form and are attached at or below the rim, which shows another transitional aspect.

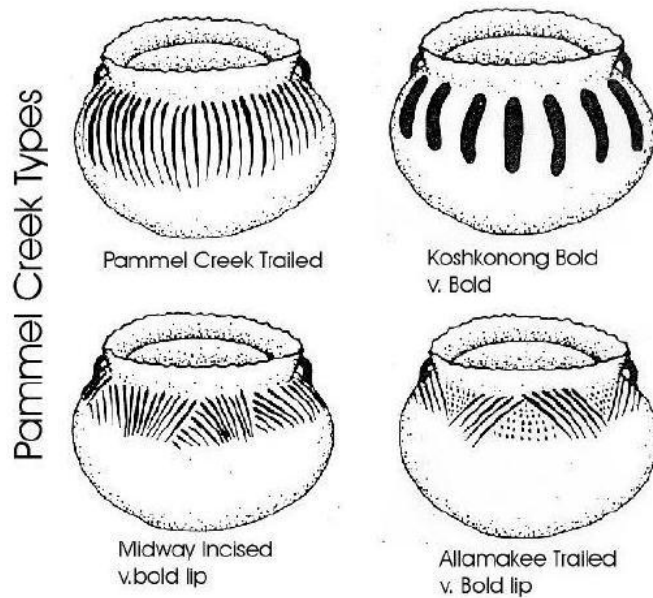


Figure 4. Pammel Creek phase ceramic designs (adapted from Holtz-Leith 2006: Figure 6-3).

The Valley View phase is the last occupation for the La Crosse area. Radiocarbon dates from Valley View sites date to A.D 1530 and 1600 (Boszhardt 1994). Oneota sites in the La Crosse locality are not found with historic trade goods, which would have been available through trade networks by A.D. 1625 or from early historic traders by A.D. 1680's. The absence of trade items in Oneota sites in La Crosse shows that they had abandoned the area by A.D 1625 (Boszhardt 1994). Many sites from this time are located away from the Mississippi River, although there are Valley View components at earlier occupied sites which are closer to the river showing reoccupation of some of these sites (Boszhardt 1994). Valley View ceramics are characterized by fine lip-top notching that is less than 1.25 centimeters, and attachment of decorated wide strap handles below the lip (Boszhardt 1994). This phase also marks the end of the punctate border that is found in both Brice Prairie and Pammel Creek phases (Figure 5). The

continuation of punctate filled zones, oblique tool trailed alternating panels, and vertical finger trails emerge in the Pammel Creek phase and are still found in the Valley View phase.

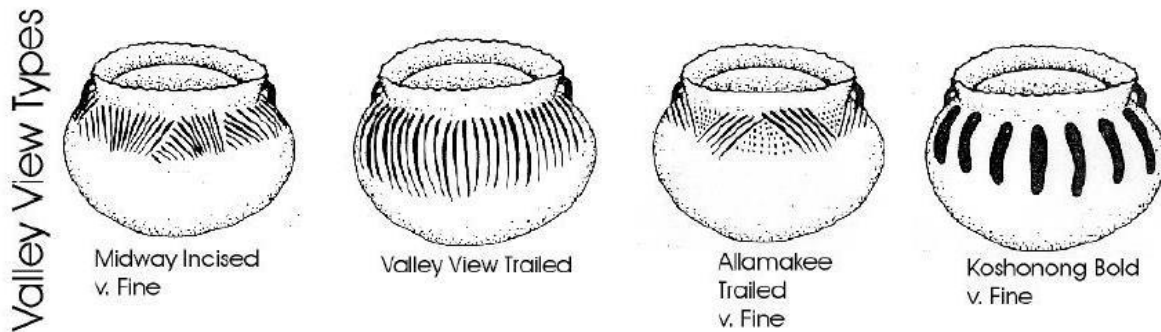


Figure 5. Valley View phase ceramic designs (adapted from Holtz-Leith 2006: Figure 6-3).

## SITES UTILIZED IN THE STUDY

### **The Olson Site (47LC76)**

The Olson Site is a single component Brice Prairie site dating to A.D. 1390+/-70 (Boszhardt 1994), which is why it was chosen for analysis. This site is located on an outlying Pleistocene terrace called Brice Prairie and is the type site for the Brice Prairie phase (Boszhardt 2006). A surface survey was conducted in 1980 which recovered over 23,000 artifacts, a large number considering the site is known to many local collectors (Gallager et. al. 1982). From this site, six large rim sherds with Perrot Punctate were selected as well as the only two bags of body sherds with punctates, in which 96 were selected for analysis. These two bags of punctates were cataloged separately from the diagnostic body sherds because these punctates were visible.

## **The Sanford Archaeological District (47LC394)**

The Sanford Archaeological District (SAD) commonly known as the Gundersen Site is the location of a 500-700 year old Oneota village and covered approximately 26 city blocks on the south side of La Crosse (Holtz-Leith 2006). The SAD is broken up into 25 localities; this study will look at ceramics from Locality 9, 15 and 1/6. This site overlooks the Mississippi River floodplain and was used as a habitation and burial site. Excavations in the SAD uncovered 700 storage pits, and 53 burials in a one block area (Holtz-Leith 2006). Artifacts found in the SAD are predominately dominated by Brice Prairie rim sherds, the next highest amount of rims are Valley View, with only few designated to the Pammel Creek phase (Holtz-Leith 2006). From the SAD, 43 body sherds and 13 rims were selected for analysis.

## **METHODOLOGY**

In order to determine who made the vessel, this study will look at punctates, specifically the shape and form of the punctate to see if the procedure is the same. I will attempt to see if the same tool can be identified that will tie two different body sherds together, or possibly a body sherd to a rim sherd based on punctate shape and size. By examining the shape of a punctate, and comparing this shape to other punctates, a correlation may occur that will link two separate features at one site or two separate sites together to show that the same people were at both sites or that the tool was passed down and curated within a family. If the same tool was used in the same way, possibly through ideas passed down through family members, then it is possible that these could be linked to show that the punctate was made by the same individual or family.

The analysis for all punctates, regardless of the punctate location on a rim or body sherd, was first to categorize punctates by shape. The categories were round, oval, and unique shaped. Both round and oval categories were subdivided into small, medium and large, which was confirmed through measuring the diameter. Small punctates had a width less than three millimeters, medium punctates were between three and four millimeters and large punctates had a width over four millimeters. Categories were used to group together sherds that may have been made by the same tool to make analysis simpler.

Large rim sherds of Perrot Punctate were analyzed first to see if there were any similarities between sherds to determine if they were made by the same tool, which would suggest they were made by the same person or family. The length and widths of all punctates were measured on the rim sherds, for a comparison with the body sherds could be made, and in order to determine the variability of a single potter. Variability was calculated to see the distribution of widths, as well as calculating the mean and standard deviation of each rim sherd.

The sample of rim sherds also was analyzed for the number and placement of punctates, chevrons, vertical and horizontal lines. The general pattern of decoration in Perrot Punctate consists of chevrons, punctates, and vertical lines. Within this general pattern a wide range of variability exists relative to the placement of punctates above, below, to the sides of, or a combination of these three placements around the chevrons. If a distinct and identifiable pattern can be seen on a sherd from two different sites, it may suggest that the same person or family may have lived at both of the locations. For example, if two rim sherds from different vessels were found that have six chevrons surrounded by twenty punctates, nine above and eleven below the chevrons with seven horizontal lines between chevron patterns, this type of pattern would be too unique to have been made by two separate people or clans. This could be seen as an

individual's signature in some respects if it was only found on a few different vessels. If that pattern was seen widespread across the entire site, it would show that there was very little variation and that artistic license was not used by the makers of the vessels.

Body sherds were selected from the bags of punctated sherds, from the Olson Site, or from the bags of decorated body sherds, from the Gundersen Site. Body sherds were examined and only included in the sample if they had three full punctates or had a unique and identifiable tool shape seen in the punctate. These body sherds were then put into the shape categories, small, medium and large based on punctate width, then the length and widths were measured. The mean size of punctates of each body sherd was calculated, which was then graphed to find clusters of sherds that had similar lengths and widths. The mean lengths and mean widths were used to compare to the rim sherds to determine if any body sherds could be linked up to a large rim sherd that has the same mean length and mean width, then looking to see if the same tool could have made both punctates.

All measurements were taken with digital calipers that were accurate to a tenth of a millimeter. Punctates were measured on the widest part of the tool mark, which may or may not have been the widest part of the punctate. The widest part of the tool mark was used for primary measurements because there would be less variability than the length of the punctate, which could be completely dependent on the maker's aesthetic desire, especially for oval punctates. If it appeared that the tool was wiggled, or that there was movement from side to side in the execution of the punctate the measurement was taken where the crispest tool impression could be seen and was measured consistently from at that point for the sherd. The length of the punctate was also measured to get the full representation of the punctate shape.

## DATA AND RESULTS

The measurements of all punctates were put into an Excel spreadsheets based on the shape categories of circle, oval, unique punctates or rim sherd. The mean punctate length and width for each sherd was calculated and was used as the primary representative measurement for the sherd. The means were then graphed on a scatter plot to visually reveal clusters of sherds that had similar means length to mean width ratios. These clusters helped to narrow the focus of the punctate analysis. The variation in tool measurements of one vessel was also calculated to determine a possible standard variation rate. All graphs throughout this paper are in millimeters. Scale on all graphs was altered to show a magnified examination of the punctate measurements. This was done in order to eliminate blank space in the graphs and to focus on the punctate measurements.

The sample analyzed was comprised of a total of 169 sherds. Broken down by the shape of punctate on the sherd, each category consisted of 46 circular, 82 oval, 22 unique shaped sherds, and 19 rim sherds in each category as seen in Figure 6. Oval punctates were almost twice as common in the sample as circular punctates. Unique shaped punctates were those that were not circular or oval, the four main categories being triangular, rectangular, extra small rectangular and stab and drag which are examined in a later section. A total of three triangular, six rectangular, five extra small rectangular and four stab and drag punctates were identified and analyzed. Other shapes were encountered in the analysis, but these were only represented by a single sherd. A total of 18 rim sherds of Brice Prairies Perrot punctate were analyzed for the placement of design elements. The final rim sherd, for a total of 19 in the sample, was used for calculating the variance because there were 78 total punctates on this vessel.

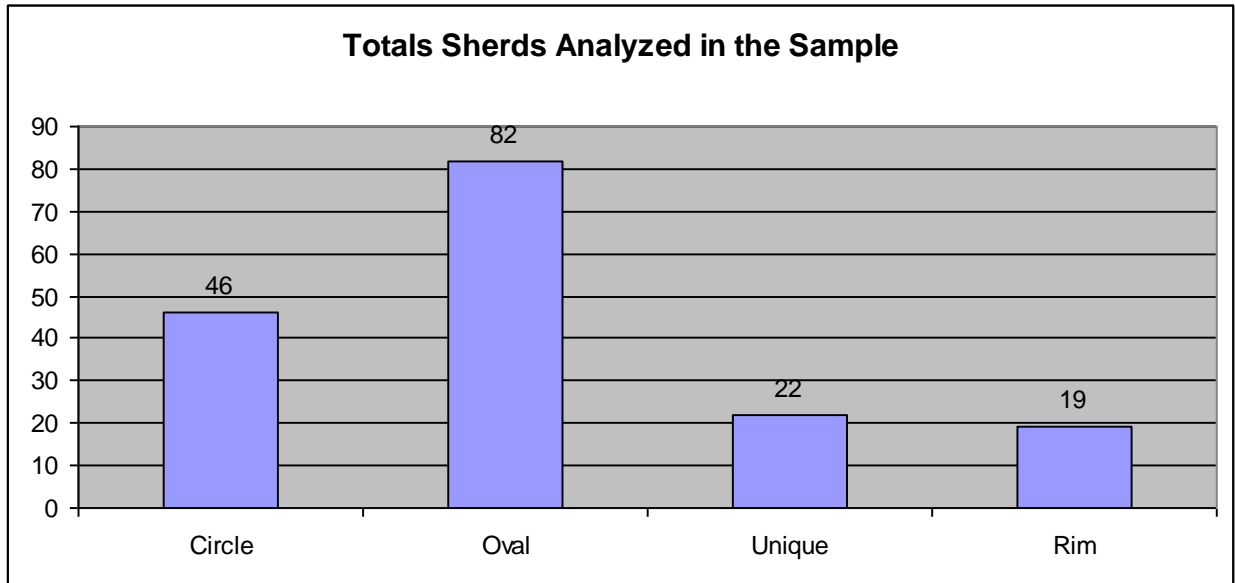


Figure 6. Total sherds analyzed in the sample, broken down by punctate shape on the sherds.

As the visual analysis of clusters proceeded, it was clear that only a small number of sherds would reveal any punctate mark which was unique and could be linked with another sherd with a high level of confidence. These sherds were seen as positive matches. Positive matches were identified on punctates that had a unique tool impression. This was seen as aspect of the tool that would have been hard or impossible to reproduce on a separate tool. If this unique punctate shape was seen on two sherds from separate vessels, it shows the same tool was used to make both punctates. Other punctates were very similar and showed promise and were labeled as possible matches. Possible matches were punctates with very similar shapes but lacking a unique aspect about the tool impressions which needed to be seen on both sherds in order to make a strong positive match. All clusters that are categorized as possible and positives are examined in their own section.

## Body Sherds Analysis

The mean length and width of the punctates on each body sherd was graphed on a scatter plot and can be seen for circular punctates in Figure 7 and for oval punctates in Figure 8. Each dot on the graphs represents the average measurements on one sherd. Clusters of sherds were identified from the graph when there were other dots in close proximity to each other. In Figure 8, average of oval punctates, clusters were identified when dots overlapped due to the larger sample of oval punctates. The overlapping clusters in the oval punctate scatter plot either share a mean measurement or are within one millimeter to the other mean measurements. The punctates on sherds in the clusters were then visually analyzed to see if they were made by the same tool.

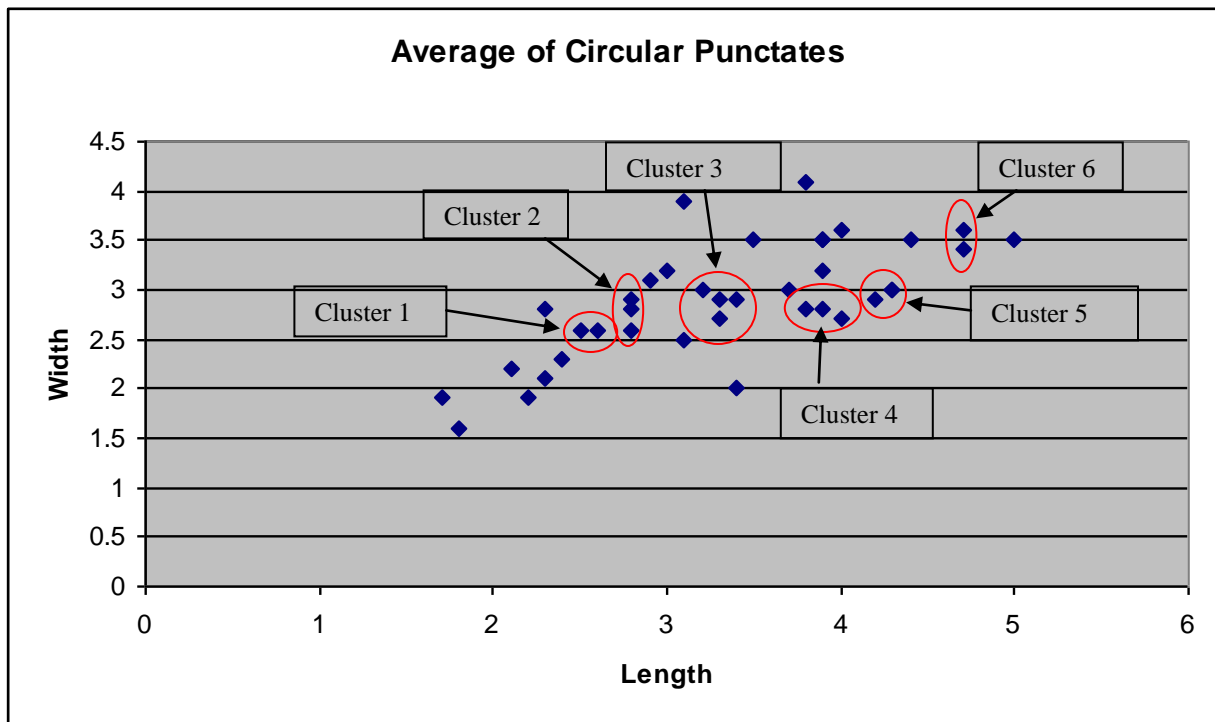


Figure 7. Graph of circular punctate averages from body sherds, measurements in millimeters.

Six clusters were identified for circular punctates as seen in Figure 7. When the sherds within the clusters were visually analyzed, the punctates did not show any similarity, except Cluster 2. Two of the three sherds in Cluster 2 were extremely similar. Impressions were taken of the punctates on these two sherds using modeling clay. The impressions showed that the tool that made both of these punctates was pointed, but the tip was not in the center of the punctate, it was off to one side. This distinctive attribute suggests that the same tool and perhaps person made the impressions on both sherds. This cluster will be examined further under the section positive matches.

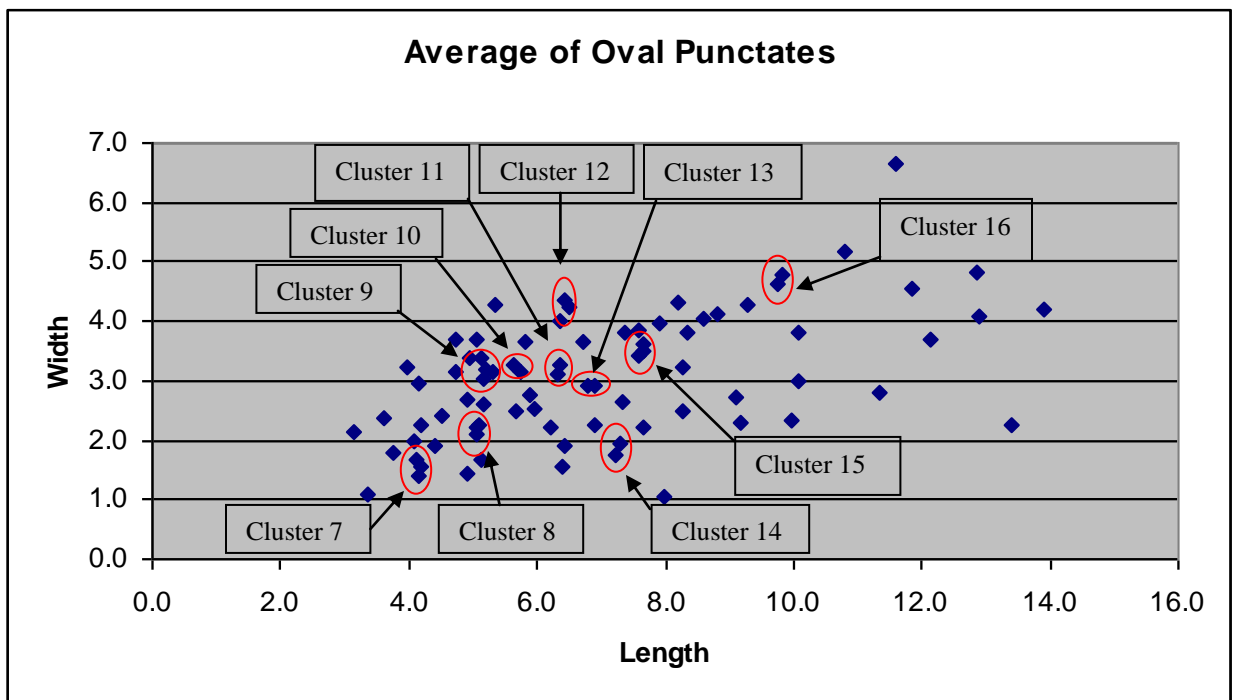


Figure 8. Graph of oval punctate averages from body sherds, all measurements in millimeters.

Ten clusters of oval punctates were identified in Figure 8. Three clusters showed similarly shaped punctates, Cluster 8, Cluster 9, and Cluster 14. The same visual analysis using

molding clay was used to see the exact tool impression. None of these similar sherds could be definitively matched because unique tool impressions were not seen in the punctates. These three clusters are considered possible matches.

## **Rim Sherds Analysis**

### Style Analysis

Rim sherds were analyzed not only for their punctate measurements, but for their pattern or motifs. Rim sherds were selected for the sample because they were designated as Perrot Punctate. This style is a combination of chevrons, punctates, and vertical lines. Chevrons are v-shaped lines that when stacked one above the other are sometimes called nested chevrons. Punctates on the Perrot Punctates style are typically found above or below the nested chevrons. Vertical lines are found separating the panel of nested chevrons and punctates. A typical example of Perrot Punctate is shown in Figure 9.

There was quite a bit of variation in the placement of punctates on the vessels in the sample. Some were located above, below or both above and below the nested chevrons. Variants of this included a sherd that had punctates above the nested chevrons and in between the chevrons and the vertical lines (Figure 10). It was not evident if there were punctates below the chevrons because the sherd was broken before the pattern ended. Another variant was categorized as Perrot Punctate, but it did not have any chevrons. There were panels of vertical lines with punctates on either side of the panels but without chevrons. The place where chevrons could have been was left blank, with no decoration (Figure 11). One sherd had all the typical signs of Perrot Punctate, except the chevrons were inverted, forming an arrow shape (Figure 12).



Figure 9. Typical Perrot Punctate style, punctates are located above and below chevrons, vessel number 92.512.93 T.P. 4.



Figure 10. Variant of Perrot Punctate with punctates above and adjacent to the chevrons, vessel number 92.831.01 F.17.



Figure 11. Variant of Perrot Punctate, vertical lines surrounded by punctates and missing chevrons, vessel number 80.707.550.



Figure 12. Variant of Perrot Punctate, chevrons are inverted, Vessel 30 99.1802.82.

When analyzing the rim sherds in the sample for similar patterns, there was too much variation to definitively conclude that the same individual made separate vessels. Also, there were problems with the sample; there were many sherds that did not have an entire pattern visible before the break occurred. When these rim sherds did not have the full pattern, it made this type of analysis impossible because only the minimum number of design elements could be counted. This was the reason that it was impossible to make comparisons between vessels and to arrive at any definitive results using a style analysis.

#### Punctate Measurements on the Rim Sherds

The same analysis of punctate shape from the body sherds was also done with the rim sherds. Punctates were measured, the means calculated in an Excel spreadsheet, and then graphed on a scatter plot as seen in Figure 13. The graph of average rim sherd punctate measurements showed four clusters.

When these four clusters were analyzed, it was clear that Cluster 18, Cluster 19, and Cluster 20 did not share any similarities in punctate shape, while Cluster 17 had some similarities. In this cluster there were four rim sherds, it was clear that two of these sherds did not match the other two. These other two rim sherds were the same color, thickness, rim height and angle, and had the same deteriorated lip (Figure 14). It seems that these two rim sherds were not only made with the same tool, but were once part of the same vessel.

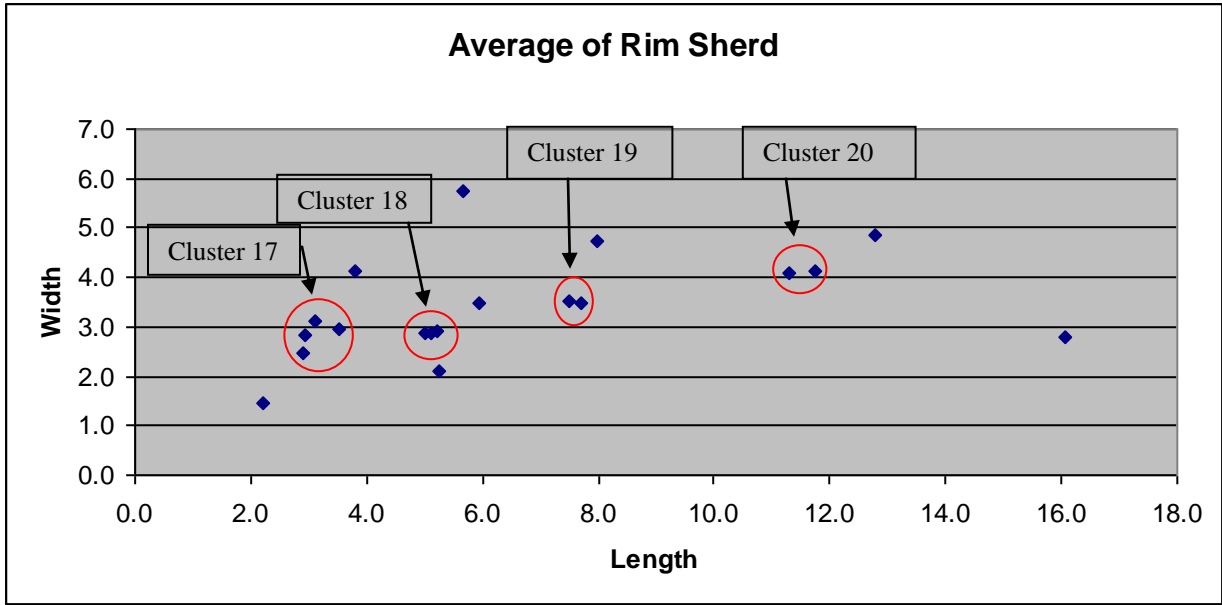


Figure 13. Average punctate measurements of all rim sherds.



Figure 14. Two rim sherds from Cluster 17 that were originally from the same vessel, Vessel 10 99.1366. F. 30 and 99.1767.104.

## Comparison of Rim Sherds with Body Sherds

In order to see if any punctates from body sherds could be linked with punctates from a rim sherd, the means of each sherd were graphed. This was done for both circular and oval punctates as seen in Figure 15 for circular punctates and Figure 16 for oval punctates.

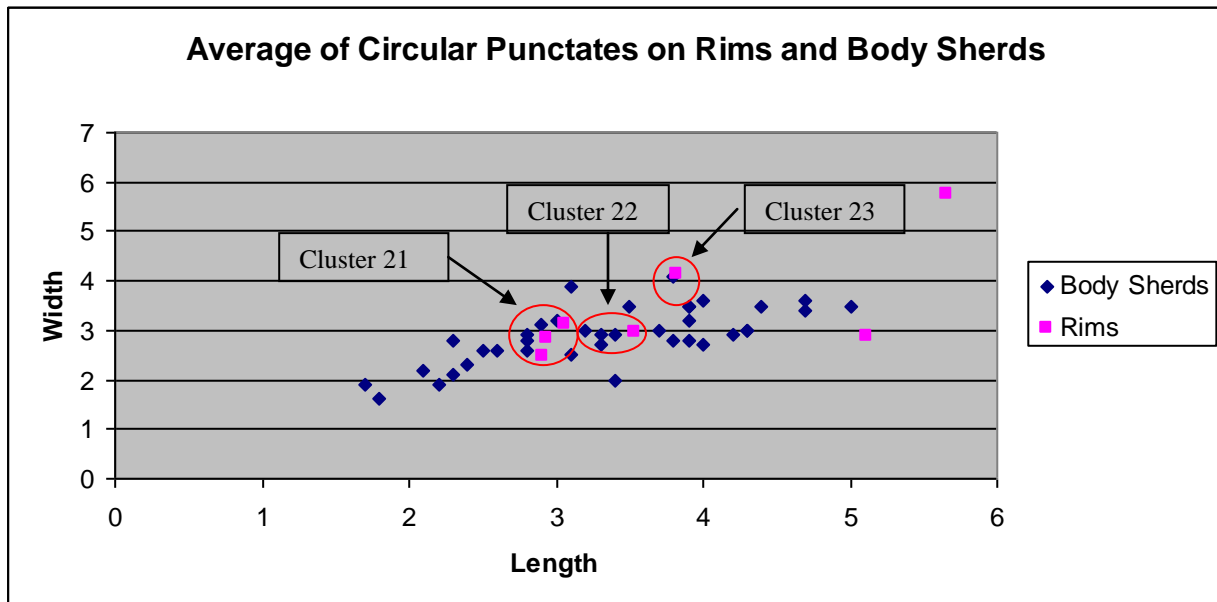


Figure 15. Comparison of circular punctates from rim and body sherds.

Three clusters of rim and body sherds of circular punctates were identified. Cluster 21 and Cluster 22 were associated with previous clusters of body sherds, only Cluster 23 did not coincide with a cluster in the body sherds analysis. Cluster 21 involved two more body sherds than the original body sherd analysis. Although these extra sherds did not have any similar tool shapes found in the cluster.

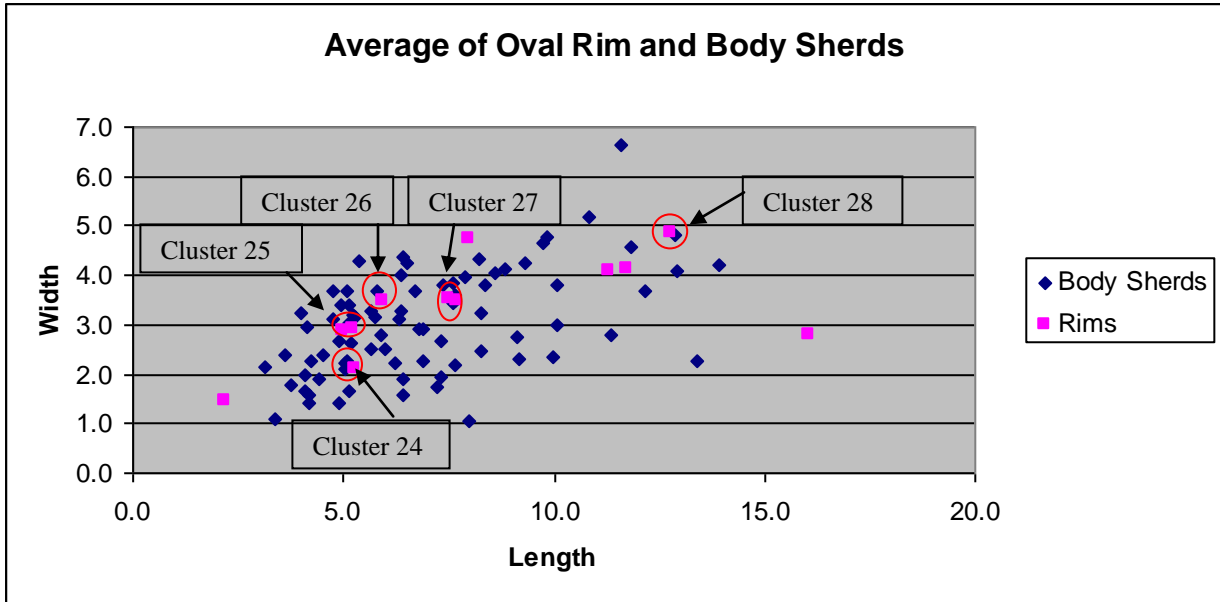


Figure 16. Comparison of oval punctates from rim and body sherds.

Of these five clusters, only two had similar tool shapes, Cluster 25 and Cluster 27. Both of these clusters were comparing three body sherds to two rim sherds. In Cluster 25, two body sherds had similar tool shapes with only one of the rim sherds. In Cluster 27, only one body and one rim sherds had similar tool shapes. Both of these similar punctates did not have any identifiable characteristics to be able to definitively match the punctates to one tool. Cluster 25 and 27 coincide with Cluster 9 and Cluster 15 in Figure # for the average of oval punctates.

### Variability of a Rim Sherd

Knowing how much variability is present in the punctates can help to link sherds from different vessels that were made by the same tool. To understand this, the variance was calculated for all rim sherds which can be seen in Table 1. A vessel with a high variance shows that there was a considerable amount of variation in the punctates measurements. A low variance shows that the

measurements were more consistent and standard. The rim sherds used in this study show a range of variations. Vessel 80.707.550 for example has a variance of 1.14 which is very high compared to vessel 99.1767.104 which only has a variance of 0.01. These two rim sherds show that within one sample the amount of variability in punctate widths can be extensive. The variance was only calculated for the widths of punctates because this measurement consists only partially of human variation, whereas the length measurement is based on more human variation and less on total tool shape.

Table 1. Variance of punctate widths calculated for each rim sherd.

Vessel Acquisition #	Variance		Vessel Acquisition #	Variance
92.1005.21 F.29	0.06			
			V. 22 2000.2435.32	0.04
92.506.07 T.P. 16	1.11			
			V. 21 2000.2400.08	0.03
92.555.363 T.P.23	0.11			
			V. ? 99.1156.06	0.04
92.512.93 T.P. 4	0.13			
			V. 39 99.1870	0.09
80.707.550	1.14			
			V. ? 99.1767.104	0.01
92.831.01 F. 17	0.13			
			V. 20 99.1429.02	0.08
V.23 2000.2479.28-.29	0.20			
			V. 7 99.1264.01	0.00
V.19 99.1208.05	0.06			
			V. 10 99.1366	0.16
V. 30 99.1802.82	0.12			
			V. 26 2000.2589.05	0.05
V. 3 99.1142.01	0.10			

In order to understand the variability, a rim sherd with many punctates was chosen for analysis, Vessel 10. This was a Brice Prairie phase vessel that did not fit into any typical pattern and is considered a transitional design. This sherd has 78 punctates and all were measured. This

sherd was included in the rest of the analysis for punctate measurements and was matched up with another rim sherd from the same vessel which can be seen in Figure 14, Cluster 17. The measurements of each punctate on this sherd were graphed individually and can be seen in Figure 17.

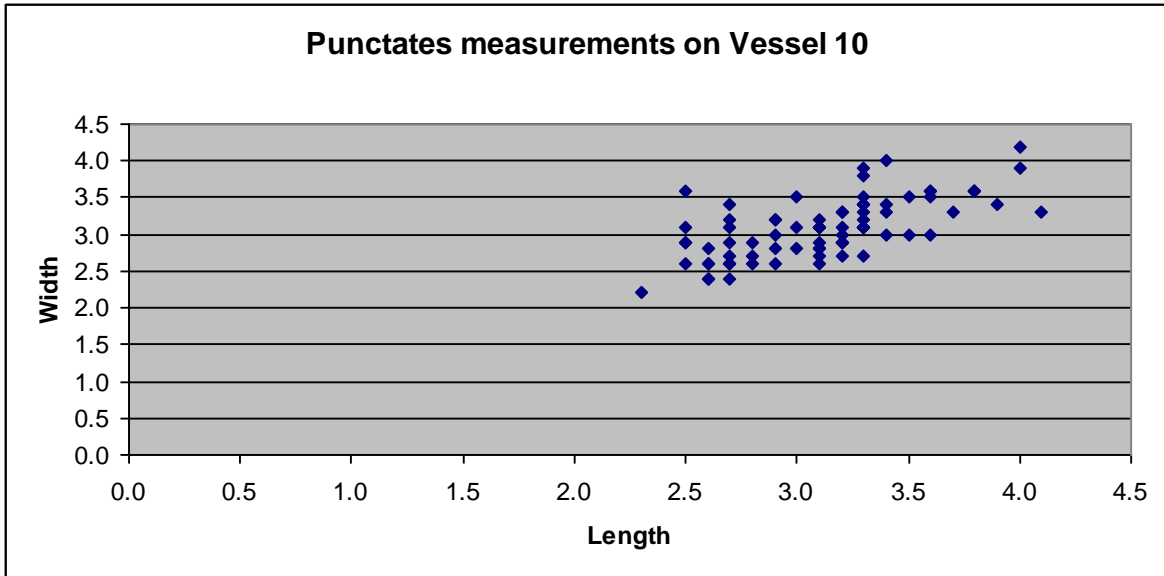


Figure 17. Punctate measurements from Vessel 10, each dot represents one punctate.

This graph shows that the punctates are grouped together. Most punctates fall within a range of 2.5 to 4 millimeters in both length and width. The variance for this sherd was 0.16 which shows the punctates were very similar in size. Since the variance was very low, it shows that the individual making the punctates was consistent.

Table 2 shows the mean and standard deviation of each vessel along with the number of punctates that were present on the vessel. The higher the number of punctates on a vessel, the more accurate the measurements of mean and standard deviation will reflect the real yet

Table 2. Variability of punctates using mean and standard deviation of length and width.

Vessel Acquisition #	# of Punctates	Mean	Standard Deviation	Vessel Acquisition #	# of Punctates	Mean	Standard Deviation
92.1005.21 F.29	10	7.4	0.64	V. 22 2000.2435.32	3	11.7	0.37
		3.5	0.25			4.1	0.21
92.506.07 T.P. 16	22	5.9	1.19	V. 21 2000.2400.08	3	11.3	3.34
		5.9	1.05			4.1	0.17
92.555.363 T.P.23	7	3.9	0.48	V.? 99.1156.06	17	5.1	0.80
		4.3	0.33			2.1	0.19
92.512.93 T.P. 4	20	3.5	0.61	V. 39 99.1870	4	2.5	0.45
		3.0	0.36			2.3	0.30
80.707.550	14	17.6	3.69	V.? 99.1767.104	4	3.0	0.13
		2.7	1.07			2.8	0.10
92.831.01 F. 17	19	4.9	1.32	V. 20 99.1429.02	12	2.4	0.62
		2.9	0.35			1.4	0.29
V.23 2000.2479.2 8-.29	12	5.1	0.44	V. 7 99.1264.01	1	7.7	0.00
		2.9	0.45			3.5	0.00
V.19 99.1208.05	2	12.8	1.30	V. 10 99.1366	78	3.1	0.40
		4.9	0.25			3.1	0.40
V. 30 99.1802.82	9	6.5	1.63	V. 26 2000.2589.05	5	5.7	0.93
		3.5	0.34			2.9	0.22
V. 3 99.1142.01	10	7.7	0.81				
		4.8	0.31				

unknown statistical computations. Some measurements, vessel 39 99.1870 and 99.1767.104 for example, have a low standard deviation showing low variability even though the sample comes from four punctate measurements.

A wide range of standard deviations are seen in the sample of rim sherds. Vessel 80.707.550 has the highest variation in both length and width, showing that the 14 punctates were not consistent. The most consistent variability is seen on vessel 10 99.1366 which has a standard deviation of 0.40 in both length and width.

Variability of punctates within rim sherds can vary considerably. This variation depends on the number of punctates measured; some of the computations were calculated using only a couple of punctate measurements since this was all the punctates on the vessel. Rather than Vessel 10 which had a total of 78 punctates, showing the higher the number in the calculation, the more consistent information which be gained when more punctates are available. Although some punctates few measurements and still had a low variance and standard deviation. With the low number of measurements and the low calculations, it shows that the individual making the punctates was consistent.

### **Unique Punctates**

As punctates were originally sorted, some did not fit into the circular or oval categories. These were put into their own category because the punctates shape was particularly unique. It seemed that there were certain groups of unique punctate shapes. Main categories included triangular, rectangular, extra small rectangular and stab and drag. Some unique punctates did not fit into these four main categories, but are only present on a single sherd.



Figure 18. Triangular punctates, acquisition numbers 80.704.243, 80.825.59 and 80.833.23.

Since the sample size of each of these three categories was not very large, three triangular, six rectangular, five extra small rectangular and four stab and drag body sherds, the entire sample of these four categories of punctates was visually analyzed. The three triangular punctates, seen in Figure 18, were analyzed, but none of the three sherds showed any similarities in tool impression. Here, the triangles on each sherd were unique and did not have any similarities beyond their triangular shape.

Rectangular punctates were very similar. Of the six, two of the sherds stood out from the rest. Measurements for these punctates can be seen in Table 3. Figure 19 shows the six sherds in this category. Two of these sherds did not match the punctates on the other four. One of these had a unique mark in the impression which none of the other punctates possessed. Due to this mark in the impression it could not have been made by the same tool as the other punctates which did not show this mark. The second punctate that stood out had a crisper tool impression

than the rest and was slightly larger. This showed that the overall tool was larger than the remaining four sherds. These four sherds, seen on the top row in Figure 19, were extremely similar, but seemed to be paired. The tool impressions were similar in shape and width. All of the punctates on these four sherds were made by a tool that did not have any distinguishing characteristics, so these sherds cannot definitively be made with the same tool. Since they are extremely similar, these are considered as possibly being made by the same tool.



Figure 19. Rectangular punctates in Unique Category, acquisition numbers 80.722.100, 81.200.31, 81.151.43, 81.144.32, 80.712.905 and 99.1893.14.

Table 3. Measurements of unique rectangular punctates.

Rectangle	Acquisition #						Mean
	80.722.100	L	7.2				7.2
		W	3.5				3.5
	81.200.31	L	7.9	7.1	6.4		7.1
		W	3.2	2.7	3.2		3.0
	81.151.43	L	N/A				
		W	3.2				3.2
	81.144.32	L	5.2	6.2			5.7
		W	3.3	2.7			3.0
	80.712.905	L	5.6	N/A			5.6
		W	2.2	2.3			2.3
	99.1893.14	L	6.1	N/A			6.1
		W	2.6	2.8			2.7

These measurements show quite a bit of variation within the punctates which were made by the same tool. This indicates that even when the same tool is used, significant variation within the punctate can be seen. The widths of the punctates do not vary as greatly as the length of which can be seen on 80.200.31 and 81.144.32.

Extra small rectangles were just that, extra small, seen in Figure 20. Five sherds were categorized as extra small. Molding clay impressions were taken of these sherds and two were extremely similar. These two similar sherds are considered positives and are analyzed further in the Discussion section. Any tool that was small enough to make these punctates would have been hard to make because of its size and rectangular shape.



Figure 20. Extra Small Rectangular punctates, acquisition numbers 80.708.552, 80.708.594, 92.773.13, 99.1869.11 and 99.1414.75.



Figure 21. Unique shaped punctates in the stab and drag category, acquisition numbers 80.748.61, 99.1354.05 and 2000.2679.06.

The final category of unique shaped punctates was the stab and drag technique (Figure 21). Here the tool was inserted into the clay, and then drug down the surface of the vessel creating a tool trailed line, but keeping a distinct punctate mark at the beginning of this line. When this category was visually analyzed it was clear that the tools used to make the punctates on these three sherds were all different. One of these sherds, seen in the top of Figure 21, was made with a tool which was not shaped or smoothed before being used as a tool. This gave a very jagged tool impression which was only seen on this sherd.



Figure 22. Bird bone punctates, acquisition numbers 99.1572.08 and 99.707.563.

Some unique tool marks were encountered during initial sorting. One of these unique marks included two sherds with circular punctates that had a small bulge of clay in the middle of the punctate that was not pushed down when the tool was inserted into the clay (Figure 22). Showing there was a gap in the head of the tool that formed this bulge. The tool was most likely

bird bone, because it is hollow which would have allowed this effect to occur and could have been present on the sites. Since the sizes of these punctates were so small, the bone came from a bird the size of a red-winged black bird or a blue-winged teal duck (James Theler, personal communication).



Figure 23. Elongated punctate with thin strip of clay in the middle, acquisition number 99.1183.08.

Other punctates with interesting tool marks were only seen on a single sherd. If these impressions were found on multiple sherds, it would show that the tool was used possibly on multiple vessels. One of these sherds was similar to the bird bone tools mentioned previously, but it was elongated (Figure 23). There was a thin strip of clay that conformed to a linear hole in the tool surface.

## Clay Impressions of Three Possible Bone Tools

After consulting with Dr. Jim Theler about the possible bird bone tools mentioned above, he suggested some other bones that may have been used to make punctates. These included a phalanx, antler tines, and the residual toe bone all deer bones. These bones were pressed into clay at different angles to produce different punctate marks. After these marks were made, the lengths and widths were measured, all measurements are in millimeters.



Figure 24. Deer phalanx impressions in clay with examples of triangular punctates.

A phalanx is a toe bone which in a deer has a triangular tip and was considered to be a possible tool to make a triangular punctate. This phalanx had a fossa, a hole or trench in one side near the tip of the tool. This fossa left a very unique impression in the clay which can be seen in three out of the four impressions made with the tool in Figure 24. Although this tool made a

triangular punctate, no punctates encountered in this study found any mark similar to this fossa impressions in punctates. Measurements from the phalanx impressions can be seen in Table 4 and shows that the angle in which this tool was impressed into the clay and the pressure used can make very different punctates.

Table 4. Measurements from the impressions of a deer phalanx into clay seen in Figure #.

		Perpendicular				Angle 1		
Phalanx	L	6.4	6.1	6.1		9.4	9.2	9.6
	W	3.4	2.7	3.9		1.4	1.8	1.5
		Angle 2				Angle 3		
	L	5.4	4.4	5.7		10.3	8.4	11.0
	W	2.9	3.3	3.8		4.0	4.4	3.8



Figure 25. Residual toe bone of a deer with examples of similar punctates.

A residual toe bone from a deer is a very thin bone and fits in a hand nicely. Punctates were very consistent when impressed perpendicularly into the clay which can be seen as the top left imprint on the clay in Figure 25. When making the longer punctates, this small tool cut through the clay very easily, but due to human variation the end of these marks appears at different lengths. This shows that in order to make an oval punctate with the same exact tool marks, the overall tool shape would have to be oval. The perpendicular tool shapes with the residual toe bone shows similar punctates to the extra small rectangular punctates that were seen in the unique category.

Table 5. Measurements of tool impressions from a residual deer toe.

		Perpendicular							Angle 1				
Residual toe bone	L	2.3	2.2	2.7	2.6	2.4		4.3	4.3	4.2	5.8	5.3	
	W	0.6	0.5	1.0	0.7	0.8		1.0	0.9	0.5	0.7	0.8	
		Drag Through											
	L	10.3	10.9	10	10.8	12.9							
	W	0.9	0.6	0.8	0.7	1.0							

The measurements, specifically width, from the residual toe bone are extremely thin as seen in Table 5. Only few punctates seen in the study are similar to this width. Although the widths are very thin, these measurements were thinner than any seen in the archaeological sample. The lengths from angle one and the drag through show just how much human variation plays into the length of a punctate.

The last tool analyzed was an antler with three tines, each of different sizes. This tool was inserted into the clay in two different ways. The left row of punctates on the clay (Figure

26) shows that the tool was inserted perpendicularly into the clay, while the right row shows the mark when inserted at an angle. Both of these types of punctates were seen in the sample. Since the antler tines were unmodified, they were naturally smooth and made smooth marks which were unidentifiable.



Figure 26. Antler tine punctates with examples from the sample.

Table 6. Measurements taken from antler tine impressed into clay, seen in Figure 26.

		Circle				Oval		
Antler Tine	L	2.4	2.2	2.2		7.2	6.8	6.8
	W	2.8	1.9	2.4		3.2	4.1	3.7
	L	3.5	3.5	3.6		8.6	5.9	6.7
	W	3.2	3.3	3.9		4.0	4.5	5.6
	L	2.5	2.5	3.0		6.7	6.5	7.7
	W	2.2	2.0	3.0		3.6	3.0	2.7

The measurements seen in Table 6 show the variation that can occur within half of a set of antlers from one deer, consisting of three tines. When each of these punctates was measured it shows that there can be considerable variation within one tool. Evidence can be seen here showing the differences in tool measurements depending on the angle in which the tool was impressed into the clay. These measurements also fit into any category that punctates were analyzed in this study.

## **DISCUSSION**

### **What Clusters Show**

The clusters in the graphs show that the lengths and widths of the punctates were similar, and possibly the same kind of tools were used to make these similarly shaped punctates. However, when the sherds within the clusters were visually analyzed, it was evident most of the sherds were not made by the same tool. This was seen in the shape of the punctate; some punctates had distinct edges that were not seen on the other sherds punctates, indicating the punctates were not made by the same tool.

If the graph did not have any clusters, it could mean a variety of things. A lack of clusters could show that the sample was too small. If the sample was large enough but still did not show any clusters it could also have been due to a lack of communication between the two sites that were included in the analysis. Another reason may have been the tools used to make punctates. If the measurements were too varied, the tools may be temporary and only used on one vessel, then discarded instead of being kept and used on many vessels. This would be

especially evident on circular punctates, because this is an exact imprint of the tool shape and the distinct edges of the tool may be discernable.

The main advantage of graphing data and analyzing the clusters was a way to focus the sample. Clusters narrow the sample to punctates that have the same measurements, which shows they may have been made by the same tool. Overall trends can be seen visually in graphs better than just analyzing the raw data. Clusters help to pull out the information that helps answer specific questions.

#### Clusters Categorized as Possible Matches

The clusters that were labeled possible were three clusters of oval punctates seen in Figure 27, 28, and 29, and four sherds of rectangular unique punctates seen in Figure 30. The oval punctates seen in Figure 27 are of Cluster 14 from the oval body sherd analysis. The sherd on the right has two different shaped punctates, the top row is pointed while the lower row is rounded showing there were two different tools used. The punctates in the lower row matches the punctate mark on its matching cluster sherd. These two sherds are both from the SAD.

Cluster 26, seen in Figure 28 all show oval punctates. These three sherds have faint punctates. The same tool shape and the same amount of pressure were used to make these punctates. The same pressure used with the same tool shape points to one person making these punctates. All three of these sherds are from the SAD.



Figure 27. Cluster 14 of Oval Punctates, acquisition numbers 99.1429.296 and 99.1125.12.



Figure 28. Cluster 26 of Oval Punctates, acquisition numbers 99.1528.03, 2000.2471.83, and Vessel 26 2000.2589.05.



Figure 29. Cluster 27 of Oval Rim and Body Sherds, acquisition numbers 92.532.105 and 92.1005.21 F. 29.

Cluster 27 from the analysis of all oval punctates from both rim and body sherds (Figure 29) are from both sites, the rim is from the Gundersen site, while the body sherd is from the Olson site. These punctates have a pointed top and a rounded bottom because the tool was inserted into the clay at an angle. When the tool is inserted at an angle, it gives a good impression of the face of the tool and if there were unique edges. Here the only unique aspects of the punctates were its pointed tip.

The category of unique rectangles consisting of six total sherds analyzed, four were very similar, as seen in figure 30. These four sherds are all made with a tool that has a blunt smooth face; with the only identifiable aspect is the rectangular shape. The sherd in the top right is from the Gundersen site, while the other three are from the Olson site.



Figure 30. Unique Rectangular punctates, acquisition numbers 80.722.100, 81.200.31, 81.144.32 and 99.1893.14.

From this analysis, it seems possible that these punctates were all made by the same tool. Similar tool shape and size is the common link between the sherds. However, without a unique identifiable shape to the punctate, it is impossible to say for certain that the punctates were made by the same tool. With similar tool shapes from different sites, it is possible that there may have been communication between these two sites.

#### Clusters Categorized as Positive

Cluster 2 and two sherds from the unique punctate category of extra small rectangular punctates were considered positive matches. Tool impressions of the punctates show an uncanny similarity between tool shape and size. It would be extremely unlikely for two separate tools with these unique characteristics to exist.

Figure 31 shows two sherds from the extra small rectangular punctate category, which consisted of five sherds. The punctates in this category are very thin and long, which is a unique tool shape compared to the rest of the sample which was mainly composed of circular and rectangular punctates. When the sherds were analyzed, it was clear that two were extremely similar compared to the rest of the sherds in the category.



Figure 31. Extra small rectangular punctates with putty tool impression.

Figure 31 shows that the molding clay impressions from the two sherds that are extremely similar. Measurements were taken from the putty impressions to show the variability of the tool impressions when the same tool was most likely used, seen in Table 7. The width of the molding clay impression was only one tenth of a millimeter off from the other measurements

on the same sherd. The same measurements were recorded from both sherds showing that the tool used to make these punctates was the same width.

Table 7. Measurements of putty impressions from extra small rectangular sherds.

Extra Small Rectangles			
	L	4.4	4
80.708.594	W	0.9	1
92.773.13	L	4.5	4.7
	W	0.9	1

It can be seen that the measurements are extremely similar which supports the claim that these punctates were made with a tool that was the same in width and possibly a similar length. This unique shape of punctate would have been hard to produce since the tools was so thin; therefore these two thin punctates were made with the same tool. Both of these sherds are from the Olson site which increases the likelihood that they were made with the same tool.

The second cluster that showed a similar punctate shape and measurement can be seen in Figure 32. These punctates were made with a tool that had unique edges which were imprinted into the punctate. The tool was inserted perpendicularly into the clay because the shape of the punctate is circular; showing the tool impression inside the punctate exactly represents the tool shape.

Figure 32 shows the putty impression with the two sherds. Here the point of the tool is off-center and the angle that leads to this asymmetry is identical. The tool was not impressed into the clay at an angle; these are both circular punctates that were inserted perpendicularly into the clay. The molding clay impressions were measured to better understand the shape of the



Figure 32. Tool impressions showing the same tool made both punctates, from Cluster 2.

Table 8. Measurements of the putty impressions of two circular punctates.

Circular					
80.718.71	L	2.6	2.7	2.6	2.6
	W	2.3	2.3	2	NA
2000.2324.21	L	2.7			
	W	2.5			

tool and are presented in Table 8. The measurements show how similar the two punctate impressions are, which shows that the tool was similar in size and shape.

Due to the asymmetry of the point of the tool and the angle of the point, along with the size of the punctate, it makes the tool extremely unique. Just like the extra small rectangular sherds, it seems incredibly unlikely that two tools with these unique characteristics could be produced by two separate individuals. Therefore it seems reasonable that the punctates on these two sherds were made by the same tool. These two sherds are not from the same site; one is from the Gundersen site, while the other is from the Olson site. The implications for this discovery will be considered later.

### **Style Analysis**

The analysis of the Perrot Punctate style was unsuccessful in identifying the exact pattern on two different vessels. There was too much variation in the styles and the placement of design elements. From this analysis, style was not unique to a person. Sample size and type played into this outcome. Many sherds were broken before the full pattern was completed so only a minimum number of design elements were counted.

### **Tool Marks**

Most tool marks did not have any distinctive impressions which would set it apart from the rest. This shows that the tool that made these marks was smooth and rounded. Smooth tool marks show that the material was worked in order to achieve this smooth surface. Some punctate impressions showed that the tool had distinct edges which allowed sherds to be matched with

others of similar form, and allowed sherds to be excluded due to the uniqueness of the impression.

Many components play into the final shape of a punctate. The actual tool shape and size makes up the main component of the tool mark. If the tool is large, the punctate will be large, if the tool is small, the mark will be small. This would be the case for many circular punctates with well defined margins, but there are other variables that play into the final shape of the punctate. If the tool was inserted into the clay and moved around, wiggled, then the punctate will not reflect the tool shape as much as if the tool was inserted and was removed, with no wiggling.

For oval punctates, another variable is the individual making the mark. The length of the oval punctates depends completely on the individual. The width still depends on the original width of the tool and if the tool was wiggled while it was drug through the clay to make the elongated mark.

Another variable that plays into punctate shape is the plasticity of the clay. Identifiable tool impressions may have been made into the clay as it was beginning to dry which allowed unique tool traits to leave an impression in the punctate. If the clay was wet when the tool was impressed into the clay, any unique marks on the tool face would get clogged with clay, so the impression would not be as evident in other punctates.

There was only one sherd which had punctates made with a tool that left a very jagged impression (Figure 33). This sherd was one in which the stab and drag style of punctate was used. Other punctate impressions may have had a small flaw in the face of the tool that left an impression, but this tool may have been a piece of wood that was broken off and not modified in any way to create a smooth surface.

There are various ways that a tool can be inserted into the clay to produce any mark, whether a punctate or an incised line. This variation can make marks made by the same tool indecipherable. Although this type of discrepancy is inevitable in any analysis, it is part of the sample; the researcher cannot do anything to prevent this, although there is some hope that conclusions can be made through the discrepancies to a final conclusion.



Figure 33. Stab and Drag punctate with a very jagged tool impression, acquisition number 2000.2679.06.

### **Bone Impressions in Clay**

The three deer bones show many similarities found in the sample. The phalanx does produce a triangular punctate. Although similar punctates were not seen in the sample, mainly due to the fossa located near the tip of the tool which left unique marks in the punctate.

The residual toe bone from the deer shows a similar punctate which can be seen in the unique category of extra small rectangles. The width of the measurements was thinner than this category even in wet clay, and would continue to shrink as the clay dried and was fired. Showing that this un-worked bone may not have been used to make the punctates from the extra small rectangular category, although if the thin tip of the tool was worked to the thicker part of the bone, this could be used to make punctates.

Impressions from antler tines are extremely similar to the punctates seen in the sample. Similarities were seen in the impressions inserted perpendicularly as well as at an angle. Any smooth punctates without any unique edges could be made by antler tines. This was a tool that is usually associated with flintknapping which is seen as a male activity. If this tool was used by women it could mean that this tool was a universal tool rather than just a male tool. If antler tine was not used to make these punctates, this shows the general shape that the wooden tool would need to be in order to make these impressions, although a wooden tool would not preserve in the archaeological record.

## **CONCLUSION**

There were almost twice as many oval punctates than circular punctates in the study which shows that the oval punctates were more popular as a design element. The elevated number of oval punctates may also be due to the angle at which the tool is inserted. If the tip of the tool was inserted at an angle, then the start of the shaft may have left its impression as the bottom of the punctate. This made the punctate an irregular shape that fit into the oval category because

the tool was not inserted perpendicular to the clay. These marks may not have intentionally been created to look like ovals, as other punctates in this category.

The placement of punctates, chevrons, and vertical lines were too varied to conclusively define any patterns on multiple vessels. The stylistic analysis was unsuccessful because the sample of rim sherds with complete patterns was too small. The pattern of numbers of design elements did not show any trends between sites, showing that this may have just been the aesthetic of the individual about how many lines and punctates they wanted. This also could be based on how large the vessel was, or the size of the tool, a finer tool could make more impressions than a larger tool and more impressions can be left on a larger vessel regardless of tool size.

Variation on the rim sherds was wide ranging. Some sherds had very consistently shaped punctates where others showed more variation. Most of the rim sherds had a low variance and standard deviation which shows that the individual making the punctates was consistent. The variability of Vessel 10 is very consistent. This shows how much individual consistency can occur with one tool and one skilled individual.

Bone tool impressions showed some possible bones that may have been used to make punctates. Although two of the tools were similar in shape to punctates seen in the sample, there were differences. The phalanx had a fossa which left a unique mark not seen in the sample, and the residual toe bone was thinner than the widths seen in the sample. Antler tines showed many similarities to the sample. When inserted either perpendicularly or at an angle it produced punctates that were seen in the both the circular and oval categories of the sample. Even if the tool used archaeologically was not antler tine, this would be the shape needed in a tool to

produce these punctates. If the tools used were antler tines, it suggests that this tool is a universal tool, rather than just a male flintknapping tool.

The analysis of body sherds was successful because clusters of similar tools shape were identified. Tool shape needed to be unique and identifiable in order for the punctates to be definitively linked with another sherd from a different vessel. This was reasonably identified in two clusters. One of these clusters consisted of two sherds, one from each site used in the study. These two sherds suggest that there was communication and travel between these two sites. Since there were only one set of positively identified clusters involving sherds from both sites, it is presumptuous to claim that these sites were connected. There is a need for more clusters to be positively identified with sherds from both sites to definitively conclude how the sites were connected.

This analysis gained more insight into the tools used by Oneota. The tools came in a variety of shapes and sizes seen from the diversity of punctate shapes and sizes. Evidence for these tools in the archaeological record is unknown, showing the tools possibly were made out of organic materials like wood. Tools were worked to a smooth surface and only occasionally show any edges or angles that were not smoothed completely. These edges and angles were crucial in this study to identify the same tool. Since most tools were smooth and do not show any unique characteristics, this shows the type of tool was similar between both sites. This may reflect similar traditions within families or clans that are passed down through generations. It is impossible to tell if these smoothed tools were curated within a family because there are no distinguishing marks. Since the analysis of punctates on body sherds was unable to link multiple punctates of similar size and tool shape, it shows that even within the same site, most vessels were made with different tools, possibly only used on one vessel. With this implication, the

asymmetrical tip of the tool found at both sites shows further that there was a direct connection between these two sites.

This study set out to hopefully identify if there were punctates from two sites that could be identified by the punctate shape. This was seen in a circular punctate with an asymmetrical tip on two sherds from two sites. This ceramics similarity points to communication or interaction between the two sites or that the same person or tool was used at both locations. Tuck was able to identify settlement patterns and to trace exactly where people were moving across the landscape from the ceramic designs and although the design analysis of this study was not as successful, the circular tool with an asymmetrical tip found at two separate sites points to similar conclusions of contact between the sites.

Future researchers studying punctates should exclude smooth shaped punctates from the study. Studies should focus on punctates that have unique characteristics that have the potential to be matched with identical marks. Expanding sample size to hundreds of sherds from the two sites may find more punctates from the same tool to make the conclusion of communication between the two sites stronger. Another line of research could reproduce tools that would make punctates similar to the punctates seen in the study. These could be made either from bone or wood to also identify which is easier to make. Also, analyzing other possible bones that could be used unmodified to produce punctates.

APPENDIX A

TABLE A. CIRCULAR PUNCTATE MEASUREMENTS AND MEANS

SMALL  
47LC76

Acquisition #											Average
80.706.277	L	2.3	2.2								2.3
	W	2.8	2.8								2.8
80.711.795	L	3.1									3.1
	W	2.5									2.5
80.719.71	L	2.7	2.8	2.8							2.8
	W	2.8	2.9	2.9							2.9
80.710.271	L	1.8	1.6	1.9							1.8
	W	1.5	1.7	1.6							1.6
80.711.835	L	2.4	2.8								2.6
	W	2.9	2.2								2.6
80.760.151	L	1.3	1.7	1.9	1.9						1.7
	W	1.7	1.6	2.3	2.1						1.9
80.711.813	L	1.8	2.5	2.5							2.3
	W	2.0	2.0	2.2							2.1
80.711.804	L	2.5	2.5	2.5	2.3	1.7	2.2	2.6	1.5		2.2
	W	2.0	2.5	2.2	2.3	1.6	1.7	2.0	1.1		1.9
80.821.26	L	3.3	3.1	3.7							3.4
	W	1.9	1.6	2.6							2.0
80.817.39	L	2.9	3.1								3.0
	W	2.7	3.6								3.2
80.747.58	L	2.1	2.1								2.1
	W	2.1	2.2								2.2
92.512.100	L	4.4	3.5	3.5	4.1	4.1					3.9
	W	3.3	3.1	2.4	2.6	2.7					2.8

	92.972.41	L	2.4	2.4	2.2	3.0	2.4	2.5	2.0	2.5	2.7	2.5
		W	2.5	2.5	2.7	2.2	2.4	2.6	2.3	3.1	2.7	2.6
47LC394-15												
	99.1973.04	L	2.4	2.2	2.4	2.4	2.4	2.4	2.4			2.4
		W	2.1	2.3	2.5	2.1	2.4	2.5	2.4			2.3
	99.1916.04	L	2.6	2.7	3.1	2.6						2.8
		W	2.5	2.6	3.0	3.2						2.8
	99.1891.59	L	3.2	3.3								3.3
		W	2.9	2.5								2.7
47LC394-1/6												
	2000.2324.21	L	2.8									2.8
		W	2.6									2.6
47LC394-9												
	2000.2684.134	L	3.9	4.2	2.4	3.2	3.4	3.2				3.4
		W	2.8	3.2	2.8	2.6	3.0	2.8				2.9
	2000.2709.244	L	4.0									4
		W	2.7									2.7
MEDIUM												
47LC76												
	Acquisition #											
	80.711.780	L	4.7	3.8	4.5							4.3
		W	3.2	2.5	3.2							3.0
	80.712.883	L	4.1	4.5								4.3
		W	3.2	2.7								3.0
	80.708.615	L	3.5	3.5								3.5
		W	3.4	3.6								3.5
	80.707.563	L	3.1	3.4								3.3
		W	2.7	3.1								2.9
	80.777.33	L	3.5	3.3	2.9							3.2
		W	2.9	3.5	2.6							3.0
	80.711.973	L	4.7	5.8	4.4	5.0						5.0
		W	3.5	3.3	4.0	3.3						3.5
	81.209.51	L	4.1	4.1	3.6							3.9
		W	3.2	3.3	3.1							3.2
	92.634.95	L	3.0	2.8								2.9
		W	3.2	3.0								3.1

	92.515.132	L	5.2	4.6	4.4								4.7
		W	4.0	3.3	3.4								3.6
	92.546.134	L	3.9	4.4	3.9	3.9	3.9	3.3	3.7	3.5			3.8
		W	2.8	2.8	2.6	3.0	3.1	2.7	2.7	2.8			2.8
	92.500.156	L	2.9	3.3	3.4	3.2	2.8						3.1
		W	3.6	3.5	3.7	4.3	4.4						3.9
47LC394-15													
	99.1493.11	L	3.9										3.9
		W	3.5										3.5
	99.1924.38	L	3.9	5.7	4.4	4.8							4.7
		W	3.2	3.2	3.8	3.5							3.4
	99.1917.42	L	4.3	4.5	3.7								4.2
		W	3.1	2.6	2.9								2.9
	99.1989.05	L	4.3	4.9	3.8	4.4	4.7	3.1					4.4
		W	3.5	3.8	3.4	3.4	3.6	3.3					3.5
47LC394-1/6													
	2000.2437.55	L	3.9	3.5									3.7
		W	3.3	2.6									3.0
	2000.2688.08-.10	L	4.2	4.2	3.7	4.2	3.7	4.6	3.7	3.6			4.0
		W	3.6	3.4	4	3.7	3.5	3.3	2.9	3			3.6
47LC394-9													
	2000.2710.270	L	3.0	4.6	4.2	3.3	3.7	3.5					3.8
		W	3.6	4.1	5.0	3.5	4.5	3.8					4.1
LARGE													
47LC76													
	Acquisition #												
	80.750.73	L	5.5	4.8	4.7	4.9							5.0
		W	4.5	3.8	4.2	4.2							4.2
	80.711.861	L	5.0	4.4									4.7
		W	4.7	4.8									4.8
	80.738.32	L	6.5	6.4									6.5
		W	4.2	3.9									4.1
	80.707.623	L	4.7	5.5	3.8	6.0	5.3	4.6	4.7				5.1
		W	3.2	3.8	3.8	3.7	4.2	3.5	4.3				3.7
	81.196.16	L	5.7										5.7
		W	5.0										5.0

80.709.261	L	4.5	5.0	4.0		4.5
	W	3.7	4.5	5.1		4.4
47LC394-1/6						
2000.2470.14	L	5.4	5.2	5.5	4.1	5.1
	W	5.6	5.5	5.3	4.1	5.1
47LC394-9						
2000.2638.290	L	6.2	5.7	6.3	7	6.3
	W	5.1	4.2	5.5	5.5	5.1
2000.2579.06	L	8	7.6	8.3	6.5	7.6
	W	6.3	6.5	6.2	5.1	6.0

APPENDIX B

TABLE B. OVAL PUNCTATE MEASUREMENTS AND MEANS

											Average
62	SMALL										
	47LC76										
	Acquisition#										
	80.706.294	L	6.4	8.0	9.3	6.7	9.3				7.9
		W	1.6	1.1	1.1	0.9	1.1				1.2
	80.978.07	L	6.1	8.0	5.2						6.4
		W	2.0	1.9	1.8						1.9
	80.706.289	L	13.3	13.5							13.4
		W	2.2	2.3							2.3
	80.206.259	L	5.0	5.5	5.5	5.0					5.3
		W	2.0	1.9	1.9	1.5					1.8
	80.770.22	L	4.8	5.6	4.3						4.9
		W	1.6	1.5	1.2						1.4
	80.711.828	L	6.2	6.3	6.8	5.7					6.3
		W	2.6	2.9	2.7	2.4					2.7
	81.134.38	L	4.5	4.3	3.7						4.2
	W	1.4	1.4	1.4						1.4	
81.134.36	L	5.6	6.8	6.8						6.4	
	W	1.6	1.5	1.6						1.6	
80.825.53	L	4.0	3.4	3.2	3.9	3.6	3.7	4.0	3.6	3.7	
	W	1.6	1.6	2.0	1.9	1.7	1.6	1.8	1.9	1.8	

80.710.255	L	5.2	4.8	4.7					4.9
	W	2.6	2.7	2.7					2.7
80.753.68	L	9.3	9.9	10.7					10.0
	W	2.6	1.4	3.0					2.3
80.761.40	L	4.8	4.0						4.4
	W	2.0	1.8						1.9
80.711.684	L	4.0	3.4	3.2	2.9				3.4
	W	2.6	2.3	1.8	2.1				2.2
80.787.41	L	5.0	6.1	6.1	6.0				5.8
	W	2.5	2.4	2.8	2.9				2.7
80.712.748	L	4.7	5.4						5.1
	W	2.1	2.1						2.1
81.134.37	L	4.6	4.4						4.5
	W	2.2	2.6						2.4
81.164.17	L	6.1	7.7						6.9
	W	2.1	2.4						2.3
80.750.75	L	4.1	4.1	4.1					4.1
	W	1.7	1.8	1.5					1.7
80.704.234	L	5.7	5.6	4.8	4.9				5.3
	W	2.3	2.2	2.0	2.3				2.2
80.707.618	L	3.4	3.5	3.2	3.7	3.5	3.7	3.7	3.5
	W	1.9	2.5	1.8	2.2	2.6	2.6	2.2	2.3
80.799.23	L	8.6	9.1	9.6					9.1
	W	2.8	2.5	2.9					2.7

80.705.353	L	2.9	3.4	3.3	3.8	3.5	2.8	3.7	3.0					3.3
	W	1.4	1.3	1.3	1.8	0.6	1.2	0.7	1.0					1.2
80.707.598	L	3.6	3.8	3.8	4.2	4.1								3.9
	W	1.6	2.0	1.8	2.4	1.7								1.9
92.800.05	L	7.0	6.6	6.7	7.0	6.9	6.5	7.3						6.9
	W	2.8	2.6	2.7	2.8	2.5	3.4	3.1						2.8
47LC394-15														
99.1208.08	L	7.5	8.8	6.7										7.7
	W	2.6	2.7	1.3										2.2
99.1868.08	L	5.8	5	5.3	3.5									4.9
	W	2.6	2.2	2.2	1.1									2.0
99.1955.07	L	6.4	6.7	6.8	6.3	7.9	4.3							6.4
	W	2.5	2.3	2.6	2.5	2.5	1.6							2.3
99.1528.03	L	5	4.8	5.4	5.5	5.2								5.2
	W	2.7	2.6	3.2	3.2	3.3								3.0
99.1613.06	L	7.6	6.7	6.8	8	5.5								6.9
	W	2.5	3	2.6	3.2	2.7								2.8
99.1611.14	L	4.3	5.5	7.2										5.7
	W	2.1	2.7	2.7										2.5
99.1125.12	L	7.6	7.3	7										7.3
	W	1.7	2	2.1										1.9
99.1429.296	L	5.4	7.5	8.9	7.8	7.4	6.5							7.3
	W	2	1.9	1.8	1.7	1.7	1.8							1.8
99.1919.81	L	4.2	2.9	5.1	3.8	4.3	3.8	3.9	4.6	4.7	4.2	4.4	4.2	4.2
	W	2.4	2.4	2.4	2.1	2.3	2.4	1.9	2	2.5	2.3	2.3	2.4	2.3

47LC394-1/6 2000.2470.14	L	5.2	4.9	N/A		5.1
	W	2.3	2.3	2.1		2.2
47LC394-9 2000.2606.08	L	11.9	11			11.4
	W	2.8	2.8			2.8
MEDIUM 47LC76 80.704.221	L	5.6	5.3	6.3		5.7
	W	3.0	3.4	3.1		3.2
80.711.848	L	12.8	11.5			12.2
	W	3.6	3.8			3.7
80.708.566	L	6.0	6.7	7.4		6.7
	W	3.5	3.6	3.9		3.7
80.707.570	L	7.1	8.3	7.5		7.6
	W	3.5	3.6	3.7		3.6
80.798.61	L	9.7	9.1	11.4		10.1
	W	3.0	3.0	3.0		3.0
80.803.377	L	6.7	6.7	7.0	7.7	7.0
	W	4.1	3.5	4.3	3.7	3.9
80.710.266	L	5.3	4.1	4.8	5.5	4.9
	W	3.3	3.1	3.2	3.2	3.2
80.708.533	L	6.2	5.5	6.5	6.5	6.2
	W	3.6	3.5	3.2	2.9	3.3
81.158.25	L	3.7	4.6	6.5		4.9
	W	3.1	3.2	3.9		3.4

80.705.320	L	6.2	6.3	6.8	6.4							6.4
	W	4.8	4.2	3.8	4.4							4.3
80.712.780	L	9.1	9.0	9.4	8.6							9.0
	W	4.6	4.0	4.5	4.0							4.3
80.704.225	L	5.3	5.5	4.6								5.1
	W	3.3	3.7	3.2								3.4
80.712.790	L	8.6	9.4	11.0	11.5							10.1
	W	4.5	4.5	4.5	5.6							4.8
80.151.60	L	5.3	6.1	6.5	6.1	7.0	6.5	6.3	6.3	6.1		6.2
	W	3.2	3.3	3.0	2.9	3.6	3.3	3.3	3.3	3.2		3.2
80.705.306	L	9.8	8.4	7.4	8.0	8.4						8.4
	W	2.8	2.8	2.7	2.1	2.7						2.6
92.1066.33	L	4.4	4.9	5.3	3.7							4.6
	W	3.0	3.5	2.6	2.9							3.0
92.512.106	L	6.0	5.6	5.3								5.6
	W	3.3	3.3	3.2								3.3
92.532.105	L	8.0	7.7	7.5	7.6							7.7
	W	3.3	3.1	3.5	3.6							3.4
92.1080.11	L	5.6	5.3	4.7	4.7	5.3	4.0					4.9
	W	3.4	3.8	2.9	3.5	4.0	3.7					3.6
92.501.18	L	6.0	4.5	7.3	5.0							5.7
	W	4.8	4.2	4.2	4.2							4.4
92.839.14	L	5.6	4.8	4.6	5.1							5.0
	W	3.9	3.5	3.6	3.7							3.7

47LC394-15											
99.1422.04	L	8.3	7.7	8.1	8.4						8.1
	W	3.0	3.1	3.7	3.2						3.3
99.1208.12	L	7.9	NA								7.9
	W	3.9	4.0								4.0
99.1890.12	L	10.2	11.7	8.3							10.1
	W	3.8	3.8	3.8							3.8
99.1931.11	L	8.4	7.6	9.7	7.0						8.2
	W	2.6	3.1	3.7	3.6						3.3
99.1183.11	L	7.6	5.2	5.0	2.8						5.2
	W	3.7	3.7	2.9	3.1						3.4
99.1208.07	L	8.1	8.6								8.4
	W	3.8	3.8								3.8
99.1208.06	L	10.9	7.6	6.2	8.5	10.3					8.7
	W	2.9	2.9	3.1	2.2	2.1					2.6
99.1208.02	L	10.1	7.9	7.6	5.9	6.4	8.1	7.4	8.5		7.7
	W	3.7	2.3	3.4	3.1	2.7	2.0	2.9	2.4		2.8
47LC394-1/6											
2000.2471.83	L	4.9	5.4								5.2
	W	3	3.1								3.1
2000.2430.27	L	4.3	5.4	5	5.3	4.6	5.7				5.1
	W	2.6	2.2	2.7	2.8	2.8	2.3				2.6
2000.2304.29	L	4.3	5.1	4.8							4.7
	W	3.1	3.5	2.8							3.1

47LC394-9						
2000.2709.233	L	8.8	10	8.8		9.3
	W	4.4	4.3	4.1		4.3
LARGE						
47LC76						
80.710.252	L	6.1	7.2	6.2		6.5
	W	4.0	4.4	4.3		4.2
80.722.119	L	10.8	12.2	12.5		11.8
	W	4.4	4.8	4.5		4.6
80.783.101	L	5.4	5.6	7.3	6.5	6.2
	W	4.0	4.6	3.9	3.9	4.1
80.711.721	L	7.8	8.5	9.5		8.6
	W	4.0	4.1	4.0		4.0
80.705.361	L	12.0	11.4	11.4		11.6
	W	7.1	6.2	6.6		6.6
80.710.272	L	12.5	14.5	14.7		13.9
	W	4.3	4.3	4.0		4.2
92.618.100	L	7.1	6.9	8.8		7.6
	W	3.4	3.7	4.4		3.8
47LC394-15						
99.1231.05	L	11.5	14.3	NA		12.9
	W	3.5	4.4	4.4		4.1
99.1941.11	L	12.1	12.4	14.1	NA	12.9
	W	5.4	5.1	5.1	4.6	5.1
99.1097.16	L	8.5	8.5	7.6		8.2

	W	4.4	4.5	4.1		4.3
2000.2687.29	L	10.3	9.3	10.8	9.5	10.0
	W	4.3	4.5	5.3	4.6	4.7
47LC394-1/6						
2000.2523.02-	L	9.2	8.3	5.5	4.7	6.9
.06	W	3.5	3.4	3.9	3.7	3.6
2000.2396.07	L	10.1	9.7	9.7		9.8
	W	4.7	5.0	4.6		4.8

## APPENDIX C

TABLE C. UNIQUE SHAPED PUNCTATE MEASUREMENTS AND MEANS

	Acquisition #						Average	
Triangular	47LC76	Top	4.8	4.4			4.6	
		Side	3.8	3.5			3.7	
		Side	5.7	N/A			5.7	
	80.825.59	Top	5.5				5.5	
		Side	3.3				3.3	
	80.833.23	Top	1.0				1.0	
		Side	2.1				2.1	
		Side	2.4				2.4	
	Rectangular	80.722.100	L	7.2				7.2
			W	3.5				3.5
81.200.31		L	7.9	7.1	6.4		7.1	
		W	3.2	2.7	3.2		3.0	
81.151.43		L	N/A					
		W	3.2				3.2	
81.144.32		L	5.2	6.2			5.7	
		W	3.3	2.7			3.0	
Extra Small Rectangles	80.708.552	L	2.6	2.7	2.3	3.3	2.7	
		W	0.7	1.2	1.0	1.0	1.0	
	80.708.594	L	4.1	3.5	2.6	2.3	3.1	
		W	1.1	1.0	1.0	1.2	1.1	
	Long Dashes	80.852.36	L	19.2				19.2
			W	3.8				3.8
Rectangular	80.712.905	L	5.6	N/A			5.6	
		W	2.2	2.3			2.3	

Extra Small Rectangle											
80.708.598	L	N/A									
	W	1.1									1.1
Stab&Drag with Punctates											
80.748.61	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Stab&Drag	W	3	3.8	4.6	4.2	3.7	3.8	4.5			3.9
Punctate	L	11.8	11.8								11.8
	W	4.6	5.1								4.9
Extra Small Rectangle											
92.773.13	L	3.1	3.6	4.8							3.8
	W	1.3	1.1	0.7							1.0
Circles on row of built up clay											
92.972.36	L	6.1	5.2								5.7
	W	5.6	5.2								5.4
47LC394-15	Gundersen Site										
Circle in the middle of punctate											
99.1572.08	L	3.9	3.5								3.7
	W	2.1	2.0								2.1
Line in the middle of punctate											
99.1183.08	L	7.5	9.5								8.5
	W	3.5	4.5								4.0
Rectangular											
99.1893.14	L	6.1	N/A								6.1
	W	2.6	2.8								2.7
Stab & Drag											
99.1354.05	L	5.9	5.0	4.3	3.8						4.8
	W	4.2	4.2	3.7	3.3						3.9
Extra Small Rectangle											
99.1869.11	L	4.9	4.7								4.8
	W	2.0	1.4								1.7
99.1414.75	L	6.3	5.8	N/A							6.1
	W	1.4	1.5	1.4							1.4
47LC394-1/6	Stab & Drag										
2000.2679.06	L	7.3	7.0	7.5	5.8	6.4	6.4	7.9	7.9		7.0
	W	4.2	4.8	4.4	3.9	4.0	4.0	4.3	3.9		4.2



92.831.01 F. 17	Circle	L	3.7	4.6	3.5	3.9	4.3	4.1	3.8	5.6	4.6	5.5	4.6		4.4
		W	3.0	3.3	2.7	2.3	3.3	3.2	2.5	2.7	2.7	3.1	2.4		2.8
		L	4.9	4.2	3.2	4.8	6.2	6.9	7.8	7.7					
		W	2.9	2.7	2.6	2.6	3.5	3.2	3.5	3.0					
47LC394 V.23 2000.2479.28- .29	Oval	L	5.5	5.9	4.8	5.5	4.9	5.1	4.5	4.7	4.5	4.8	5.6	5.3	5.1
		W	3.3	2.5	3.2	3.3	2.9	3.5	3.0	1.9	2.4	2.9	2.6	3.3	2.9
V.19 99.1208.05	Oval	L	14.1	11.5											12.8
		W	5.1	4.6											4.9
V. 30 99.1802.82	Oval	L	9.5	8.1	5.7	4.7	4.3	5.1	6.5	7.7	6.9				6.5
		W	3.7	3.6	3.3	2.9	3.1	3.4	4.1	3.8	3.5				3.5
V. 3 99.1142.01	Oval	L	6.4	8.0	6.7	7.3	8.8	7.4	10.1	10.1	8.2	8.6			7.7
		W	4.7	5.3	4.7	4.8	4.9	4.5	4.8	4.7	4.2	5.3			4.8
V. 22 2000.2435.32	Oval	L	12.2	11.3	11.7										11.7
		W	4.4	4.1	3.9										4.1
V. 21 2000.2400.08	Oval	L	16.0	9.3	8.6										11.3
		W	3.9	4.3	4.0										4.1
V.? 99.1156.06	Oval	L	3.9	4.3	5.5	5.4	5.7	6.2	5.3	5.7	4.5				5.2
		W	1.9	2.2	2.2	2.1	2.4	2.0	2.2	2.4	2.2				2.2
		L	4.7	6.1	3.5	4.3	5.3	5.9	6.2	4.9					
		W	2.1	2.1	1.6	1.9	2.2	2.2	2.0	2.3					
V. 39 99.1870	Circle	L	2.3	2.3	2.2	3.3									2.5
		W	2.1	1.9	2.3	2.7									2.3
V.? 99.1767.104	Circle	L	3.2	2.9	2.9	2.9									3.0
		W	2.7	2.7	2.9	2.9									2.8

V. 20 99.1429.02	Oval	L	2.6	3.4	2.6	1.8	2.9	2.4	1.5	2.2	1.8	2.1	1.6	3.4	2.4
		W	1.1	1.6	1.2	1.3	1.7	1.8	1.1	1.1	1.3	1.4	1.4	2.0	1.4
V. 7 99.1264.01	Oval	L	7.7												7.7
		W	3.5												3.5
V. 10 99.1366	Circle	L	2.6	2.3	3.2	3.1	3.2	3.1	3.7	3.3	3.3	3.4	3.2		3.1
		W	2.4	2.2	3.3	3.1	3.1	3.1	3.3	3.1	3.8	4.0	3.3		3.1
Top		L	3.3	2.7	3.3	2.9	3.2	2.9	3.3	2.9	2.5	3.1	2.5	2.7	2.7
		W	3.4	3.1	3.5	3.2	2.9	2.8	3.4	3.0	3.1	3.1	2.9	3.2	3.4
Bottom		L	2.8	2.7	2.7	2.9	2.8	2.6	3.3	3.1	2.9	3.8	3.0	2.5	
		W	2.6	2.7	2.6	2.6	2.7	2.4	2.7	2.8	3.2	3.6	3.1	2.6	
		L	3.0	3.3	3.6	3.4	4.0	3.8	3.9	3.3	3.6	3.8	2.5	3.3	
		W	3.5	3.9	3.6	3.3	3.9	3.6	3.4	3.1	3.5	3.6	3.6	3.1	
		L	3.2	3.5	3.4	3.3	3.4	4.0	3.6	2.5	2.8	2.7	2.6	3.3	
		W	2.9	3.0	3.0	3.2	3.4	4.2	3.6	2.9	2.9	2.6	2.6	3.4	
		L	3.3	3.5	4.1	3.6	2.7	3.1	2.7	3.2	3.1	3.1	3.2	3.2	
		W	3.3	3.5	3.3	3.0	2.9	3.2	2.4	2.7	2.6	2.9	3.0	2.9	
			3.0	3.3	2.6	2.6	3.1	3.1							
			2.8	3.1	2.8	2.6	2.8	2.7							
V. 26 2000.2589.05	Oval	L	5.5	5.8	7.4	5.3	4.6								5.7
		W	2.8	2.8	3.1	3.2	2.6								2.9

## APPENCIX E

TABLE E. STYLE ANALYSIS OF RIM SHERDS

Vessel Acquisition #	Punctates
47LC76 92.1005.21 F.29	Pointed Ovals, below chevrons only, minimum of 10 Nested chevrons: 7 vertical lines: 9
92.506.07 T.P. 16	Circular, 9 above and 15 below the chevrons Nested chevrons: 4 on the left, 6 starting and 5 ending on the right, vertical lines: 7 on the left, at least 11 on the right
92.555.363 T.P.23	Circular, 7 above chevrons, below- unknown Nested chevrons: minimum of 5, vertical: minimum of 5
92.512.93 T.P. 4	Circular, 15 above and minimum of 7 below Nested chevrons: 11, vertical: minimum of 15
80.707.550	Long ovals, 14 adjacent to vertical lines, at least 12 on the left and 7 on the right No chevrons, 7 vertical lines
92.831.01 F. 17	Circular, 16 above chevrons, below-unknown, 4 ovals to the side of chevrons Nested chevrons: minimum of 7, vertical lines: minimum of 3
47LC394 V.23 2000.2479.28-.29	Ovals, 12 in between vertical lines No chevrons, vertical lines: 8
V.19 99.1208.05	Ovals, 2 next to vertical lines Nested Chevrons: minimum of 5, vertical lines: 7
V. 30 99.1802.82	Oval, 9 on top of inverted chevrons Inverted chevrons: 4 on the left, 3 on the right, vertical lines: minimum of 5
V. 3 99.1142.01	Ovals, 10 above chevrons Nested chevrons: minimum of 4, vertical lines: minimum of 2
V. 22 2000.2435.32	Ovals, 3 beneath horizontal lines No chevrons, vertical lines: 6, horizontal lines: minimum of 3

V. 21 2000.2400.08	Ovals, 3 between panels of vertical lines No chevrons, vertical lines: 8
V.? 99.1156.06	Ovals, 17 between vertical panels No chevrons, vertical lines: 7
V. 39 99.1870	Circular, 4 in between vertical lines No chevrons, vertical lines: 3
V.? 99.1767.104	Circular, 4 above chevron, below-unknown Nested chevrons: minimum of 2
V. 20 99.1429.02	Oval, 9 on handle No chevrons, vertical lines: minimum of 3, horizontal lines: minimum of 5
V. 7 99.1264.01	Oval, 1 above chevron, below-unknown Nested chevrons: minimum of 7, vertical lines: minimum of 17
V. 10 99.1366	Circular, 78 above and below zigzag pattern 4 horizontal zigzag lines
V. 26 2000.2589.05	Oval, 5 in between vertical lines No chevrons, vertical lines: minimum of 5

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