5-2017

Patterned Variation of Early Woodland Waubesa Contracting Stem Projectile Points in Wisconsin

Michael G. Straskowski
St. Cloud State University

Patterned Variation of Early Woodland Waubesa Contracting Stem Projectile Points in Wisconsin

by

Michael George Straskowski

A Thesis

Submitted to the Graduate Faculty of

Saint Cloud State University

in Partial Fulfillment of the Requirements

for the Degree of

Masters of Science

in Cultural Resource Management

May, 2017

Thesis Committee:
Mark Muñiz, Chairperson
Debra Gold
Katherine Stevenson

Abstract

The overall research goal is to examine the Waubesa Contracting Stem projectile points from three different regions to determine if there are any stylistic changes between three geographically defined concentrations. Identifying any statistical patterning of the blade and shoulder may be related to different social influences from the different geographical regions. The knowledge gained by identifying different styles of Waubesa Contracting Stem points could allow archaeologists to determine which of these three regions a point most likely came from if recovered outside of the core culture area.

The study of patterned variation in Waubesa Contracting Stem points could indicate the presence or absence of social interaction and social boundaries between groups of people of the Early Woodland culture in Wisconsin. The morphological analysis of projectile points related to cultural interaction can be used to provide additional information about prehistoric cultures in Wisconsin. Identifying style variation of projectile points can be more difficult as compared to other types of artifacts due to lack of style added to lithics. The patterned variation in the blade or base might be linked to different styles used by different social groups.

The analyses presented in this thesis uses data sets out of a sample of 256 projectile points from the three regions of Wisconsin to examine style variation. The analyses on the attributes were found to be useful for identifying style variations in Waubesa Contracting Stem point. Understanding stylistic variations in projectile points could indicate the presence or absence of social interaction and social boundaries between groups of people of the Early Woodland cultures in Wisconsin.

Acknowledgements

I would like to thank Dr. Mark Muñiz, Dr. Debra Gold and Dr. Katherine Stevenson for their insight and assistance while serving on my committee. I extend my thanks to my colleagues: Louise Pfotenhauer at Neville Public Museum, John D. Richards at Milwaukee Public Museum, Danielle Benden at University of Wisconsin-Madison, James E. Myster at U.S. Fish and Wildlife Service, and Dr. Katherine Stevenson at Mississippi Valley Archaeology Center for access to their collections for this thesis. Finally, my greatest thanks to my family; Roger, Arlene, Ken, and Jen for their support.

Table of Contents

List of Tables

List of Figures

Chapter I: Introduction

The research goal of this thesis is to identify if there is patterned shoulder variation of the Early Woodland Waubesa Contracting Stem points in certain regions of Wisconsin. The environment of Wisconsin consists of various types of landscapes and stratigraphic buried soils. These regions include the following: northern highlands, central sand plains, lower river valleys, mounds, and the Driftless Area. Projectile points may provide a correlation between the cultural material of Wisconsin and shared design ideas of the manufacturers. It could be possible that the complexity of the form of the projectile points throughout the Woodland prehistoric context is related to the idea of design and style planning that could show statistical patterning. The morphological analysis of the Waubesa Contracting Stem points could also be related to cultural transmission of style that could provide important information to Wisconsin prehistory.

Description of Waubesa Contracting Stem Points

Waubesa Contracting Stem projectile points (i.e., Waubesa points) are lithic tools of Native American culture from the Early Woodland period in the Midwest region of the United States. This thesis will address the question of whether or not Waubesa points have patterned variation depending on where they occur in different regions of Wisconsin.

According to Justice (1987), Waubesa points may be a variation of Adena Stemmed points which are found in certain regions of the Dickson Contracting Stemmed distribution. The Dickson Contracting Stemmed and Adena Stemmed points are associated with the Early Woodland period (Justice 1987). The Dickson Contracting Stemmed point length is 68.20 – 72.80 mm and width is 30.20 – 37.20 mm (Justice 1987). Justice (1987) notes the Dickson

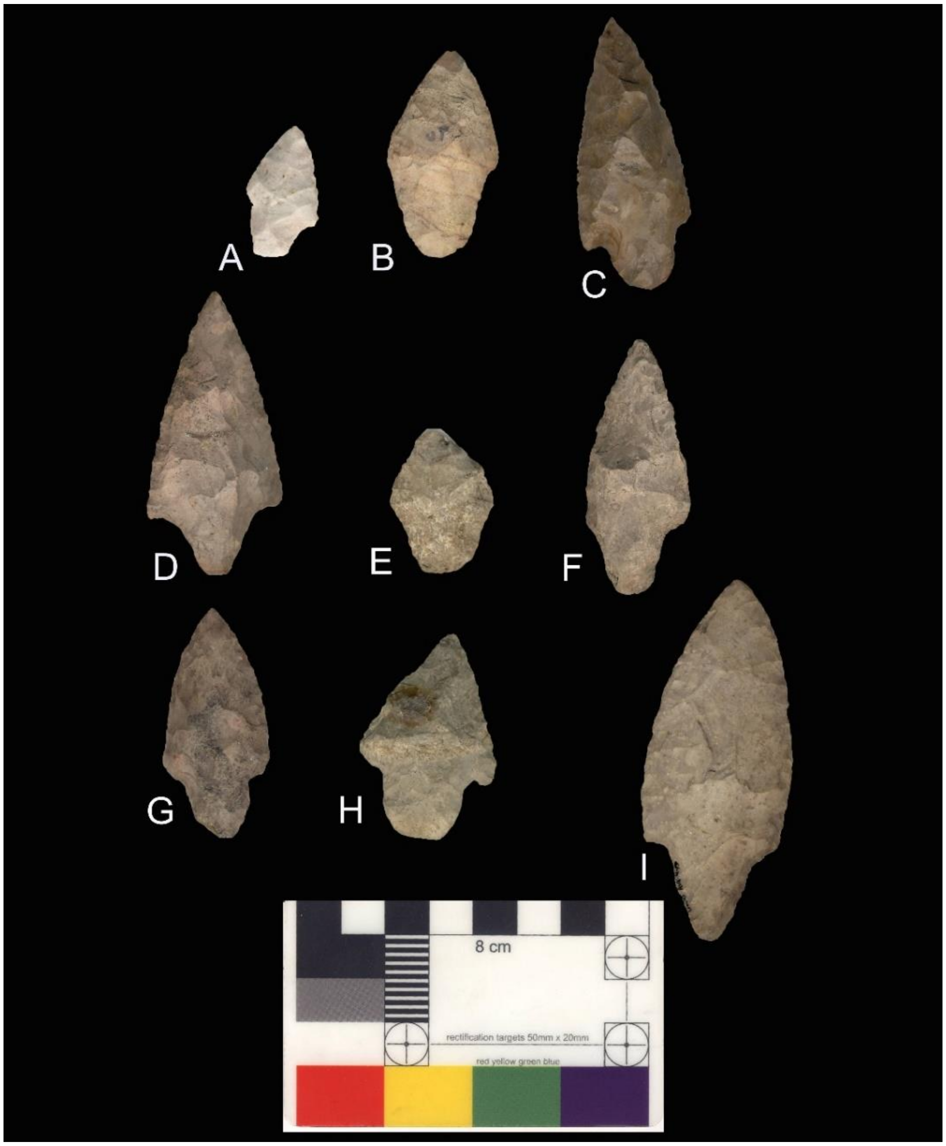

Figure 1.1

Waubesa Contracting Stems from Wisconsin

A. Mississippi Valley Archaeology Center; 47TR440; Trempealeau County.
B. Mississippi Valley Archaeology Center; 47CR356; Crawford County.
C. Mississippi Valley Archaeology Center; 47CR354; Crawford County.
D. University of Wisconsin – Milwaukee/GLARC; 47GT593; Grant County.
E. University of Wisconsin – Madison; 47DO47; Dodge County.
F. University of Wisconsin – Madison; 47DA459; Dane County.
G. Neville Public Museum – Green Bay; 47BR437; Brown County.
H. University of Wisconsin – Madison; 47WP26/70; Waupaca County.
I. University of Wisconsin – Oshkosh; Winnebago County.

Contracting Stemmed points are found throughout Illinois and extends into portions of Iowa. The Adena Stemmed point length is 34.00 – 150.00 mm and width is 17.00 – 43.00 mm (Justice 1987). Justice (1987) notes the Adena Stemmed points are primarily located in Ohio Valley Drainage, extend north into portions of Wisconsin, south into portions of Florida, and east into portions of New York.

According to Nienow and Boszhardt (1997), Waubesa Contracting Stem points are lanceolate to triangular in shape, and the length is 50.80 – 127.00 mm with the width 25.40 – 40.60 mm. Justice's (1987) study of Adena Stemmed points have a wider range of length and width, and the Dickson Contracting Stemmed points have a tighter range of length and width than Nienow and Boszhardt's (1997) study of Waubesa Contracting Stem points. These Waubesa points are found to be longer and thicker than projectile points from the Late Archaic period that precede them.

The shape of the blade and the shoulders of the Waubesa points have variations which are straight, sloped, or barbed (Figure 1.1). There are variations to the width and length of the contracting stem of the Waubesa point, which may be related to the overall form of the point. These projectile points are often flintknapped from local chert, and a few are manufactured from exotic lithic materials. Waubesa points have been located in multiple Midwest regions and most commonly appear around 2450 cal B.P.[1] (calibrated radiocarbon years) (Emerson 1986).

Webb (1946:254) describes Contracting Stem projectile points from Kentucky, "One would suspect that [this form] was particularly difficult to attach firmly to the haft. Perhaps it was intended to be easily detached". The shaft may have been split so that the stem of the

[1]years Before the Present with 1950 used as the Present date

Waubesa point would be placed in the shaft and clamped shut with a binding, such as cordage or sinew. It is possible that the advantage of the contracting stem of Waubesa point is that just the stone point rather than the wooden foreshaft, sinew, and the wooden spear is lost in a wounded game if it escapes (Boszhardt 2002). I would agree with Boszhardt (2002) since Waubesa points do not have notches which may have aided in hafting the point more securely by the use of sinew or type of cordage. Since a contracting stem point would have been able to stay in the wound, they may have been used for hunting and warfare. Webb's (1946) investigation at Indian Knoll cemetery leads to the idea that these contracting stem points would have been used in warfare. Since the low number of contracting stem points found with burials suggesting that the points may have been embedded in the flesh rather than being ceremonial objects. The point could have been left in the flesh due to individuals attempting to remove the spear, and the point detached from the shaft (Webb 1946).

According to the Wisconsin Historic Preservation Database of the Wisconsin Historical Society (2017), there are multiple Early Woodland sites in Wisconsin that contain Waubesa points. The total number of recorded Early Woodland sites is 1,174 out of 34,908 sites in Wisconsin (3.36 percent), and the total number of sites that contain Waubesa is 407 out of 1,174 Early Woodland sites (34.67 percent)(WHS 2017). After examining the locations of the sites that include Waubesa points in Wisconsin, I determined three spatial groupings or regions of concentration. These three regions seem to correspond to three natural divisions of the state.

Defined Regions

One method archaeologists may use for identifying spatial organization is studying settlement patterns found in the archaeological record. I have divided the state into three regions based on my interpretation of the main centers of Waubesa point concentrations as shown on the map (Figure 1.2). The three site concentrations are separated into three different regions of Wisconsin: Region 1, Region 2, and Region 3. One concentration is located in the southwestern region of Wisconsin with a high artifact count located in Vernon County (24 sites) with adjacent Monroe County having 25 sites. The second concentration is located in southern Wisconsin with a high artifact count in Dane County (52 sites). The third concentration is located in eastern Wisconsin with the high artifact count in Winnebago County (28 sites). No other counties produce Waubesa site clusters nearly as high causing these concentrations to stand out. The Wisconsin River is used for defining the geographic boundary of Region 1 and Region 3. Also, part of the Wisconsin River is used for defining the geographic boundary of Region 1 and Region 2. The rest of the geographic boundary for Region 1 and Region 2 is from the Wisconsin River to Lake Winnebago and then to Lake Michigan.

The number of sites in Wisconsin containing Waubesa points is a small subset of all the archaeological surveys that have been conducted over multiple years. Certain counties in Wisconsin may have higher numbers of recorded sites than other counties which may be due to more surveys conducted in those counties. This may be a factor for explaining site clusters in Wisconsin. The three Regions defined in Figure 1.2 are an experimental approach for dividing the site clusters with the available information. Other archaeologists may disagree with the defined experimental regions. Certain portions of Wisconsin (i.e., the Driftless Area) may have a wide variation of different cultural materials as compared to the rest of the state. Future research may divide Wisconsin into different regions which could have different results.

Figure 1.2

A County Map of Wisconsin with Dashed Lines Outlining the Three Waubesa Regions. Modified map of Woodward (1972). Reprinted from Woodward (1972) with permission from Cartographic Laboratory University of Wisconsin – Madison.

The competition for resources could have been one of the primary influences of territorial or social behavior. Territorial boundaries are recognized by “the maintenance of an area within which the resident controls or restricts the use of one or more environmental resources” (Cashden 1983:47; Carpenter and MacMillan 1976:639). Each of these site clusters in Monroe/Vernon, Dane, and Winnebago counties could be regions that shared similar social behavior and access to the social groups may have been restricted to certain individuals. I would argue that controlled access to join these social groups may have limited the passage to the lithic resources within each region for the individuals who were outside these social groups. The inhabitants of these social groups may have been able to exchange lithic raw materials through the use of trade networks to individuals in other social groups.

Projectile Point Morphology

The use life of a projectile point starts with raw material procurement, followed by the variation added by the manufacturer, damage from use, resharpening, and is eventually discarded (Andrefsky 2012). According to Rondeau (1996:232), “Variation in typologically diagnostic point attributes may first be influenced at manufacture by the lithic landscape, which includes differential sizes, workability, and availability of tool stone”. I agree with Rondeau (1996) that lithic material can be a major factor for the variations of style when manufacturing projectile points. I would argue that stylistic variation to projectile points would have been added during the final stages of manufacture after the creator had gotten the relative point shape he/she wanted at that time. The quality of the raw material and the size of the raw material package could have affected point style. The use life of the projectile points may make it difficult to identify any stylistic differences that were intentionally created during the manufacturing due to damage and reshaping, which changes the shape of the projectile.

There have been multiple methods used for measuring and analyzing the changes made to projectile points. Andrefsky (2012) covers characteristics and morphology of projectile points, which change shape or size over time. An example of a projectile changing shape is, if the point gets broken and rather than being discarded it is reworked into another point form. The author also suggests that there is evidence of retouch on hafted bifaces that can be useful for studying projectile points hafted onto spears or arrow shafts. Andrefsky (2012) suggests that hunters would often have kept the fractured bifaces until they had reached a settlement and then discarded the biface. I believe Andrefsky’s (2012) statement has good reasoning because the hunter may have wanted to keep any good quality chert on hand in case the individual needed to cobble a tool together quickly from a previously broken tool.

Once at a settlement, the hunter may have access to new chert material and may want to discard the broken biface. Andrefsky (2012) provides a study of lithic sources related to the bifaces by comparing near and distant sources to archaeological sites. Andrefsky (2012) concluded that hafted bifaces made from distant raw materials would tend to have more resharpening and reconfiguration than bifaces from local raw materials. I found that Andrefsky’s (2012) study could be used to help examine the relation between distance and local raw materials of Waubesa points by examining the resharpening of the points. I would expect that bifaces manufactured from exotic raw materials would have detailed small flaking across the blade of the biface from resharpening, then points made from local raw materials would have larger flakes removed from the biface, because they had not traveled as far or been maintained for as long.

Thomas' (1970) study proposes standard measurements for recording variation of projectile points and these measurements reduce subjectivity when making visual inspections. Thomas (1981) uses these standard measurements on a study of Monitor Valley typology in the Western Great Basin. I found this study useful for obtaining standard measurements of the Waubesa projectile points, because I will have an accurate way to analyze variations in the projectile point form. Thomas' (1981) standard measurements are defined in Chapter IV.

However, typological analysis of the projectile points does not provide the necessary information for style variation of Waubesa points. Social factors are seen as causes for style variation (Shott 1997).

Summary

The overall research goal is to examine the Waubesa points from Region 1 (Monroe/Vernon Counties), Region 2 (Dane County), and Region 3 (Winnebago County) to determine if there are any patterned shoulder variation between these three geographically defined concentrations. Social groups distant from each other may have added style variations to the blade and shoulder of the Waubesa points. The knowledge gained by identifying different styles of Waubesa points may allow archaeologists to determine where a recovered Waubesa point most likely came from out of these three regions. Furthermore, understanding stylistic variation in projectile points could indicate the presence or absence of social interaction and social boundaries between groups of people of the Early Woodland culture in Wisconsin.

The Organization of Thesis

Chapter II covers a brief overview of the Woodland and Late Archaic periods of the Wisconsin region. This chapter covers the prehistory of settlements during Early, Middle, and Late Woodland periods from 2500 - 925 cal B.P. This chapter covers the cultural traits and subsistence practices respective to each of the Woodland periods. Part of the chapter covers the vegetation changes of the later Holocene period and the temporal framework used in this thesis.

Chapter III explains the definition of style and the approach that has been used in previous studies to define geographic and temporal regions. The chapter covers the relationship of manufacturing artifacts and social interaction. This chapter covers the style and functional aspects of the Waubesa points that are used in this thesis.

Chapter IV includes the defined attributes selected for the study of Waubesa Contracting Stem shoulder morphological changes. Chapter IV covers the data sets selected for metric and non-metric analyses. There are two data sets: Data Set 1 is used for metric analyses and Data Set 2 is used for non-metric analyses. This chapter also includes the sites and counties that are used in this thesis.

Chapter V covers the results of metric analyses on Data Set 1. Histograms are used to show the general frequency of each of the metric variables. These analyses compare the attributes discussed in Chapter IV. The first part of the chapter focuses on conducting ANOVA analyses for any significant differences between the metric attributes and the different regions in Wisconsin. The second portion of the chapter focuses on the results of non-metric analyses on Data Set 2. The second portion focuses on conducting chi-square analysis for any significant differences between the non-metric attributes and the different regions in Wisconsin.

Chapter VI discusses the results of the ANOVA and chi-square conducted on the attributes and offers overall interpretations of the results. The chapter also covers significant variations and suggestions for future research.

Chapter II: Background Context

Introduction

The following provides an overview of the Woodland period in Wisconsin. One main source used is "The Woodland Tradition" in *The Wisconsin Archeologist* by Katherine P. Stevenson, Robert F. Boszhardt, Charles R. Moffat, Phillip H. Salkin, Thomas C. Pleger, James L. Theler and Constance M. Arzigian (1997). Another source used is *Twelve Millennia: Archaeology of the Upper Mississippi Valley* by James L. Theler and Robert F. Boszhardt (2003), because they provide an overview of temporal periods in the Upper Mississippi Valley Region.

The Woodland period spans from 2500 cal B.P. to 925 cal B.P. divided into three time periods (Early, Middle, and Late) determined by technology, such as projectile point types, pottery style, and burial practices. Stevenson et al. (1997) provide a date in which the Woodland period ends in 850 cal B.P.; Theler and Boszhardt (2003) provide a date that the Woodland period ends in 1000 cal B.P; therefore, I have chosen to use the date 925 cal B.P. which is located between the other dates provided. The Early Woodland period marks the transition period from the Archaic tradition to the Woodland tradition. Theler and Boszhardt (2003:97) note, "Today, the arrival of the Woodland tradition in the Upper Mississippi River Valley is signaled by the first appearance of pottery vessels".

Vegetation Changes of the Holocene Period

James E. King (1980, 1981) and Benedict et al. (2008) provide detailed information about vegetation and climate change in the Midwestern and Midsouthern regions. As compared to the Holocene, the Pleistocene period climate was cooler, and the Central Grassland was covered mostly by pines and spruce (Benedict et al. 2008). This spruce forest was slowly replaced by an oak-dominated forest by 10,500 cal B.P. around the start of the Holocene period (Figure 2.1). Most of the climate after 10,500 cal B.P. the average temperature could have been 2.5 ^{o}C cooler than the average annual current temperature (Davis et al. 2000). The Hypsithermal (8500-5000 cal B.P.) is a warming period when the Midwest region had an increase in fires on the prairies. During this period the average yearly temperature increased between 1 – 4 ^{o}C warmer than it had been and a decrease in precipitation occurred in the Midwest (Bartlein et al. 1984).

Around 3000 cal B.P. the climate became more stable, and it is possible that the climate might have influenced the subsistence and social systems of the Woodland and Mississippian period (Brown 1986). The groups of the Middle Woodland period and Mississippian period later on may have experienced increased social development, because as the climate changed it allowed the groups to focus on agriculture and horticulture to support the larger populations. Horticultural individuals would start to create labor saving tools to work the soil, such as bison scapulas used as hoes. Individuals gathering to certain localities for the growing of crops during the season, may have increased social interaction and extensive trade networks. Agricultural crops would have usually been planted in the late spring and then most likely harvested in the fall as a food source for the winter (Stevenson et al. 1997; Theler and Boszhardt 2003). While maize has a lot of carbohydrates and can be stored for long periods during the winter, it could need to be supplemented with protein such as deer or elk (Theler and Boszhardt 2003). Settling in areas with an increase in supply and reliability of food resources (i.e., river resources) may have helped support larger populations. It may have been important for the Woodland culture to be more sedentary, as compared to a semi-sedentary Archaic culture, as they might not have

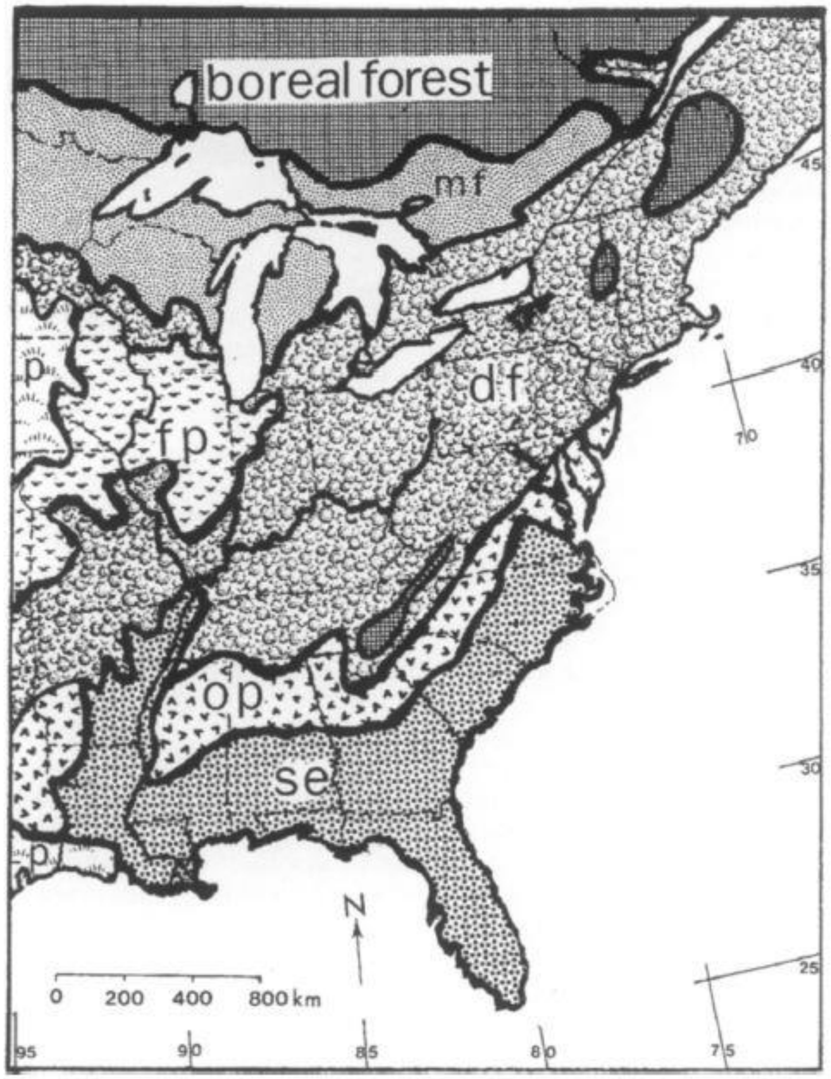

Figure 2.1

Vegetation Region of the Midwest Prior to Euroamerican Settlement (Smith 1986; Webb et al. 1983). mf- mixed conifer-hardwood forest; df- deciduous forest; fp- forest-prairie mosaic; p- prairie; op- oak-pine forest; se- southeastern evergreen forest. Reprinted from Webb 1986 with permission of the University of Minnesota Press.

been able to migrate a large population to a warmer climate and keep enough food to survive long cold winters. The larger populations lead to an increase in: social organization, specialists, social status and kinship (Stevenson et al. 1997; Theler and Boszhardt 2003). The creation of forts is a defensive strategy in response to population increase and territory pressure which relate to maize cultivation (Theler and Boszhardt 2003).

Woodland Overview

The Woodland Tradition (2500-950 cal B.P.) represents an increasingly sedentary lifestyle, including the practice of gardening, early horticulture, the construction of earthen burial mounds, and the introduction of grit or sand tempered ceramic containers. The mounds served as cemeteries that appear throughout the Midwest, and some have been interpreted as territorial markers (Brown 1985). Archaeological studies note that some Woodland people relied heavily on fish and mussels in major river valleys as revealed by excavations of storage pits and middens (Theler 1986). These Woodland people may have relied on fish and mussel; however, they might also have continued to hunt deer and elk as another possible source of protein. Excavations in Wisconsin revealed an increase in cultivated plants that were supplemented with other food sources evident throughout the tradition (Arzigian 2008).

It might be possible that as more individuals started gathering in larger groups, they would have looked for additional sources of food to support the larger populations. These people were semi-nomadic and were moving to different locations during the year, drawn by seasonally available food resources (Stevenson et al. 1997; Theler and Boszhardt 2003). These concentrations of river resources and horticultural plants may have been the influence that moved Woodland societies from the uplands to the floodplains. Before summarizing the Woodland, it is important to understand the Late Archaic that came before.

Late Archaic Material Culture

The Late Archaic (3000-2500 cal B.P.) includes bands of hunter-gatherers, manufacture of notches and stems on projectile points, practicing certain burial rites and trade networks. "Ground-stone artifacts become prominent during the Late Archaic. These include woodworking tools such as grooved axes" (Theler and Boszhardt 2003:87). These grooved axes may have been used for acquiring wood by cutting down trees. The axes could be useful for gathering wood more efficiently for structures, tools, and firewood, than gathering dead branches from the ground. "Red Ochre burials are associated with a decline in the heavy, large utilitarian copper tools and an increase in the use of copper for personal ornamentation, as well as an increase in population" (Pleger and Stoltman 2009:39). It is possible the act of adding burial goods such as red ochre and copper artifacts to the body may be evident of social complexity. There has been some debate on whether burial goods are related to high status members of society (Pleger and Stoltman 2009). Most of the projectile points were manufactured smaller than earlier Archaic points which could be a shift in technology to start using foreshafts with spears (Theler and Boszhardt 2003).

Early Woodland Material Culture

The Early Woodland (2500-1900 cal B.P.) lifestyles were similar to that of the preceding Archaic people, except the Early Woodland culture has the innovation of ceramics. There are gradual changes in settlement patterns, utilized resources, and increased exchange networks

(Stevenson et al. 1997 and Theler and Boszhardt 2003). According to Yerkes (1988), the first evidence of gardening in the Midwest come from Early Woodland sites with some containing evidence of sumpweed, *Chenopodium*, and sunflower. The dating of these plants has been determined through the use of radiocarbon dating from archaeological sites. The introduction of ceramic vessels is one indication that these people began to settle in areas for longer periods of time compared to the Archaic people (Stevenson et al. 1997). Recovered pottery fragments from excavations allowed the reconstruction of pottery vessels. These reconstructed pottery vessels provide a method for defining different pottery styles. The multiple studies of ceramics recovered from Wisconsin revealed that the earliest ceramics are found to be thick-walled, flat-bottomed vessels that are occasionally decorated.

According to Theler and Boszhardt (2003), Early Woodland pottery types are Marion Thick, Prairie Ware, and Black Sand Ware. These ceramics are distinctive of the Indian Isle Phase in southwestern Wisconsin (Stoltman 1990). Later, thinned cone-shaped pots, which are often sand tempered and decorated with incised lines and fingernail impressions, appear and mark the Prairie Phase in Southwestern Wisconsin (Stoltman 1986, 1990; Boszhardt 2003). Some of the projectile points in the Early Woodland period include Kramer, Waubesa Contracting Stem, and Dickson Broad Blade.

Kramer points differ from Waubesa points due to having a straight stem rather than contracting stem. Dickson Broad Blade is a projectile point that has a contracting stem but is wider than Waubesa points. The Waubesa Contracting Stems are some of the first projectile points associated with the Early Woodland period in Wisconsin. The Waubesa Contracting Stem points are generally longer and thicker than Late Archaic points, which are side-notched with straight or flared stems (Theler and Boszhardt 2003). The contracting stem of the Waubesa point offers a unique hafting method, for it allows the point to separate more easily from the haft than prior Late Archaic point styles that used a notch hafting method. This contracting stem hafting method could suggest that Native Americans were more interested in recovering the straight foreshaft rather than the projectile point. The contracting stem of the Waubesa may have affected the manufacture of the projectile point in both style and lithic material in the Early Woodland period. "Indeed, many Waubesa points are relatively thick with unfinished edges, giving the impression that they were expediently manufactured as expendable" (Theler and Boszhardt 2003:103). I agree with Theler and Boszhardt (2003) that the thickness and unfinished edges of the Waubesa Contracting Stem points could be a result of expedient manufacture. One social group may expediently manufacture their point with a certain style to differentiate themselves from other groups.

The Early Woodland period is known for the early burial mounds being circular in shape (Theler and Boszhardt 2003). Archaeologists have conducted excavations of burial mounds from the Ohio River Valley to along the Upper Mississippi River drainage in Wisconsin and found human burials and cultural materials in some of these mounds (Theler and Boszhardt 2003). Some of the cultural materials recovered from the mounds are exotic to the regions and may indicate elaborate trade networks. It may be possible that as social groups gained more complex societies they created more elaborate burial practices. There are some cases in which burial mounds are created near each other. This could be due to social groups being more sedentary to a region and burying family members in a certain locality.

The end of the Early Woodland period is determined by the absence of certain types of pottery design styles, such as: Marion Thick, Prairie ware, and Black Sand ware.

Middle Woodland Material Culture

The Middle Woodland period (1900-1600 cal B.P.) is most notable for the Hopewell Interaction Sphere (Theler and Boszhardt 2003). One of the main characteristics of the Hopewell Interaction Sphere is the design and creation of elaborate burial practices. The projectile points from the Middle Woodland period include corner notched points and side-notched points similar to the Late Archaic period but with sharper corners (Nienow and Boszhardt 1997). Some of the Middle Woodland projectile points are: Steuben, Snyder Corner Notched, McCoy Corner Notched, and Monona Stemmed points.

This period is often distinguished from the Early Woodland period by complex mortuary practices, refined artwork, burial motifs, refined ideologies and extensive trade networks (Stevenson et al. 1997). This period seems to indicate a more sedentary lifestyle as demonstrated by individuals putting more work put into burial practices. The Interaction Sphere is used to explain the widespread use of exotic artifacts such as copper, art motifs, marine shells, and Pipestone though trade between the New York region and Rocky Mountains (Stevenson et al. 1997; Theler and Boszhardt 2003). These extensive trade networks could have been used by prehistoric individuals for the acquisition of exotic lithic materials from other states such as Burlington Chert in Iowa and Illinois, Gray Hornstone in Illinois and Iowa, and Knife River Flint in Dakotas to manufacture projectile points (Theler and Boszhardt 2003). The authors discuss how trade networks may have been used by lithic manufacturers for the acquisition of exotic lithic materials. I would agree with the author’s discussion of the importance of trade networks especially, for settlements located in the northern and eastern part of the state of Wisconsin. People in the settlements located near the southern and western portion of the state could have traveled directly for local lithic raw materials originating in neighboring states. In southwestern Wisconsin, many Middle Woodland sites include large mound complexes and campsites predominately located along the Mississippi River (Stevenson et al. 1997; Theler and Boszhardt 2003). These burials and earthen mounds were often located on elevated landforms such as bluffs and hills near water sources such as rivers and lakes.

Since the 1880s, these burial mounds attracted the attention of anthropologists and non-academic individuals (Stevenson et al. 1997; Theler and Boszhardt 2003). Excavations of these burials revealed unique burial goods which resulted in many of these burials being looted by individuals to sell burial goods. A small amount of waste flakes of lithic production from raw materials of the western Great Plains region have been recovered from mounds in the Upper Mississippi Valley, which could suggest that preform blades were traded eastward (Theler and Boszhardt 2003). The practice of trading preform blades could have been used for the transport of exotic lithic materials across Wisconsin. These individuals could have used the major rivers in Wisconsin such as the Wisconsin, Mississippi, and Black River as major trade routes or seasonally traveled for the acquisition of exotic lithic materials.

Late Woodland Material Culture

The Late Woodland (1600-925 cal B.P.) period is distinguished by distinctive regional styles of pottery and a rapid population growth. This period of the Woodland is known for the crop cultivation such as maize, beans, squash, and other wild food (Stevenson et al. 1997; Theler and Boszhardt 2003). I would agree with the authors that an increase in cultivated plants is connected to the rapid population growth of the period. Usually increased population growth can be related to groups of individuals becoming more sedentary and living in villages. I would believe as people become sedentary, individuals could have more time to focus on burial practices and other local practices rather than needing to travel long distances for food.

The Effigy Mound Culture is commonly related to the Late Woodland period. “After A.D. 600, the shape of the mounds, long restricted to the round conical form, began to include elongated linear forms and those in the shapes of animals, such as birds and mammals” (Theler and Boszhardt 2003:127). In some cases, these mounds could have been built close to each other forming a burial mound group. The grouping of burial mounds may be related to individuals wanting to bury their dead together in a local region. Some of the artifacts found in effigy mounds include thinner wall pottery as compared to Early Woodland pottery and decorated by woven fabric or woven wrapped paddles pressed into the outside of the vessel (Stevenson et al. 1997; Theler and Boszhardt 2003). The burials in these mounds may be related to a rising of social structure or clans, especially if there are different styles of effigy mounds (Stevenson et al. 1997, Yerkes 1988).

This period saw the introduction of the bow and arrow and increasing emphasis on growing maize (Stevenson et al. 1997; Theler and Boszhardt 2003). With maize being a major source of carbohydrates, the people of this period may have searched for other resources to supplement their diet of maize. Some examples would have been fishes and mussels since, they would have been near sources of water for their maize fields (Theler and Boszhardt 2003). There is evidence in southwestern Wisconsin of Late Woodland sites in variable types of occupation locations, from major river valleys to small spring-fed streams (Stevenson et al. 1997; Theler and

Boszhardt 2003). The increase in cultivation in this period could have had an increase in social tension and conflict. The increase in settlement numbers could have given rise to social status and created different clans (Theler and Boszhardt 2003). Certain clans may have had more land and been able to harvest more crops before winter than other clans. Certain clans might have raided other settlements for the harvested crops to help them survive the winter. “Villagers may join together under a prophetlike leader whom it is believed will deliver followers from harm” (Theler and Boszhardt 2003:13). The joining of villages and clans may have been the rise of tribal territorial boundaries, since the larger land segments needed for cultivation needed to be protected.

As people became more sedentary, they might have developed or adopted new technologies to help procure more food and protection from unwanted visitors. One such technology is the bow and arrow. The introduction of the bow and arrow shows a reduction in the size of projectile points. Side-notched, Cahokia-like triangular and often serrated, un-notched triangular points and the reduction of the projectile point size could have allowed the arrow to travel longer distances than an atlatl dart or spear (Theler and Boszhardt 2003). It is possible that some of these points could have been designed for warfare, such as projectile points with serrated edges which could have caused wounds to bleed out more. According to Theler and Boszhart (2003:136), “Historic accounts refer to several Plains tribes that intentionally made detachable points for use in warfare”. Since there are some accounts that these detachable points may have been used in warfare, they could have been useful for hunting as well. The following is a scenario of how the contracting stem of the Waubesa point may have performed: as the shaft detached from the point as the animal ran, then the hunters would have been able to recover the shaft and attach a new point.

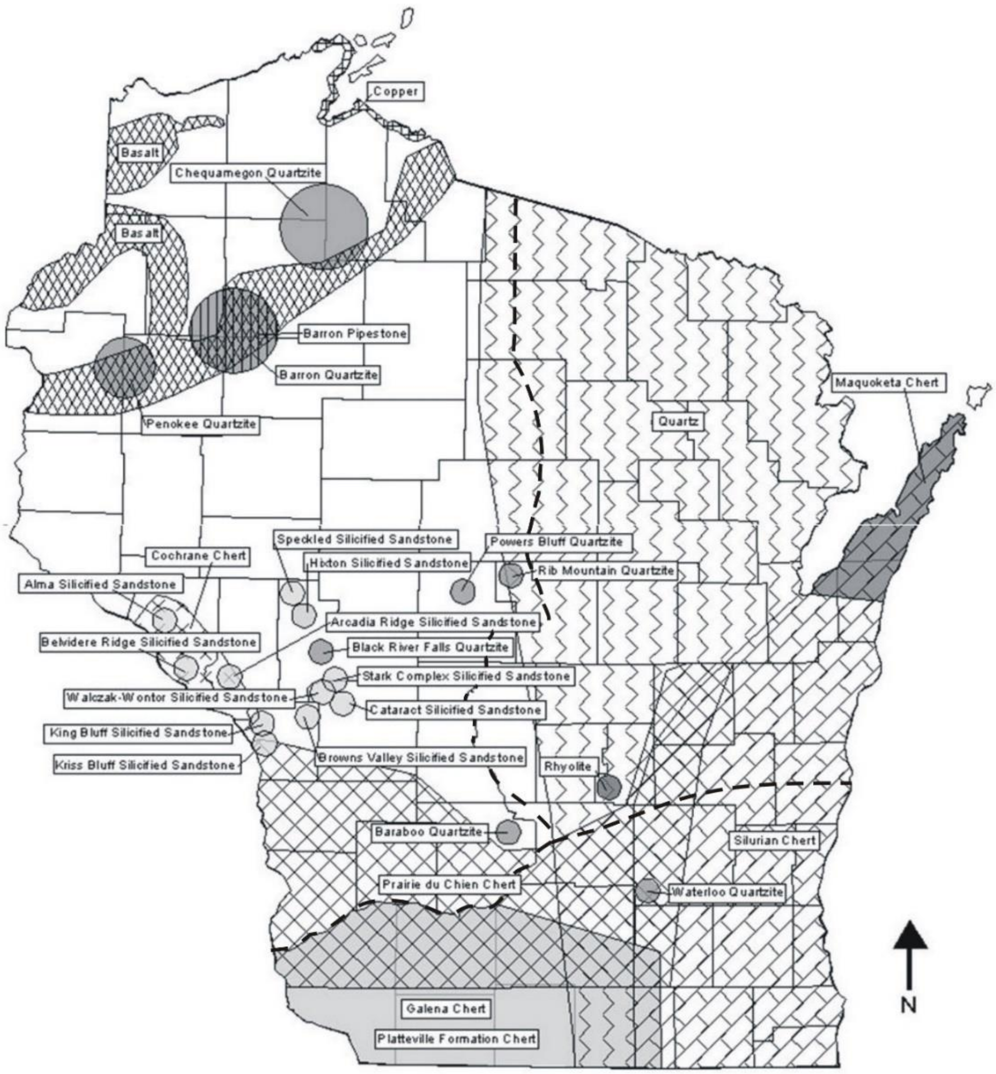

Figure 2.2

Locations of Lithic Sources. Modified map of Winkler and Blodgett (2004) showing locations of lithic sources in each region with the regions outlined that were defined earlier in this paper. Reprinted from Winkler and Blodgett (2004) with permission of the Mississippi Valley Archaeology Center.

Raw Materials of Wisconsin

Winkler and Blodgett (2004) created a map of Wisconsin identifying locations of lithic sources. The Region 1 lithic sources are as follows: Alma Silicified Sandstone, Arcadia Ridge Silicified Sandstone, Baraboo Quartzite, Barron Pipestone, Barron Quartzite, Basalt, Belvidere Ridge Silicified Sandstone, Black River Falls Quartzite, Browns Valley Silicified Sandstone, Cataract Silicified Sandstone, Chequamegon Quartzite, Cochrane Chert, Hixton Silicified Sandstone, King Bluff Silicified Sandstone, Kriss Bluff Silicified Sandstone, Penokee Quartzite, Powers Bluff Quartzite, Prairie du Chien Chert, Rib Mountain Quartzite, Speckled Silicified Sandstone, Stark Complex Silicified Sandstone, and Walczak-Wontor Silicified Sandstone. Region 2 lithic sources are as follows: Galena Chert, Platteville Formation Chert, Prairie du Chien Chert, Quartz and Silurian Chert. Region 3 lithic sources are as follows: Maquoketa Chert, Quartz, Rhyolite, Silurian Chert and Waterloo Quartzite (Figure 2.2).

Prairie du Chien Chert is present in Region 1 and Region 2; therefore, I will not be able to distinguish the lithic material as local or exotic in Regions 1 and 2. Silurian Chert is present in Region 2 and Region 3; therefore, I will not be able to distinguish the lithic material as local or exotic in Regions 2 and 3.

Summary

The evidence of the Woodland period shows an increase in sedentism and an increase in population density (Theler and Boszhardt 2003). Some of the substantial evidence would be the increase of maize cultivation and elaborate mortuary practices such as Hopewell and Effigy Mound practice mentioned earlier in this chapter towards the Late Woodland period. The Early Woodland period in the Midwest is often credited with the presence of pottery vessels. The

Waubesa points are found in association with some Early Woodland settlements. This projectile point is known for the unique hafting style as compared to the hafting method of the Late Archaic and Middle Woodland periods. Other Early Woodland projectile points are larger in size and manufactured more quickly or crudely (Theler and Boszhardt 2003). The Early Woodland period is also noted for the more elaborate burial practices compared to the Late Archaic period with the Early Woodland cultures' construction of burial mounds. The Middle Woodland period is noted for the Hopewell Interaction Sphere with long distance trade and procurement of exotic lithic materials. The Late Woodland period is distinguished by population growth and the adoption of the bow and arrow. The Late Woodland period is also known for the increase in cultivation of maize, increased social interaction and elaborate effigy mound construction. Chapter III covers the discussion of style and function on cultural materials and style variation between social groups.

Chapter III: Style and Function

Introduction

This chapter covers the discussion of style and function that is used in this thesis. Understanding the difference between style and function is important for interpreting any statistical patterning found in the point shapes. "Stylistic similarity is homologous similarity; it is the result of direct cultural transmission once chance similarity in a context of limited possibilities is excluded" (Dunnell 1978:199). Stylistic variations can change over time as the person who is manufacturing the projectiles experiences different personal and social factors. Careful examination of these projectile points could reveal an underlying style imposed by social factors. An example of these social factors would be a period of conflict with neighboring groups. These groups may have controlled who had access to join their social group.

Controlling access to the social group could have prevented outsiders from entering the social groups; therefore, reduced the outsiders' knowledge of local resources and specific ways of making projectile points. These social groups may have developed their style to add to cultural materials to differentiate themselves from other neighboring groups.

This thesis is set within limits described above, but is concentrated on a smaller scale of stylistic change focused in Wisconsin as compared to a large scope such as the Midwest Region. According to Flannery (1976), since this study has a smaller focus, the spatial and style variation would be termed as microstyle analysis. This study is examining any patterned style of the Waubesa points and the spatial relationship of Waubesa shoulder styles distributed across Wisconsin. Analyzing Waubesa points with multiple shoulder styles over a large region may provide a more accurate analysis of the variation of morphological data among the cultural materials.

Definitions of Function

When studying style variation, it is important to understand the difference between style and functional parts of the point. One attribute of the Waubesa point considered functional is the contracting stem. This type of stem would allow easy insertion into the foreshaft or main shaft of a spear, since the contracting stem cannot be bound as tightly with sinew as a notch stem can be bound (Theler and Boszhardt 2003). According to Boszhardt (2003), the increase in the size of Waubesa points from the Archaic period points that precede it could be a change in technology from small points securely hafted to a shaft to the use of detachable points.

Another aspect of function for projectile points is the change to the form of the point to improve the performance by changing the aerodynamics of the point or changing the hafting method. According to Shott (1997), the term “performance” instead of the term “function” is meant to describe the technological aspect of the material culture. Increasing the “performance” of artifacts could be modifying the cultural materials to be more effective. One example is manufacturing smaller and lighter projectile points, so the points can travel longer distances when thrown. Therefore, the overall shape of the blade is a performance aspect that could be related to the functional use of the projectile points; and one example might be larger points hafted to spear shafts and smaller bladed points hafted to arrows. In this example the blade of the projectile point could be classified as functional. The slight changes in the form of the blade do not affect the aspects of the point that would be considered stylistic, such as the shoulder. The contracting stem of the Waubesa point is a functional aspect of the tool that has the presence or absence of grinding on the edge of the contracting stem. This grinding on the contracting stem is part of a functional aspect when hafting the stem of the point to the foreshaft.

Binford (1962) recognized three functional classes of artifacts: ideo-technic, technomic, and socio-technic. Each of these functional classes has different explanations and socio-cultural traits. The ideo-technic and ideological function describes symbolization added to an artifact. These artifacts would be part of the ideological rationalization in the social system. The socio-technic function of an artifact is related to the changes in the structure of society. These cultural materials contain a primarily functional purpose for certain social members. An example may be an elaborate headdress used to identify a chief or healer. The technomic function of an artifact is seen in the economical frame of the social system. The functional aspect of these cultural materials is related to helping the manufacture gather material from the environment. One example would be manufacturing a tool for gathering wood. I agree with Binford's (1982) idea that the socio-technic function could be used to intentionally relate stylistic variations of projectile points to different groups making up various social regions. This may explain the variations to the overall shape of the Waubesa points in particular regions in Wisconsin.

Boszhardt (2003) notes Waubesa points have little resharpening along the blade, which means any style variations of the original flake patterns on the blade or style on the shoulder would probably still be visible. "Functional traits or those that persist of natural selection are characterized by patterned nonrandom behavior whereas stylistic or neutral traits are characterized by stochastic behavior" (Hughes 1998:347). Hughes's article (1998) is useful for analyzing the patterning of flakes on the projectile points to identify functional traits on the point. This could be beneficial for identifying the stylistic variation attributes from functional attributes. The “neutral traits” could be identified as attributes of projectile points that do not have any stylistic variation, but as traits created during manufacturing.

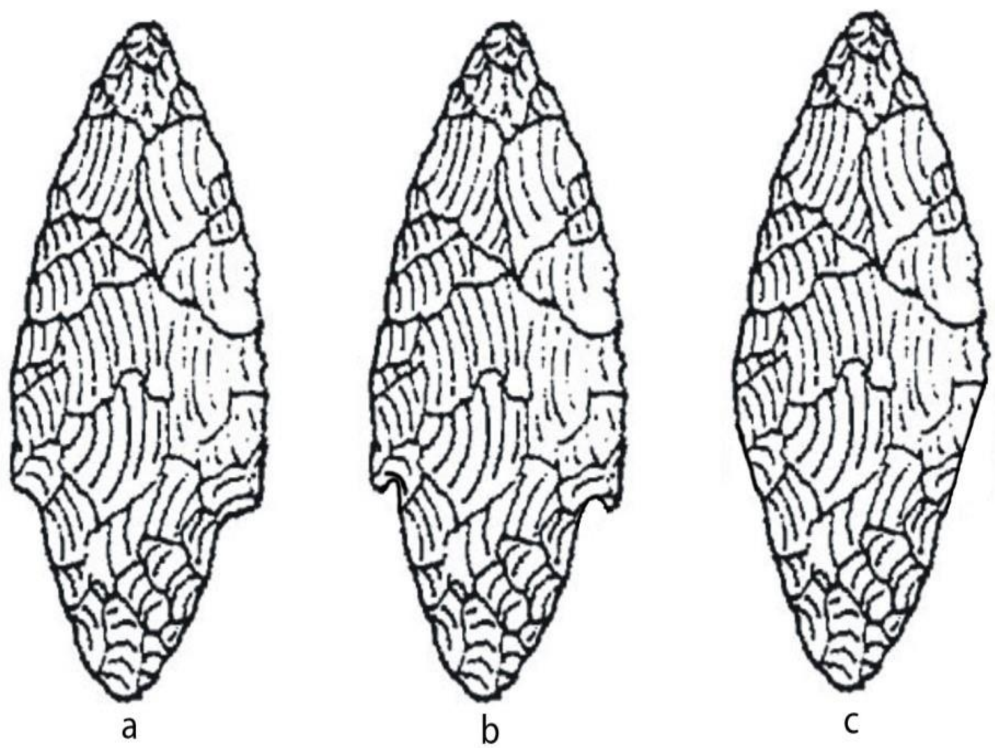

Figure 3.1

Examples of Waubesa Styles (Nienow and Boszhardt 1997:26). Shoulder types: a) sloped, b) barbed, and c) straight. Reprinted from Nienow and Boszhardt (1997) with permission of the Mississippi Valley Archaeology Center.

These articles are used for identifying the functional, neutral, and stylistic attributes of Waubesa points. The different shoulder styles related to Waubesa points are straight, barbed, and sloped. It is possible that since this projectile point has noticeable shoulder differences, they could be related to a stylistic influence by the manufacturer. If the stylistic variation is related to social boundaries, then various shoulder styles may be related to different social groups.

Definitions of Style

It is possible that stylistic variation could have been a forethought during manufacture. The manufacture of style on artifacts excludes the technological and functional design factors during manufacture, as mentioned above. Sackett has provided a definition of style in the archaeological record:

> as a highly specific and characteristic manner of doing something which by its very nature is peculiar to a specific time and place. And it is through an extension of this fundamental meaning that the term finds its most common usage in the everyday speech and writing of archaeologists. To them what is stylistic is by definition diagnostic, and concerns the manner in which morphological or formal, variation among artifacts reflects cultural-historically significant unit of ethic tradition [Sackett 1982:63].

Sackett's (1982) study provides information on different levels of social interaction between different social groups based on material culture instead of using other parameters such as a group's ethnicity. Style is the patterning of material culture such as: morphology, decoration, color, material, and manufacture (Sackett 1982). Stylistic variation of the material culture can be attributed to the social behavior. Binford has also provided a definition of style:

> formal qualities that are not directly explicable in terms of the nature of the raw material, technology of production, or variability in the structure of technology and social sub-systems of the total cultural system. These formal qualities are believed to have their primary functional context in providing a symbolically diverse yet pervasive artifactual environment promoting group solidarity and serving as a basis for group awareness and identity. This pan-systemic set of symbols is the milieu of enculturation and a basis for the recognition of social distinctiveness [Binford 1962:220].

According to both these definitions, stylistic attributes are separate from the functional and technological attributes of the artifacts as described above. Using Binford's (1962) definition only a portion of the morphological variation of an artifact can be attributed to stylistic variation. This aspect of style variation can be observed in most artifacts and most commonly found in ceramics. Sackett (1977) covers the connection between function and style found in most non-ceramic artifacts. Identifying the stylistic and functional portions of the artifacts can be difficult to observe in some artifacts. The reason that the style and function can be difficult to observe is due to the manufacturers not making an effort to distinguish style from function (Lesure 2005). This means that a research study on lithic style may have style variation observed by the research individual, due to bias, which may not have been added by the manufacturer due to bias. This means that the research individual needs to take care not to create style variation when none exists. Therefore, a person will need to be as unbiased as possible during their research and perform detailed analyses that can identify statistically significant patterns.

Hegman (1992) covers how style has been used as a type of communication between individuals or social groups to infer social boundaries. Hegman (1992) notes there are two basic tenets most archaeologists use when discussing style which are: style being a way of doing something and style involving a choice. While there is some agreement on the discussion of style, there can still be a debate on the meaning of style in culture and the archaeological record. Hegman (1992) notes archaeologists have multiple ideas of how style has multiple roles in society. Hegman (1992) seems to share some of the ideas of Sackett (1977) and Wiessner (1983) when discussing style in archaeological applications. Certain individuals within a social group might have certain social roles that they would have been charged with performing. One example of social roles in a society is tasks related to gender roles. Hegman (1992) discusses how style is usually a subset of society. “Most research on style at least considers the active role of style, whether or not such an active perspective is central to the research” (Hegman 1992:531).

According to Hodder (1990), style is related to activities of individuals and related to the individual’s feelings or thoughts. This could mean that an individual’s thoughts or feelings could be related to style when manufacturing the cultural material. Hodder’s (1990) study is similar to Binford (1962) and Sackett (1982) in that style is added to cultural materials through social functions. According to Hodder (1990), style is used in social strategies for the creation of the relationship. This could mean that different settlements in a region would share a style used on specific cultural materials. I found the Hodder (1990) and Hegman (1992) articles useful for complementing research by Binford (1962) and Sackett (1977).

Different stylistic variations of the projectile points can also be related to the individual knapper and influenced by conditions of their society. These stylistic variations would have been more evident on the external boundaries of the different cultural groups' territories (Wiessner 1983). Wiessner (1983) provides examples of different aspects of style during her analysis of Kalahari San projectile points. I would agree with Wiessner (1983) that stylistic variation of artifacts could reflect territories of certain clans or groups of settlements. However, I believe that the stylistic variation of lithic artifacts, rather than the metal ones Wiessner (1983) studied, might be more difficult to observe due to the lithic tools being reworked. She discusses two different aspects of style: "emblemic", which corresponds to social interaction of a social group, and "assertive", which can be used to correspond with social interaction of individuality (Wiessner 1983). The spatial variation of a style could be used to identify different cultural areas (Wiessner 1983). While spatial variation may be used to define variation in stylistic regional areas, the deposition of artifacts provides temporal variation. While these changes may be observed in the archaeological record, it is not always a sharp division from one style to another. I believe that this study is useful for determining which aspects of style are evident in the style variation of Waubesa points. Social boundaries change shape over time, which could be influenced by social groups and outside influences. Some examples of these outside influences that could change the social boundaries are: food availability, lithic sources, population density, and conflict/warfare.

Wiessner's (1997) later study, looks at how social identity could lead to standardization of stylistic variation, so that cultural materials manufactured within a society would share a common theme. It is possible that the standardization of stylistic variation is related to social cooperation and the manufactures of style might be interested in the same goals as the rest of the social group. If a smaller social group wanted to separate themselves from the main social group they might add a style variation to their cultural materials to make themselves known. This may be the case for the different shoulder styles added to Waubesa points. Following Wiessner (1983), the hypothetical Early Woodland groups in Wisconsin would manufacture different stylistic variation on their borders to insure that their families proclaimed which territory they called their own.

In the Early Woodland period, it may have been possible that stylistic variation would have been passed from parent to child, or teacher to student and they may have been part of a group. The process of vertical transmission is defined as the passage of traits being passed from parents to children (Cavalli-Sforza and Feldman 1981). Following Cavalli-Sforza and Feldman (1981), hypothetically style may stay the same in a cultural group over time if the style of cultural material is passed down from parents to children, and they did not travel into clusters of a different stylistic group. These multiple groups might be settled far enough apart from each other to show stylistic clusters across space. If a group of people happened to manufacture a projectile point with a certain style to differentiate themselves from other groups that might have a similar projectile point; it could have been used as a form of identification to a certain group of people (Wobst 1977). Therefore, a large region may have multiple variations in the style of cultural materials even among people that may consider themselves somehow related.

Summary

The authors Wobst (1977), Binford (1962), and Sackett (1977, 1982) provide studies of how style variation may appear within a culture. They discuss style variation as being part of the social function in the culture, and Wiessner (1983) discusses how style may travel throughout the area. I found these authors provide theories that most likely explain how style and style variation could spread across the regions of Wisconsin.

Discussion of the concepts of function and style for Waubesa points reveals that the stylistic variation of the point is mostly focused on the blade and the shoulder portion. Since there is little reworking of the blade, it could mean that the different shoulder styles (straight, barbed, and sloped) are different stylistic variations by the manufacturers. The contracting stem of the Waubesa point is a functional aspect of the point. This function has been determined to allow the point to detach from the foreshaft and to stay penetrated in animals or individuals (Boszhardt 2002). The metric and non-metric attributes analyzed for this thesis is covered in Chapter IV.

Chapter IV: Methodology

Introduction

The traits to be analyzed are the metric attributes recorded from the projectile points for the investigation of morphological patterning. Attributes have been defined as a type of observation of measurements or state of the projectile point (Hodson 1982:22). The metric attributes of the projectile points used in this thesis are derived from Thomas' standards projectile point measurements (Thomas 1970, 1981). These measurements include: Maximum Width (MW), Maximum Length (ML), Maximum Thickness (MT), Weight (g), Notch Opening (NO), Distal Shoulder Angle (DSA) and Proximal Shoulder Angle (PSA) (Thomas 1970, 1981). The major metric attribute related to style variations is the angle between the stem and the shoulder of the projectile points. Additional measurements include: Stem Length (SL), Proximal Stem Width (PSW), and Distal Stem Width (DSW). These attributes are used to analyze both the form of the blade and the hafting portions of the Waubesa points. This set of attributes of the projectile point should provide an accurate analysis of style variation. Thomas' (1970) study was designed to implement these variables for the comparison of various types of projectile points. The variables TL, SL, MT, NO, and g are attributes related to the overall point variation. The variables DSW, PSW, PSA, and DSA are attributes related to the contracting stem of the Waubesa point.

These standard measurements were first introduced by Thomas in 1970 (Thomas 1970, 1981). Thomas' (1981) standard measurements were derived from projectile points from the Great Basin region. Thomas' (1981) measurements reduce the observation subjectivity when recording projectile points. Overall, these measurements provide a decent base for a projectile points study. They allow other studies to be developed such as projectile point shape, morphology and flake patterning (Dibble and Chase 1981). Thomas (1970), Thulman (2012), Dibble and Chase (1981) articles provide information that is used in this study of Waubesa point. Thomas' (2012) article covers the overall discussion of metric attributes and Thulman's (2012) article is used to record the metric measurements. The morphological data of Waubesa points obtained from direct measurements of the points is more accurate than unscaled photographs and drawings. Thulman (2012) provided a study in which these measurements were gathered from images of projectile points using a flatbed scanner, which resulted in less than 0.1 mm error from direct measurements.

When recording the measurements and photographs, the projectile points are aligned with the tip of the blade placed away from the viewer and the base of the point near to the viewer. Some studies (Kay 1980; Behm and Green 1982) have recorded the Proximal Stem Width (PSW) of the contracting stem at 0 mm. I have measured the PSW of the contracting stem approximately 5 mm from the end of the contracting stem. This technique could provide fairly accurate proximal stem width of the Waubesa contracting stem. The long axis of projectile points is perpendicular and center of the base line (Thomas 1970). The measurements of DSA and PSA are dependent on the orientation of the main axis of the projectile point. Resharpened and asymmetric projectile points are not always centered on the long axis as compared to other attributes of the point. According to Thomas' (1970) research using the smaller measurement of two different angles has created a common standard for measuring DSA and PSA of asymmetric projectile points. I agree with Thomas (1970) that recording the smaller angle of the projectile point would provide accurate measurements of the possible original angle prior to the point being reworked.

One method to identify if the projectile point is asymmetrical is if the tip or base of the point is offset from the main vertical axis. Placing the projectile point on a polar graph so the shoulders are aligned with the 90 and 270 degrees, the tip of the point should be no more than two degrees positive and negative from the zero degree. If the tip of the point is offset from the zero degree by more than two degrees it may be possible the point is asymmetrical.

One measurement related to the stem is the degree of the stem-shoulder angle, which is the opening between the shoulder and the stem. The stem-shoulder angle was measured from the shoulder to the contracting stem. These angle measurements might coincide with non-metric shoulder styles (barbed, straight, and sloped). Barb style would have evidence of barbs on the shoulders, straight shoulders would be perpendicular to the maximum length of the projectile point, and sloped shoulders would be shoulders that merge into the contracting stem.

Table 4.1 lists the 10 metric attributes used in this thesis. Many of these attributes have been adapted from other studies (Kay 1980; Behm and Green 1982) with attribute lists. The attribute numbers in the left column are used throughout this thesis. These numbers are used as the key for the illustration in Figure 4.1 of these measurements.

Table 4.1

Metric Attributes with Units and Level of Recording

Metric Attribute Number	Attribute Name	Unit and Level of Recording
1	Total Length (TL)	0.01 mm
2	Stem Length (SL)	0.01 mm
3	Proximal Stem Width (PSW)	0.01 mm
4	Distal Stem Width (DSW)	0.01 mm
5	Maximum Point Width (MPW)	0.01 mm
6	Maximum Thickness (MT)	0.01 mm
7	Weight (g)	0.01 g
8	Notch Opening (NO)	1 degree
9	Proximal Shoulder Angle (PSA)	1 degree
10	Distal Shoulder Angle (DSA)	1 degree

Adapted from D.H. Thomas (1981). How to Classify Projectile Points from Monitor Valley, Nevada. *Journal of California and Great Basin Anthropology* 3(1):7-43

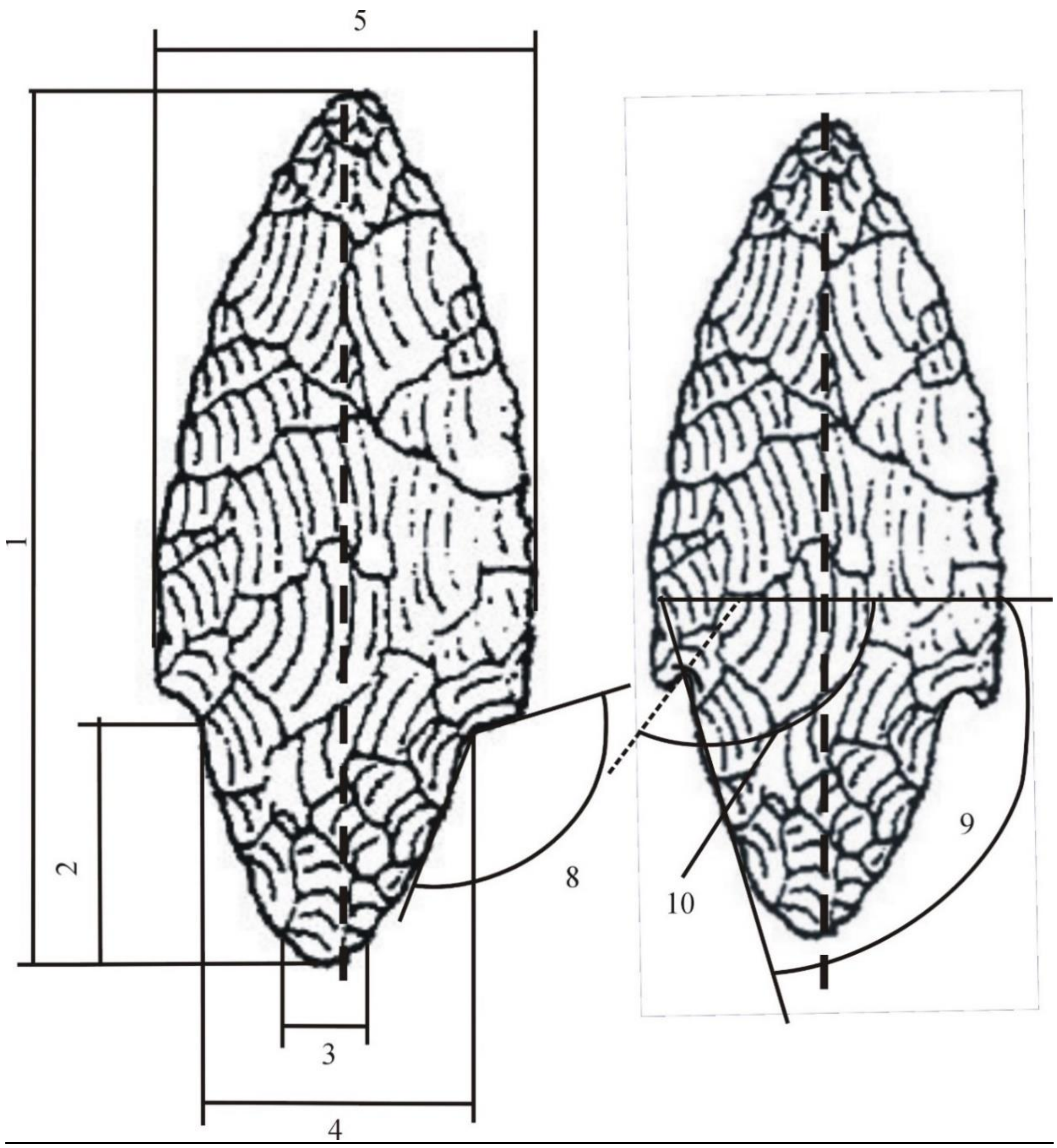

Figure 4.1

Key to the Metric Attributes. Modified (Nienow and Boszhardt1997:26). Reprinted from Nienow and Boszhardt (1997) with permission of the Mississippi Valley Archaeology Center.

1. *Total Length (TL).* The Total Length of the point is measured from the tip of the point to the base of the point parallel to the main axis.
2. *Stem Length (SL).* The length of the stem is measured from the base of the point to the location at which the blade and stem intersect.
3. *Proximal Stem Width (PSW).* This width measurement of the stem is made perpendicular to the main axis of the point and parallel to the distal stem width. This measurement is recorded 5 mm from the end of the contracting stem.
4. *Distal Stem Width (DSW).* This width measurement of the stem is made perpendicular to the main axis of the point and parallel to the proximal stem width. This measurement is recorded at the intersection of the blade and stem. Since Waubesa points have a contracting stem the distal stem width is the maximum width of the stem.
5. *Maximum Width (MW).* This attribute is measured perpendicular to the maximum length of the main axis. For Waubesa points the maximum width is usually located at the base of the blade.
6. *Maximum Thickness (MT).* This attribute measures the thickness of the point perpendicular to the horizontal plane of the maximum width of the point.
7. *Weight (g).* This attribute is measured in grams (g) and this is recorded for completed projectiles only.
8. *Notch Opening (NO).* This angle is formed by the lines which follow the margins of the stem and shoulder of the point. This measurement is the angle between the stem and the shoulder. The Notch Opening is determined by using digital scans to measure the angle.
9. *Proximal Shoulder Angle (PSA).* This angle is defined by the lines defined by the margin of the stem and perpendicular to the main axis. According to Thomas (1970, 1981), the Proximal

Shoulder Angle would range between 0º to 270º. This measurement is recorded to the nearest 1º and in the case of points with asymmetry the smaller degree is recorded.

10. D*istal Shoulder Angle (DSA).* This angle is defined by the lines defined by the margins of the shoulder and the neck of the projectile point. This angle is measured perpendicular to the main axis. According to Thomas (1970, 1981), the Distal Shoulder Angle would range between 90º to 270º. This measurement is recorded to the nearest 1º, and in the case of points with asymmetry the smaller degree is recorded.

The data in this thesis was collected personally. The metric measurements are collected by the use of a Carrera Precision caliper and the angles measured using flatbed scanned images with digital software called Canvas 14 of ACD Systems International Inc. The software contains a range of precise vector object and illustration tools for determining the angles. The weight of the projectile points was recorded with a digital scale. Each of the photographs and scanned projectile points are captured with a four-centimeter scale which included a color scale. This color scale helps insure the color balance of the projectile points when viewed on a digital screen.

Discussion of Non-Metric Variables

The database of metric variables is extensive, and these are not the only variables used in this thesis. While these metric variables contain the bulk of the data, the non-metric attributes of the Waubesa points provide additional information for analysis. Table 4.2 lists the two non-metric attributes used in this paper. Many of these attributes have been adapted from other studies (Kay 1980; Behm and Green 1982) and attribute lists. The attribute identifications in the left column are used throughout this paper. These letters are used as a key for the illustration in Figure 4.2 of these measurements.

Table 4.2

Non-Metric Attributes with Units and Level of Recording

Non-Metric Attribute Number	Non-Metric Attribute Name
A	Shoulder Style
B	Raw Material

The majority of Waubesa points are flintknapped from certain local lithic materials of chert and silicified sand in Wisconsin (Theler and Boszhardt 2003). As mentioned earlier, I have proposed three different regions of Waubesa concentrations in Wisconsin (Figure 1.2). I argue that the lithic material sources in Region 1 is considered local material, and lithic material sources from Regions 2 and 3 is considered exotic for Region 1. The same conditions would be applied to Regions 2 and 3. However, if the lithic material crosses into two regions next to each other, then the lithic material cannot be considered exotic. This distinction would be applied to the lithic material type of the Waubesa points to determine if they are manufactured from local or exotic lithic material relative to each region. I suggest that the regional boundaries I have defined in Figure 1.2 may be Early Woodland social boundaries based on the spatial distribution of Early Woodland sites.

Winkler and Blodgett (2004) provides distinguishing characteristics of the raw materials in Wisconsin with photographs for identification and comparisons of the raw materials of the Waubesa points. The Winkler and Blodgett (2004) photographs provide multiple variations and alterations of different raw materials. Bakken (1995) provides an overview of lithic raw material resources in Minnesota. Bakken's (1995) paper is used to help identify raw materials from outside Wisconsin. Morrow (1985) provides a key for identifying the raw materials common to archaeological sites in Iowa.

One method to identify raw material is a 10x pocket magnifying glass to look for features such as: fossil inclusions, oolites, marbling, and burrows. Winkler and Blodgett (2004) provide distinguishing characteristics and Munsell color chart descriptions of raw lithic materials. The Munsell color chart is used in combination with Winkler and Blodgett's (2004) distinguishing characteristics for describing the lithic material. A personal comparative raw material collection was also used to assist in identifying the lithic raw materials.

One attribute related to identifying lithic raw materials is identifying the heat treatment state of the projectile points. Heat treatment was employed to improve the quality of the raw lithic materials. Winkler and Blodgett's (2004) article covers luster and color of heat treatment of the lithic materials. The five heat treatment states have been identified as unheated, heat treated, heated, burnt, and unknown (Behm and Green 1982:34). The unheated lithic materials do not have any recognizable color or luster change to the raw material. The heat treated raw materials would have a highly lustrous surface to the surface of the tools. The term heated, refers to raw materials that have only a slight color change compared to the lithic material that was heat treated, which would have more color change and luster. Burnt is referred to raw materials of tools that have evidence of being charred and if the tool has evidence of fracture. The burnt lithic material of the projectile point may be difficult to identify due to lack of color and charred surface obscuring identifying features.

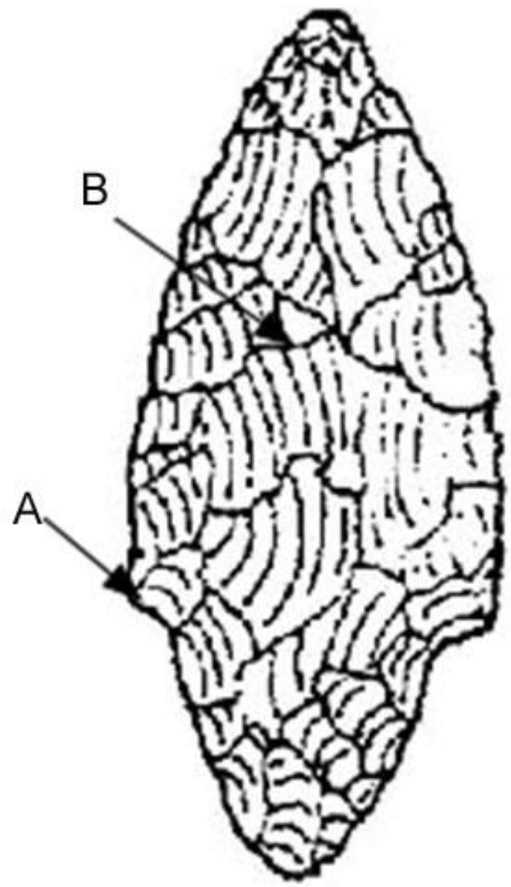

Figure 4.2

Key to the Metric Attributes. Modified (Nienow and Boszhardt 1997:26). Reprinted from Nienow and Boszhardt (1997) with permission of the Mississippi Valley Archaeology Center.

The second attribute is this section is identifying the shoulder style (barbed, straight, and sloped). Barb style would have evidence of barbs on the shoulders, straight shoulders would be nearly perpendicular to the maximum length of the projectile point, and sloped shoulders would be shoulders that merge into the contracting stem.

The Data Sets

A total of 256 Waubesa points are selected from multiple repositories, and from multiple sites across Wisconsin resulting in 71 from Region 1, 74 from Region 2, and 111 from Region 3 (Appendix B). Data Set 1 and Data Set 2 are randomly selected from this collection.

The first data set is a random sample of 40 Waubesa points that are selected from each of the three regions with a total of 120 out of 256 (Appendix C). The random sample is created by assigning a number to each point from each of the regions and using a random number generator to create the sample. The original population which the random sample is selected from is a collection of points from archaeological repositories in Wisconsin. The sites from which this sample are presented in Table 4.3. The random sampling technique selected a disproportionate number of Waubesa points from 47CR354; however, the random sample still allows other sites to contribute to the analysis. It is possible that the high total of Waubesa points from 47CR354 might unjustly influence my results.

The first data set is comprised of 40 complete projectile points to obtain complete metric analyses. The data set of these projectile points are used to examine the metric morphological changes based on the metric attributes discussed in the previous sections. Any projectile points with damaged shoulders are excluded due to the Notch Opening, Proximal Shoulder Angle and Distal Shoulder Angle not being able to be determined.

The second data set is comprised of 180 projectile points, in which the shoulder portions of the points are intact even if the tip of the point is damaged or missing. A random sample of 60 Waubesa Contracting Stem points is selected from each of the three regions with a total of 180 out of 256 (Appendix D). The original population which the random sample is selected from a collection of points from archaeological repositories in Wisconsin. The random sample for this data set is created in a similar manner as the first data set. Due to the number of points in each region and the random selection method the sample of this data set includes some points that are selected in the first data set. Any projectile points with damaged shoulders are excluded due to the shoulder style not being able to be determined. This data set of the projectile points is used to examine the non-metric attributes defined in the previous sections. The sites from this sample are presented in Table 4.4. The random selection method for this data set results in the same issue as Data Set 1. While this data set does contain a high number of Waubesa points from 47CR354, it also contains random points from other sites. The disproportionate number Waubesa points from 47CR354 may unduly influence my results. Some of these projectile points might be selected by random into both data sets.

These two data samples provides adequate information showing style and geographic variation. Appendix B provides the recorded data for artifact identification, metric and non-metric measurements of all the projectile points acquired for the thesis.

Table 4.3

Data Set 1 of Sites Selected for Metric Analysis

County	Site/Township	Number of Points Region 1	Number of Points Region 2	Number of Points Region 3
Brown	Brown			10
Brown	47BR116			1
Brown	47BR437			3
Crawford	47CR186	4		
Crawford	47CR312	3		
Crawford	47CR354	26		
Crawford	47CR356	4		
Crawford	47CR451	1		
Dane	47DA3		1	
Dane	47DA10		1	
Dane	47DA14		1	
Dane	47DA17		1	
Dane	47DA457		4	
Dane	47DA459		15	
Dodge	47DO47		4	
Grant	47GT593		8	
Grant	47GT594		1	
Grant	47GT670		3	
Grant	47GT697		1	
Manitowoc	Manitowoc			1
Trempealeau	47TR40	1		
Vernon	47VE825	1		
Waupaca	47WP26/70			9
Waushara	47WS131			1
Winnebago	47WN154			1
Winnebago	Winnebago			14
Total	26	40	40	40

Figure 4.3

Sites Distribution of Sites Used in Data Set 1 (n = 120). Modified map of Woodward (1972). Reprinted from Woodward (1972) with permission from Cartographic Laboratory University of Wisconsin – Madison.

Table 4.4

Data Set 2 of Sites Selected for Non-Metric Analysis

County	Site/Township	Number of Points Region 1	Number of Points Region 2	Number of Points Region 3
Brown	47BR116			2
Brown	47BR437			2
Brown	Brown			19
Crawford	47CR186	7		
Crawford	47CR312	5		
Crawford	47CR354	31		
Crawford	47CR356	3		
Crawford	47CR451	4		
Crawford	47CR460	3		
Dane	47DA3		3	
Dane	47DA10		3	
Dane	47DA17		1	
Dane	47DA411		2	
Dane	47DA457		4	
Dane	47DA459		14	
Dodge	47DO47		4	
Door	Door			3
Grant	47GT593		17	
Grant	47GT594		1	
Grant	47GT670		1	
Grant	47GT697		1	
Jackson	47JA522	3		
Jefferson	47JE1		7	
Kewaunee	Kewaunee			1
Lafayette	47LT149		2	
Manitowoc	Manitowoc			3
Oconto	Oconto			1
Trempealeau	47TR40	1		
Vernon	47VE825	3		

Waupaca	47WP26/70			7
Winnebago	47WN9			2
Winnebago	Winnebago			20
Totals	32	60	60	60

Figure 4.4

Sites Distribution of Sites Used in Data Set 2 (n = 180). Modified map of Woodward (1972). Reprinted from Woodward (1972) with permission from Cartographic Laboratory University of Wisconsin – Madison.

Summary

The large set of attributes defined in this chapter is useful for describing the form and stylistic variation in these Waubesa points. The reason for creating two data sets for the analysis of the Waubesa points is to have complete projectile points for metric analysis and analyses on the shoulder styles do not have to be complete projectile points. All the non-metric attributes are used to examine the stylistic variations. The evidence of stylistic variations are more commonly found on the shoulder and hafting element. This may be due to the hafting area not being reworked as often as the changes to the blade. Therefore, most of the analyses that cover the morphological variation in Waubesa points focused on the shoulder attributes.

Chapter V presents the univariate and multivariate analysis of the 10 metric attributes and two non-metric attributes defined above. The variables of Total Length (TL), Maximum Width (MW), Thickness (T), and Weight (g) covered the overall form of Waubesa Contracting Stem established by Nienow and Boszhardt (1997). The overall form can help determine the classification of the projectile point type. Another analysis covers the shoulder shape attributes by comparing the shoulder style to the regions.

Chapter V: Metric Analysis

Introduction

An analyses of variance, also known as ANOVA, is conducted on the metric attributes of the Waubesa points, which include: Maximum Length, Maximum Width, Maximum Thickness, Stem Length, and Stem Width. This test is used to find the probability that the projectile points from each region belong to the same population and differ only through the vagaries of sampling. The other test used is the chi-square analysis. I conducted chi-square to analyze the proportions of raw materials compared to the shoulder style. The chi-square analysis shows if there is a certain type of raw material preferred for a shoulder style. Another chi-square conducted is to determine if a certain shoulder style is preferred in a certain region.

Morphological variation of the Waubesa points is analyzed by examining individual attributes or by examining a group of attributes for geographic patterning. The analysis shows morphological variation within a single attribute or relationships between the attributes.

One question that is addressed in this chapter is analyzing the distribution of the archaeological sites containing Waubesa points mentioned in Chapter I. Figure 5.1 shows the number of recorded Waubesa sites in Wisconsin by county from the Wisconsin Historical Society Database (WHS 2017). Best-Fit Straight Line analysis was conducted to determine if certain counties in Wisconsin have higher counts of Waubesa sites compared to the total number of archaeological sites recorded for each county. The data used for this analysis can be found in Appendix A.

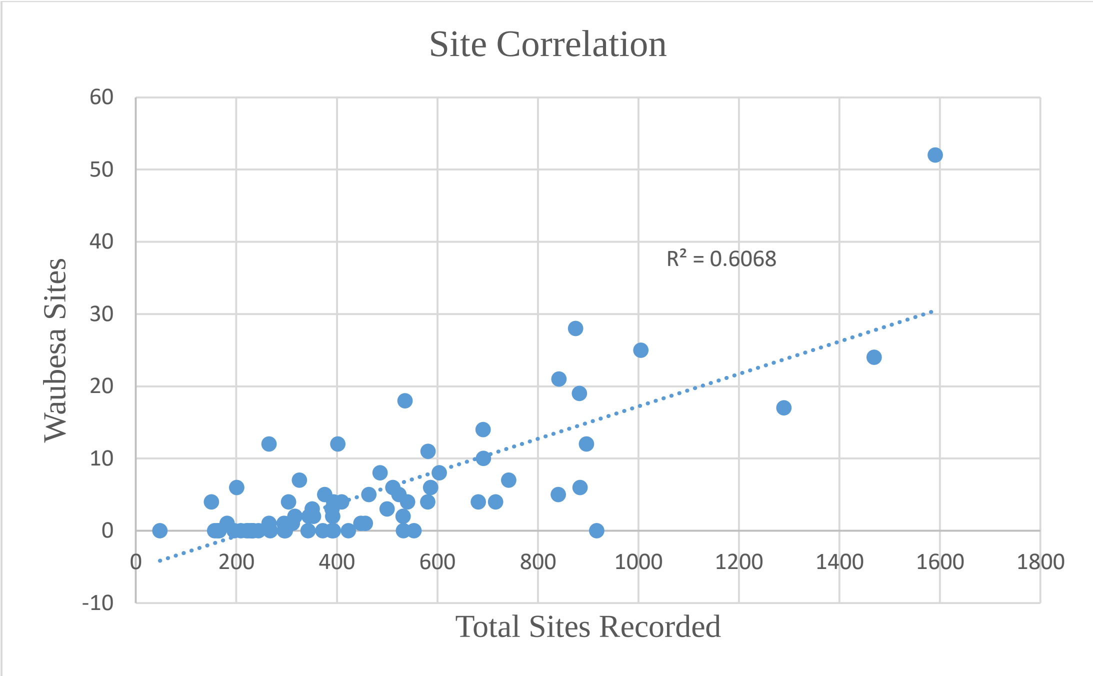

Figure 5.1

Waubesa Site Correlation to Total Sites in each County. Pearson's *r* = 0.779.

Comparing how well the data fits the line, a ratio is used on a scale of zero to one. Drennan (2009) recommends using the Pearson's *r* also known as the correlation coefficient. For the Waubesa sites in Wisconsin, there is a very strong correlation between the number of Waubesa sites to the number of total sites in each county of Wisconsin (*r* = 0.779, y = 0.0224x - 5.2291). This analysis shows the concentration of Waubesa sites in a county increases as the total number of archaeological sites in a county increases.

Metric Analysis

The data presented here are for the 10 metric attributes that cover the form and style of the Waubesa points. Each of these variables are represented through the use of histograms shown in the section below. These histograms are used to illustrate the distribution of the various metric attributes, which are used to discuss distinctive style and morphological variation.

Conducting the analysis on the metric attributes is to examine the variations in the form and identify any trends which might be reflected in cultural transmissions. Therefore, any strong trends identified in the analysis of form and style could reflect the geographic distribution of different cultural traits. The analysis of one attribute may result in normal bell curve distribution; however, there are two possible methods for determining if there are multiple batches within one of the attributes. One method is if the bell curve has a multimodal distribution and the second method is conducting an ANOVA on the attribute. A multimodal distribution of an individual attribute as measured across the entire sample is important to examine to determine what is causing the additional modes. Determining if these modes are formed by outliers, a large number of points from one region, or a combination of points from multiple regions that are outside the normal distribution is crucial. A normal distribution of the entire sample for an attribute may have a stylistic variation which could be revealed through an ANOVA analysis to determine if there are significance differences between the regions.

Histograms are used to show the general frequency of each of the metric variables for the entire sample that is comprised of the three individual batches from the three regions. The histograms should show a graphic representation of either single or multiple peaks of these combined batches for each attribute. For instance, if one of the attributes has variation in the form of the points it may create a histogram with multiple peaks with different means. These multiple peaks may be caused by outliers, a large number of points from one region, or a combination of points from multiple regions that are outside the normal distribution. One interpretation of the histograms of one attribute with multiple peaks may mean there is a separate population. Therefore, an analysis is conducted to determine what factors cause the peaks.

For comparing three or more samples to determine the probability that they came from the same parent population (i.e., share the same mean), Drennan (2009) recommends using an analysis of variance also known as ANOVA with post-hoc pairwise tests such as Tukey's Honestly Significant Difference (Tukey's HSD) to identify significant differences between batches. Low probabilities (i.e., *p* values) means there is a significant difference in the attributes showing that some projectile points may have different parent populations.

Chi-Square Analysis

The geographic analysis of the projectile points examines the style variation related to the three regions defined in Chapter I. The analysis of the raw material of the projectile points are used to determine if certain raw materials were preferred in each region. The chi-square analysis uses a matrix of data for correspondence of two or more variables that are compared and measured. The chi-square test works for any number of categories divided into the overall sample, and any number of portions are calculated (Drennan 2009). When chi-square analysis has a significant value a post hoc test is conducted to determine if any cells have significant adjusted standardized residuals (ASR) using the Bonferroni correction. Overall, the chi-square analysis compares the observed data to what is expected to be found due to random chance.

Statistics

I accept 90 percent confidence interval ($p \leq 0.10$) as a statistically significant difference between samples for the analysis of the ANOVA and any post-hoc pairwise tests. The PAST program preforms a box-and-dot plot analysis to determine the outliers of the recorded data for the attributes. A Winsorization of the sample is conducted if the PAST program reveals Winsorizing the outliers causes a 10 percent and greater difference in the standard deviation.

Metric Angle / Style Analysis

The Distal Shoulder Angle and Notched Opening style analyses are separate than the analyses in Data Set 1 and Data Set 2. The analyses on this section contain measurements from Data Set 2 and are presented prior to analyses on Data Set 1 due to data having metric analyses in the form of ANOVA. These analyses shows the mean and standard deviations of the angles for the different shoulder styles. The Proximal Shoulder Angle is not related to shoulder style due to all the points having a contracting stem. These analyses show there is no overlap between the shoulder styles and metric measurements associated with those styles.

Distal Shoulder Angle / Shoulder Style. This angle is defined by the intersection of the shoulder and the neck of the projectile point (Figure 4.1). This angle is measured perpendicular to the main axis and rounded to the nearest whole degree. This angle is one of the major variables related to the shoulder style variation.

Figure 5.2 shows the distribution of Distal Shoulder Angles with a large peak around 180.00^{o}. This is a fairly normal distribution of the Distal Shoulder Angles. The midspread of the histogram is between 181.00^{o} and 215.00^{o}. According to the PAST program's box-and-dot plot there is one outlier at 126.00^{o}.

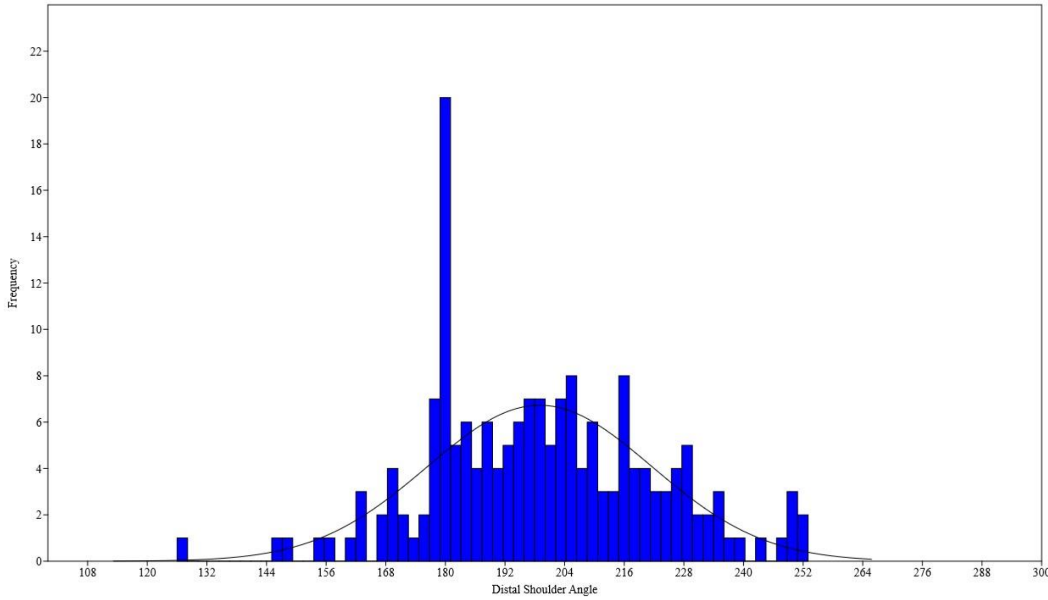

Figure 5.2

Distal Shoulder Angle by Style, n = 180

Table 5.1

Proximal Shoulder Angle Style Data

Shoulder	Number (n)	Mean (X)	Standard Deviation	Variance	
Barbed	17	163.02°	13.66°	186.54	
Sloped	51	218.63°	18.12°	328.48	
Straight	112	195.49°	16.13°	260.25	
All Wisconsin	180	198.98°	22.60°	510.29	
ANOVA	Sum of sqrs	df	Mean square	F	p
Between groups:	43045.1	2	21522.5	78.88	3.22E-25
Within groups:	48296.7	177	272.863		
Total:	91341.8	179			

The three regions were compared and found that the means were spread out. The overall mean is 198.98º with a standard deviation of 22.60º. This analysis shows barbed shoulders have the narrowest angle and sloped shoulder have the widest angle. The ANOVA test resulted in a *p*-value of 3.22E-25. For the Waubesa points in Wisconsin, the relationship between the Distal Shoulder Angle and the shoulder style has very high significance (F = 78.88, *p* = 3.22E-25). The Tukey post hoc test shows there is a high significant difference between each shoulder style with a *p*-value of 0.0000218.

Notch Opening / Shoulder Style. This angle is formed by the lines which follow the margins of the stem and shoulder of the point (Figure 4.1). The smaller angle of the two notch openings recorded for each point was used in the analysis and rounded to the nearest whole degree.

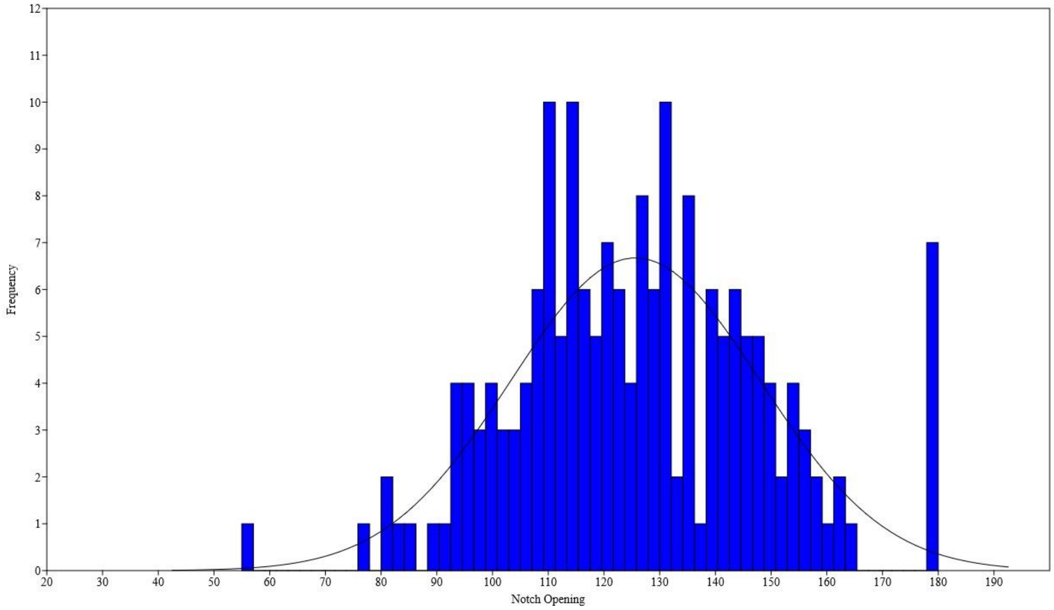

Figure 5.3

Notch Opening by Style, n = 180

Figure 5.3 shows the distribution of recorded Notch Opening and the histogram shows a fairly normal distribution. The midspread of the histogram is between 110.14^o and 141.30^o. The second peak at 180.00^o contains seven points from the sloped shoulder style. According to the PAST program's box-and-dot plot there is an outlier at 55.00^o.

Table 5.2

Notch Opening Style Data

Shoulder	Number (n)	Mean (X)	Standard Deviation	Variance	
Barbed	17	90.25^o	13.36^o	178.37	
Sloped	51	145.47^o	18.52^o	343.05	

Straight	112	122.00°	15.62°	243.94	
All Wisconsin	180	125.66°	22.41°	502.30	
ANOVA	Sum of sqrs	df	Mean square	F	*p*
Between groups:	42827.6	2	21413.8	80.5	1.37E-25
Within groups:	47083.4	177	266.008		
Total:	89911	179			

The three regions were compared and found that the means were spread out. The overall mean is 125.66° with a standard deviation of 22.41°. This analysis shows barbed shoulders have the narrowest angle and sloped shoulders have the widest angle. The ANOVA test resulted in a *p*-value of 1.37E-25. For the Waubesa points in Wisconsin, the relationship between Notch Opening Angle and the shoulder style has very high significance (F = 80.5, p = 1.37E-25). The Tukey post hoc test shows there is a high significant difference between each shoulder style with a *p*-value of 0.0000218.

Data Set 1

Data Set 1 contains 120 projectile points over a sample of Waubesa points from the regions identified in Wisconsin. This data set includes complete projectile points which are used in the analysis of metric attributes for significant differences. Some projectile point lengths were extrapolated to provide an estimated length due to slight impact damage. This extrapolation was done by using a scanned image of the point into Canvas 14 software, and using a drawing tool following the present curve of the blade; and extending past the damaged portion resulted in an estimation of how the point may have looked prior to damage. This sample is focused on the metric variations of the projectiles points. The metric attributes are listed in Table 4.3.

Total Length. The Total Length of the projectile point is measured from the tip of the point to the base of the point parallel to the main axis. The Total Length is an attribute that is part of the overall form and size of the point. This attribute can be affected by points that have resharpening which can reduce the overall point length. Resharpening could have been due to the manufacturer increasing the point effectiveness or repairing impact damage. According to Thomas (1981), resharpening can reduce the length of projectile points which would remove some of the original morphological attributes.

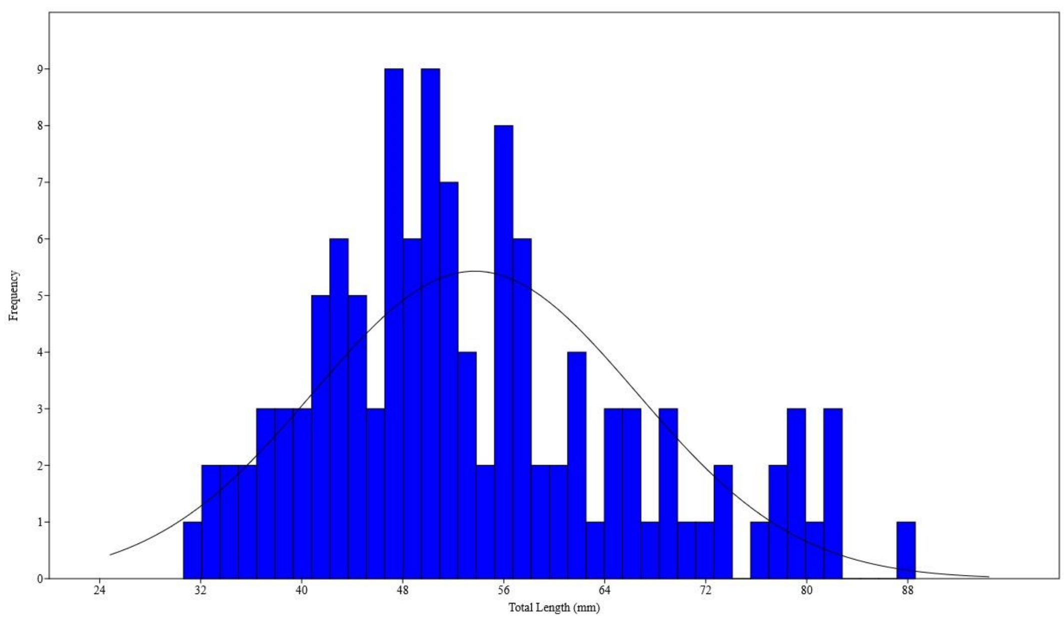

Figure 5.4

Total Length Histogram, n = 120

Figure 5.4 shows a fairly normal distribution which is slightly skewed to the right. There is a sharp peak in frequency between 46.00 mm and 58.00 mm. This study shows that this peak is different than the lengths noted by Nienow and Boszhardt (1997), which note the length is 50.8 – 127.00 mm. There is a slight dip located at 70 mm followed by a slight increase in frequency at 76.00 mm with another slight peak in frequency between 78.00 mm and 83.00 mm. The second peak contains two points (1.67 percent) from Region 1, three points (2.50 percent) from Region 2, and five points (4.17 percent) from Region 3. This shows that each region contains a few points with longer lengths than the rest of the sample. The data of the three regions is represented in Table 5.3. One interpretation of the skewness could be due to the vagaries of sampling and the few outliers causing the skewness of the histogram. The smaller cluster of total lengths to the right could also be a different population. The PAST program used to create a box-and-dot plot revealed one outlier at 88.60 mm. Since there was only one outlier causing a 1.7 percent difference in the standard deviation no trimming is required.

Table 5.3

Total Length Regions Data

Regions	Number	Mean	Standard Deviation	Variance	
Region 1	40	53.45 mm	12.20 mm	148.91	
Region 2	40	50.19 mm	12.14 mm	147.33	
Region 3	40	57.51 mm	13.20 mm	174.17	
All Wisconsin	120	53.72 mm	12.77 mm	160.20	
	Sum of sqrs	df	Mean square	F	*p*
Between groups:	1074.82	2	537.41	3.427	0.03577
Within groups:	18345.9	117	156.803		
Total:	19420.7	119			

The mean of the total length is 53.72 mm with a standard deviation of 12.77 mm. The three regions have very similar means and standard deviations. Since these three regions have similar means with large standard deviations that overlap into the other regions' means it could be possible that the total length of these samples falls under one parent population. The ANOVA test is conducted to determine if the means of the samples came from parent populations which have the same mean. The result of the ANOVA test results in a *p*-value of 0.03577. For the Waubesa points in Wisconsin, the relationship between the Total Length and the regions recovered has a high significance ($F = 3.427$, $p = 0.0358$). This means that there is a statistically significant difference in length between the three regions. The Tukey post hoc test shows there is a significant difference between Region 2 and Region 3 with a *p*-value of 0.02733. The other regions have a *p*-value greater than 0.31.

Maximum Width. The Maximum Width of the projectile point is the maximum linear distance of the point which is perpendicular to the Maximum Length. Figure 5.5 shows a fairly normal distribution, which is slightly skewed to the right. This is similar to the histogram representing the Total Length of the projectile points. There is a peak between 20.00 mm and 28.00 mm. The midspread of the histogram is between 22.10 mm and 28.34 mm. The data of the three regions is represented in Table 5.4.

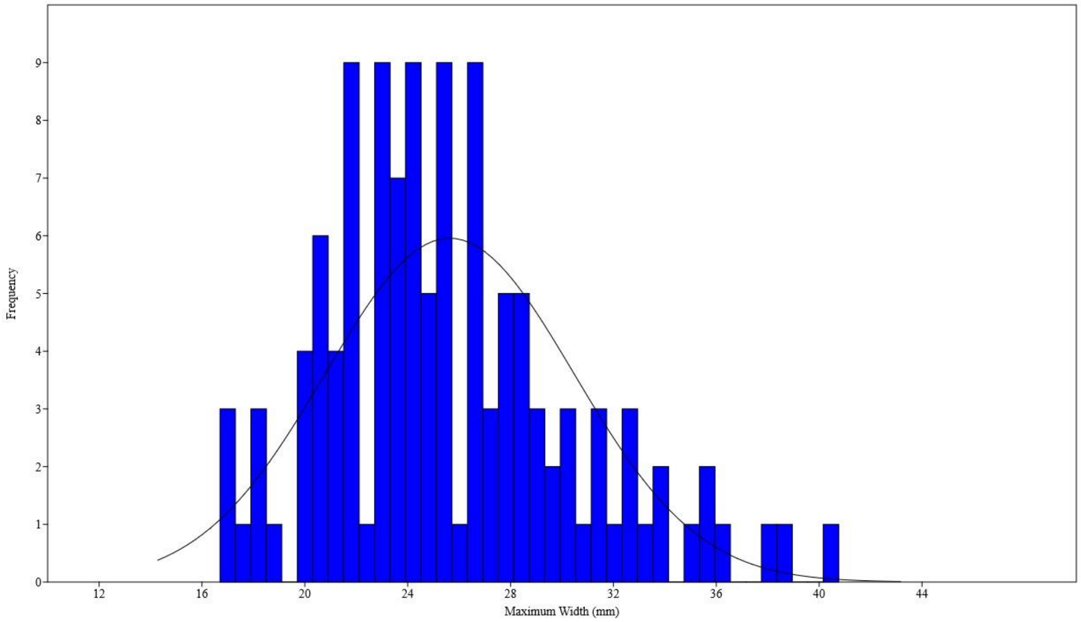

Figure 5.5

Maximum Width Histogram, n = 120

This histogram shows a few outliers located between 37.00 and 41.00 mm, which could have skewed the data. According to the PAST program used to create a box-and-dot plot there are three outliers: 37.85 mm, 38.50 mm, and 40.76 mm. Since there were only three outliers causing a 5.0 percent difference in the standard deviation no trimming is required.

Table 5.4

Maximum Width Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	
Region 1	40	24.59 mm	4.64 mm	21.50	
Region 2	40	25.2 mm	4.73 mm	22.34	
Region 3	40	27.09 mm	4.90 mm	23.97	
All Wisconsin	120	25.63 mm	4.83 mm	23.36	
ANOVA	Sum of sqrs	df	Mean square	F	*p*
Between groups:	134.91	2	67.45	2.984	0.05447
Within groups:	2644.98	117	22.61		
Total:	2779.89	119			

The Maximum Width mean for the entire sample is 25.63 mm with a standard deviation of 4.83 mm. The means of the three regions are closely placed together with a range of 24.59 mm to 27.09 mm, with a standard deviation ranging from 4.64 mm to 4.90 mm. The ANOVA test is conducted to determine if the means of the three regional samples came from a single parent population. The ANOVA test results in a *p*-value of 0.05447. For the Waubesa points in Wisconsin, the relationship between the Maximum Width and the regions recovered has high significance ($F = 2.98$, $p = 0.0545$). The Tukey post hoc test shows there is a significant difference between Region 1 and Region 3 with a *p*-value of 0.05409. The other regions have a *p*-value greater than 0.18.

Stem Length. The Stem Length of the Waubesa points is the maximum linear length of the contracting stem. This attribute is related to the overall shape and form of the projectile point.

This attribute is unlike the blade, which undergoes more intensive reworking. The ANOVA test is conducted on this attribute to determine if there is any evidence of morphological variation.

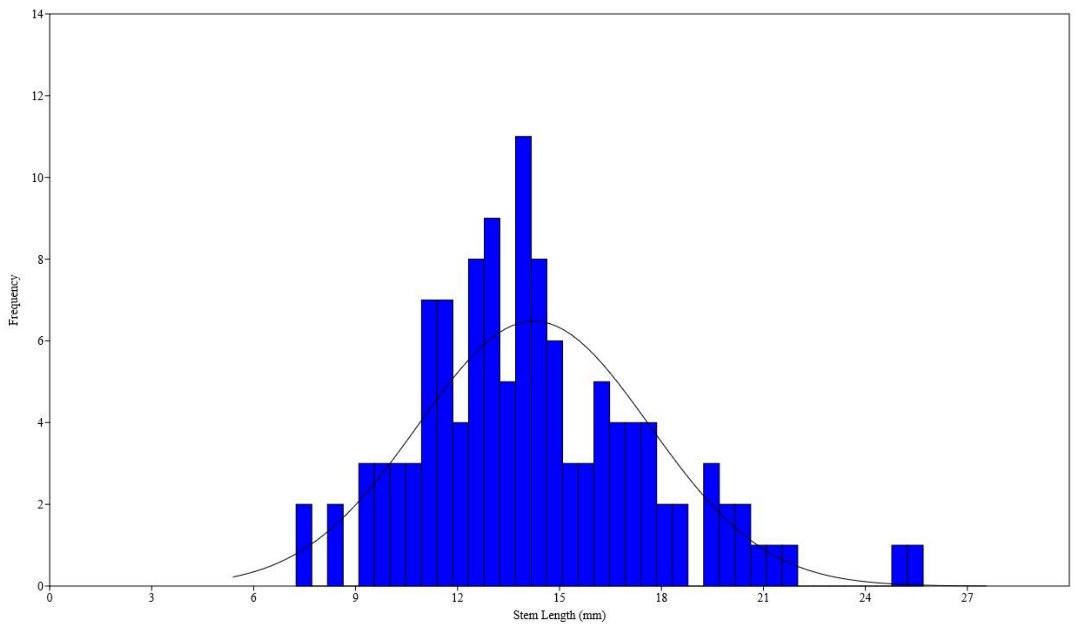

Figure 5.6

Stem Length Histogram, n = 120

Figure 5.6 shows a fairly normal distribution, which is slightly skewed to the right. The majority of the measurements fall under a normal distribution. The midspread of the histogram is between 11.83 mm and 16.19 mm. The data of the three regions is represented in Table 5.5. According to the PAST program used to create a box-and-dot plot there are two outliers: 25.2 mm and 25.7 mm. Since there were only two outliers causing a 6.0 percent difference in the standard deviation no trimming is required.

Table 5.5

Stem Length Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	
Region 1	40	14.15 mm	4.08 mm	16.68	
Region 2	40	13.12 mm	2.59 mm	6.75	
Region 3	40	15.45 mm	3.03 mm	9.17	
All Wisconsin	120	14.24 mm	3.40 mm	6.72	
ANOVA	Sum of sqrs	df	Mean square	F	*p*
Between groups:	109.102	2	54.5508	5.021	0.008091
Within groups:	1271.18	117	10.8648		
Total:	1380.28	119			

The Stem Length mean is 14.24 mm with a standard deviation of 3.40 mm. The means of the three regions range from 13.12 mm to 15.45 mm with a standard deviation range from 2.59 mm to 4.08 mm. The ANOVA test results in a *p*-value of 0.008091. For the Waubesa points in Wisconsin, the relationship between the Stem Length and the regions recovered has very high significance ($F = 5.021$, $p = 0.008$). The Tukey post hoc test shows there is a highly significant difference between Region 2 and Region 3 with a *p*-value of 0.00572. The other regions have a *p*-value greater than 0.1869.

Maximum Thickness. The Maximum Thickness attribute records the maximum thickness of the projectile point. The reduction of bifaces results in lateral flaking, which reduces the thickness of the biface during the manufacturing process. The amount of care that a manufacturer put into his/her projectile points could be seen in the thickness. Crude thick projectile points might have been quickly manufactured, and thinner and more symmetrical points might have had more work and care during manufacture. According to the PAST program used to create a box-and-dot plot there are two outliers: 16.50 mm and 17.90 mm. The two outliers caused a 15.0 percent difference in the standard deviation; therefore, a one percent Winsorized trim is conducted to remove the outliers.

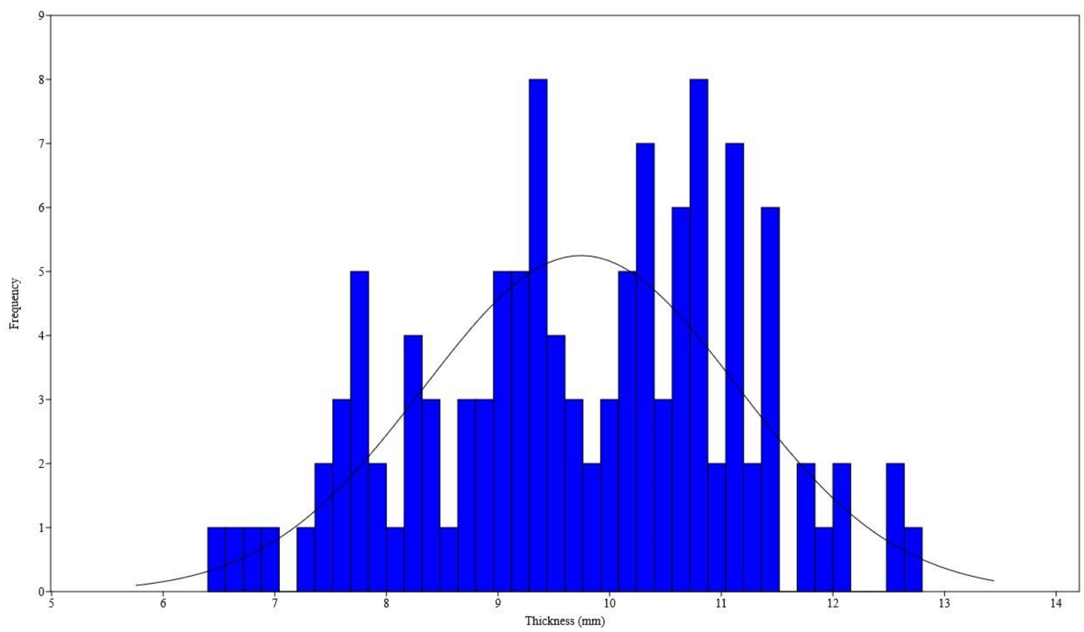

Figure 5.7

1 % Winsorized Trimmed Thickness Histogram, n = 120, n_T = 116

Figure 5.7 is a trimmed sample that shows peaks of frequency around 9.00 mm and 11.00 mm. The trimmed midspread of the histogram is between 8.73 mm and 10.79 mm. The data for the three regions is represented in Table 5.6.

Table 5.6

1 % Winsorized Trimmed Thickness Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	Number (n_T)	Mean (X_W)	Standard Deviation (s_T)
Region 1	40	9.53 mm	1.89 mm	3.59	38	9.44 mm	1.60 mm
Region 2	40	9.83 mm	2.02 mm	4.07	39	9.86 mm	1.55 mm
Region 3	40	9.90 mm	1.37 mm	1.88	39	9.91 mm	1.32 mm
All Wisconsin	120	9.75 mm	1.78 mm	3.15	116	9.74 mm	1.52 mm
ANOVA	Sum of sqrs	df	F	*p*			
Between groups:	5.3371	2	1.18	0.3109			
Within groups:	264.565	117					
Total:	269.902	119					

The statewide Winsorized mean of the Maximum Thickness of the projectile points is 9.74 mm with a standard deviation of 1.52 mm. The Winsorized means of the three regions are close together ranging from 9.44 mm to 9.91 mm with a standard deviation between 1.32 mm to 1.60 mm. The result of the ANOVA test results in a *p*-value of 0.3109. For the Waubesa points in Wisconsin, the relationship between the thickness and the regions recovered lacks significance ($F = 1.18$, $p = 0.3109$).

After reviewing the Winsorized Maximum Thickness histogram and the result of the ANOVA there are multiple modes or peaks. Therefore, ANOVA is conducted on the subsets for any significant difference. The data used in the subsets is the same Winsorized data used above to keep the outliers trimmed out of the sample. The first subset is 6.40 mm to 8.60 mm and has a normal distribution. The second subset is 8.70 mm to 9.90 mm and has a normal distribution.

The third subset is 10.00 mm to 12.80 mm and has a normal distribution slightly skewed to the right.

Table 5.7

Subset Thickness Regions Data

Subsets, Range	Number (n)	Mean (X)	Standard Deviation	Variance	Number (n_T)	Mean (X_W)	Standard Deviation (s_T)
SS 1, (6.4 - 8.6)	28	7.61 mm	0.72 mm	0.52	26	7.65 mm	0.65 mm
SS 2, (8.7 - 9.9)	34	9.29 mm	0.33 mm	0.11	34	9.29 mm	0.32 mm
SS 3, (10.0 - 12.8)	58	11.17 mm	1.33 mm	1.76	56	11.0 mm	0.73 mm
All (6.4 - 12.8)	120	9.75 mm	1.78 mm	3.15	116	9.74 mm	1.52 mm
Chi-square	Region 1	Region 2	Region 3	Total	Chi-square	*p*-value	
SS1	O 12	O 9	O 5	26	4.23	0.3764	
	E 9	E 9	E 9				
SS2	O 11	O 11	O 12	34			
	E 11	E 12	E 12				
SS3	O 15	O 19	O 22	56			
	E 18	E 19	E 19				
Total:	38	39	39	116			

This analysis of these subsets means with small standard deviations show three different groups with no overlap. Subset 1 contains 46 percent from Region 1, 35 percent from Region2, and 19 percent from Region 3. Subset 2 contains 32 percent from Regions 1, 32 percent from Region 2, and 35 percent from Region 3. Subset 3 contains 27 percent from Region 1, 34 percent from Region 2, and 39 percent from Region 3. The result of the chi-square test results in a *p*-

value of 0.3764. For the Waubesa points in Wisconsin, the relationship between the thickness and the subsets has no significance (F = 4.23, $p = 0.3764$). This shows that no region seems to prefer a thickness of the projectile point. This may be interpreted as a functional aspect of the projectile point with various thicknesses having a certain function for the manufacturers. Due to the chi-square not having a significant value, no post-hoc test is conducted.

Weight. The Weight of the projectile points was measured using a digital scale. According to Hughes (1998), projectile points associated with the same technology should have a similar mass. According to the PAST program used to create a box-and-dot plot there are seven outliers: 24.20 mm, 26.00 mm, 27.00 mm, 28.00 mm, 28.50 mm, 41.00 mm and 41.80 mm. The outliers caused a 30.0 percent difference in the standard deviation; therefore, a six percent Winsorized trim is conducted to remove the outliers.

Figure 5.8 is a trimmed sample that shows a peak of frequency around 8 grams. The midspread of the histogram is between 7.62 grams and 12.88 grams. The trimmed sample shows a fairly normal distribution. The normal distribution is spread out with fewer points on the right side of the histogram.

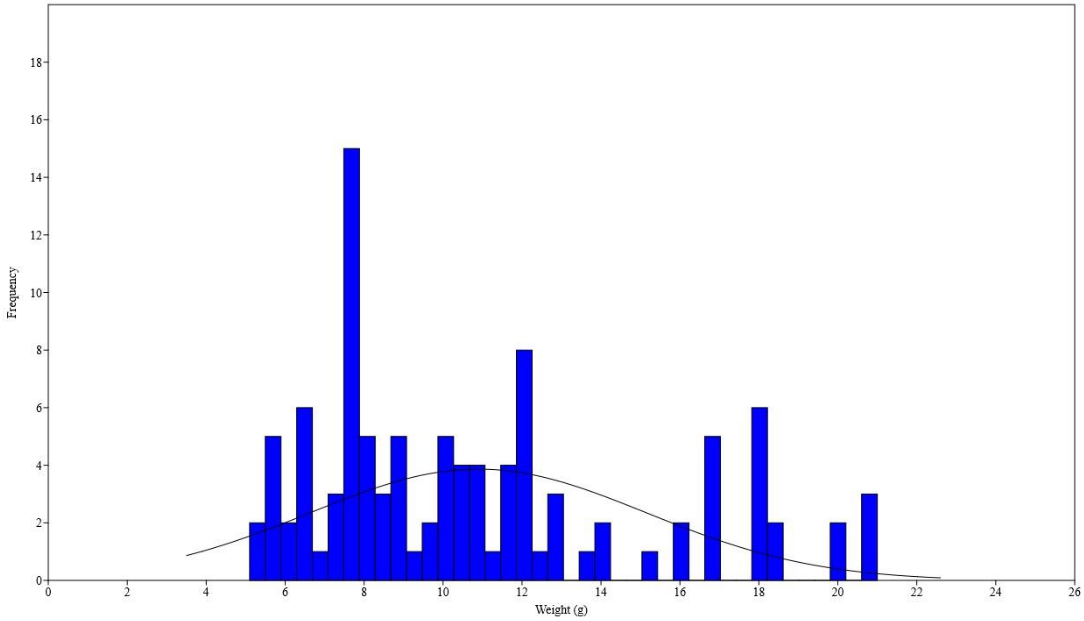

Figure 5.8

6 % Winsorized Trimmed Weight, n = 120, $n_T = 104$

Table 5.8

6 % Winsorized Trimmed Weight Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	Number (n_T)	Mean (X_W)	Standard Deviation (s_T)
Region 1	40	10.71 g	6.43 g	41.38	37	10.29 g	4.27 g
Region 2	40	10.96 g	7.07 g	49.95	33	10.23 g	4.93 g
Region 3	40	13.45 g	6.61 g	43.66	34	13.01 g	5.95 g
All Wisconsin	120	10.71 g	6.38 g	45.81	104	11.18 g	5.31 g
ANOVA	Sum of sqrs	df	F	*p*			
Between groups:	201.245	2	4.28	0.0161			
Within groups:	2750.25	117					
Total:	2951.49	119					

Table 5.8 shows the ANOVA of the Winsorized trimmed sample. The mean of the weights of the statewide trimmed sample of projectile points is 11.18 grams with a standard deviation of 5.31 grams. The means for Region 1 and Region 2 have only 0.06 grams of difference, Regions 1 and 3 have 2.72 grams of difference, and Regions 2 and 3 have 2.78 grams of difference. The ANOVA test results in a *p*-value of 0.0161. For the Waubesa points in Wisconsin, the relationship between the weight and the regions has significance (F = 3.387, *p* = 0.0161). The Tukey post hoc test shows there is a significant difference between Region 1 and Region 3 with a *p*-value of 0.0361, and between Region 2 and Region 3 with a *p*-value of 0.0313. Region 1 and Region 2 have no significance with a *p*-value of 0.9984

After reviewing the Winsorized Weight histogram and the result of the ANOVA there are multiple modes or peaks. Therefore, ANOVA is conducted on the subsets for any significant difference. The data used in the subsets is the same Winsorized data used above to keep the outliers trimmed out of the sample. The first subset is 5.10 g to 9.40 g and has a normal distribution. The second subset is 9.50 g to 14.40 g and has normal distribution slightly skewed to the right. The third subset is 14.50 g to 21.00 g and has fairly normal distribution skewed to the left.

Table 5.9

Subset Weight Regions Data

Subsets, Range	Number (n)	Mean (X)	Standard Deviation	Variance	Number (n_T)	Mean (X_W)	Standard Deviation (s_T)
SS1, (5.1 - 9.4)	56	6.85 g	1.56 g	2.45	48	7.00 g	1.35 g
SS2, (9.5 - 14.4)	35	11.47 g	1.21 g	1.46	33	11.47 g	1.18 g

SS3, (14.5 - 21.0)	29	21.36 g	6.66 g	44.33	21	18.90 g	2.41 g
All	120	10.71 g	6.38 g	45.81	104	11.18 g	5.31 g
Chi-square	Region 1	Region 2	Region 3	Total	Chi-square	*p*-value	
SS1	O 20	O 17	O 11	48	8.76	0.0673	
	E 17	E 15	E 16				
SS2	O 11	O 13	O 11	35			
	E 13	E 11	E 12				
SS3	O 6	O 3	O 12	21			
	E 7	E 7	E 7				
Total:	37	33	34	104			

This analysis of these subsets means with small standard deviations show three different groups with no overlap. Subset 1 contains 42 percent from Region 1, 35 percent from Region2, and 23 percent from Region 3. Subset 2 contains 31 percent from Regions 1, 37 percent from Region 2, and 31 percent from Region 3. Subset 3 contains 29 percent from Region 1, 14 percent from Region 2, and 57 percent from Region 3. The result of the chi-square test results in a *p*-value of 0.0673. For the Waubesa points in Wisconsin, the relationship between the weight and the subsets has a high significance ($F = 8.76$, $p = 0.0673$). The post hoc test is conducted in response to identify any cells that have any significance difference between the observed and expected value that may have contributed to the chi-square result.

Table 5.10

Subset Weight Regions Chi-Square Post-hoc Test

Region		Region 1	Region 2	Region 3	Total
SS 1	Obs	20	17	11	48
	Exp	17	15	16	
	Column %	54.05	51.52	32.35	
	Res	3	2	-5	
	Std. Res	0.73	0.52	-1.25	
	Adj. Res	1.24	0.85	**-2.08**	
SS 2	Obs	11	13	11	35
	Exp	13	11	12	
	Column %	29.73	39.39	32.35	
	Res	-2	2	-1	
	Std. Res	-0.55	0.60	-0.29	
	Adj. Res	-0.85	0.90	-0.43	
SS 3	Obs	6	3	12	21
	Exp	7	7	7	
	Column %	16.22	9.09	35.29	
	Res	-1	-4	5	
	Std. Res	-0.38	-1.51	1.89	
	Adj. Res	-0.53	**-2.05**	**2.58**	
Total		37	33	34	104

The chi-square analysis of the defined Regions of Wisconsin and subsets weight of Waubesa points has a significant result. The critical value for significant adjusted standardized residuals (ASR) using the z-score +/- 1.65 in this post hoc test. There are three cells greater than the critical value that may have caused the high significance. Subset 3 in Region 2 and Region 3 has a significant difference between observed and expected values. Another cell with a significant difference between observed and expected values is Subset 1 in Region 3.

Distal Stem Width. The Distal Stem Width is measured as the maximum linear distance of the hafting element perpendicular to the Maximum Length. This Distal Stem Width of the contracting stem of the Wauebesa point would probably not deviate by a large degree compared to the shaft.

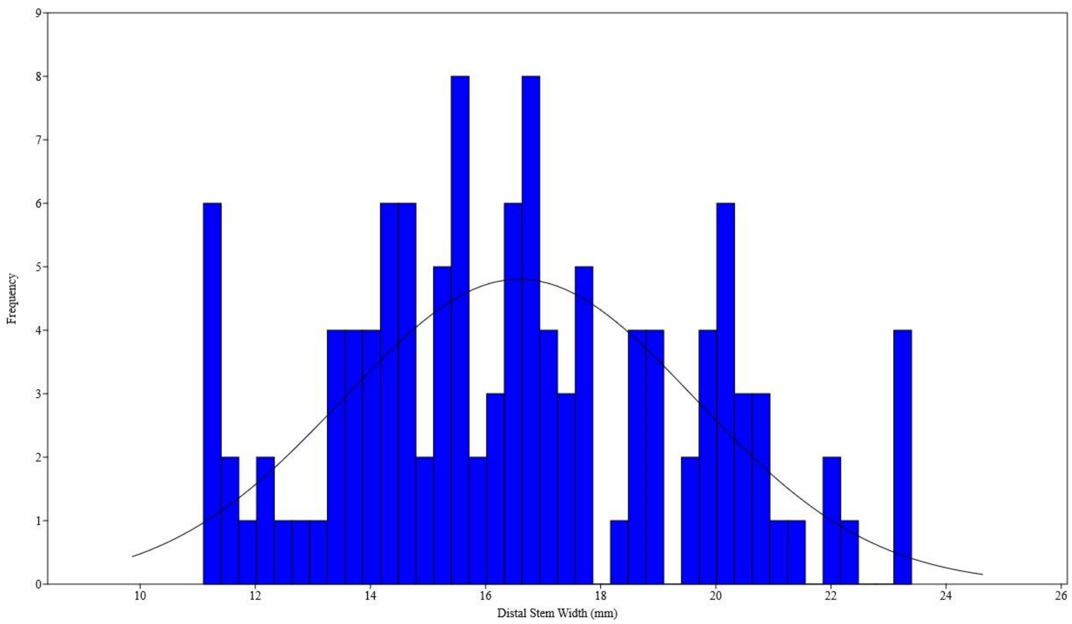

Figure 5.9

2 % Winsorized Trimmed Distal Stem Width, n = 120 n_T = 114

Figure 5.9 is a trimmed histogram that shows a fairly normal distribution. The midspread of the histogram is between 14.34 mm and 18.90 mm. According to the PAST program used to create a box-and-dot plot there are three outliers: 25.98 mm, 26.37 mm and 32.7 mm. The outliers caused a 14.0 percent difference in the standard deviation; therefore, a two percent

Winsorized trim is conducted to remove the outliers. The data of the three regions is represented in Table 5.11.

Table 5.11

2% Winsorized Trimmed Distal Stem Width Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	Number (n_T)	Mean (X_W)	Standard Deviation (s_T)
Region 1	40	15.78 mm	4.22 mm	17.80	36	15.67 mm	3.31 mm
Region 2	40	16.68 mm	3.13 mm	9.81	39	16.61 mm	2.92 mm
Region 3	40	17.55 mm	2.99 mm	8.96	39	17.47 mm	2.76 mm
All Wisconsin	120	16.66 mm	3.54 mm	12.51	114	16.59 mm	3.44 mm
ANOVA	Sum of sqrs	df	F	*p*			
Between groups:	64.88	2	3.606	0.03021			
Within groups:	1052.46	117					
Total:	1117.34	119					

The overall trimmed mean of Distal Stem Width of the statewide projectile point sample is 16.66 mm with a standard deviation of 3.54 mm. The trimmed means of the three regions are close together ranging from 15.67 mm to 17.47 mm with the trimmed standard deviation between 2.76 mm to 3.31 mm. The ANOVA test results in a *p*-value of 0.03021. For the Waubesa points in Wisconsin, the relationship between the Distal Stem Width and the regions is significant ($F = 3.606$, $p = 0.03021$). The Tukey post hoc test shows there is a significant difference between Region 1 and Region 3 with a *p*-value of 0.02258. There is no significant difference between any of the other regions.

Proximal Stem Width. The Proximal Stem Width is a measurement of the stem made perpendicular to the main axis of the point and parallel to the Distal Stem Width. This measurement is recorded 5 mm from the base of the contracting stem. Since the contracting stem proximal end comes to a point many archaeologists (Kay 1980; Behm and Green 1982) record this measurement as zero.

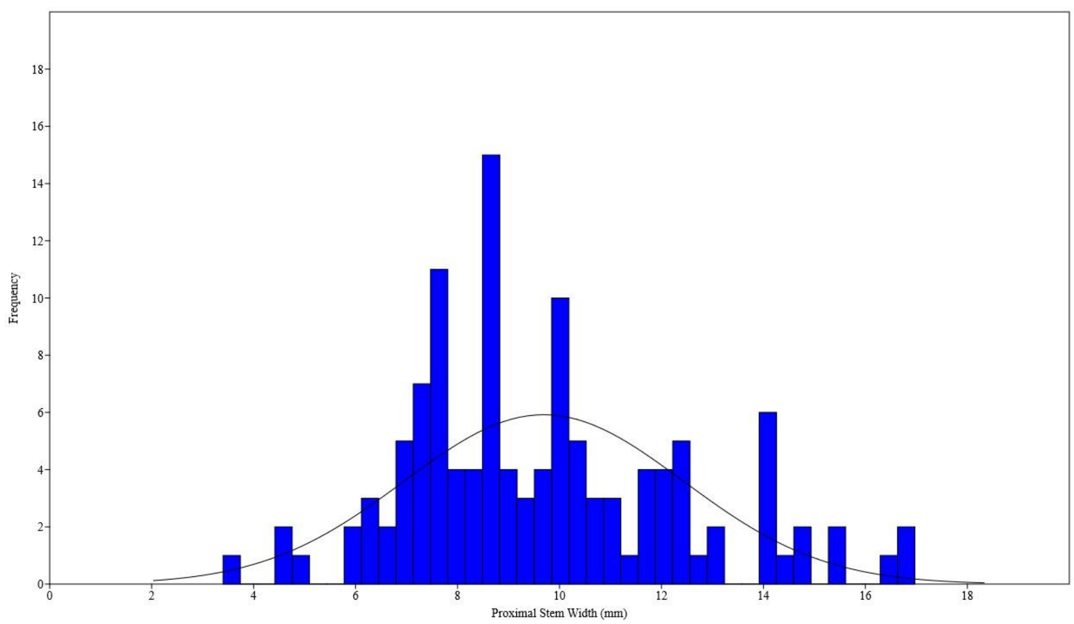

Figure 5.10

Proximal Stem Width, n = 120

Figure 5.10 shows the trimmed distribution of Proximal Stem Width. The histogram shows a fairly normal distribution. The midspread of the histogram is between 7.60 mm and 11.55 mm. There is a peak around 9.00 mm with a few points to the right side of the histogram. The data for the three regions is represented in Table 5.12.

Table 5.12

Proximal Stem Width Regions Data

Regions	Number	Mean	Standard Deviation	Variance	
Region 1	40	8.76 mm	2.55 mm	6.49	
Region 2	40	9.88 mm	3.11 mm	9.69	
Region 3	40	10.44 mm	2.30 mm	5.30	
All Wisconsin	120	9.69 mm	2.74 mm	7.53	
	Sum of sqrs	df	Mean square	F	*p*
Between groups:	58.50	2	29.25	4.087	0.01924
Within groups:	837.33	117	7.16		
Total:	895.83	119			

The ANOVA test resulted in a *p*-value of 0.01924. For the Waubesa points in Wisconsin, the relationship between the Proximal Stem Width and the regions has significance (F = 4.087, *p* = 0.01924). Since the mean and the standard deviation of these measurements are very close to one another it could be due to all the points having a contracting stem. According to a Tukey post hoc test, there is a high significant difference between Region 1 and Region 3 with a *p*-value of 0.01617. There is no significant difference between any of the other regions.

Proximal Shoulder Angle. This angle is defined by the intersection of the margin of the stem and shoulder (Figure 4.1). This angle is measured perpendicular to the main axis. The Proximal Shoulder Angle is around 60.00^{o} to 90.00^{o} and the angle is measured to the nearest whole degree. According to the PAST program’s box-and-dot plot there are two outliers: 50.00^{o} and 52.00^{o}. The outliers caused a 7.0 percent difference in the standard deviation no trimming is required.

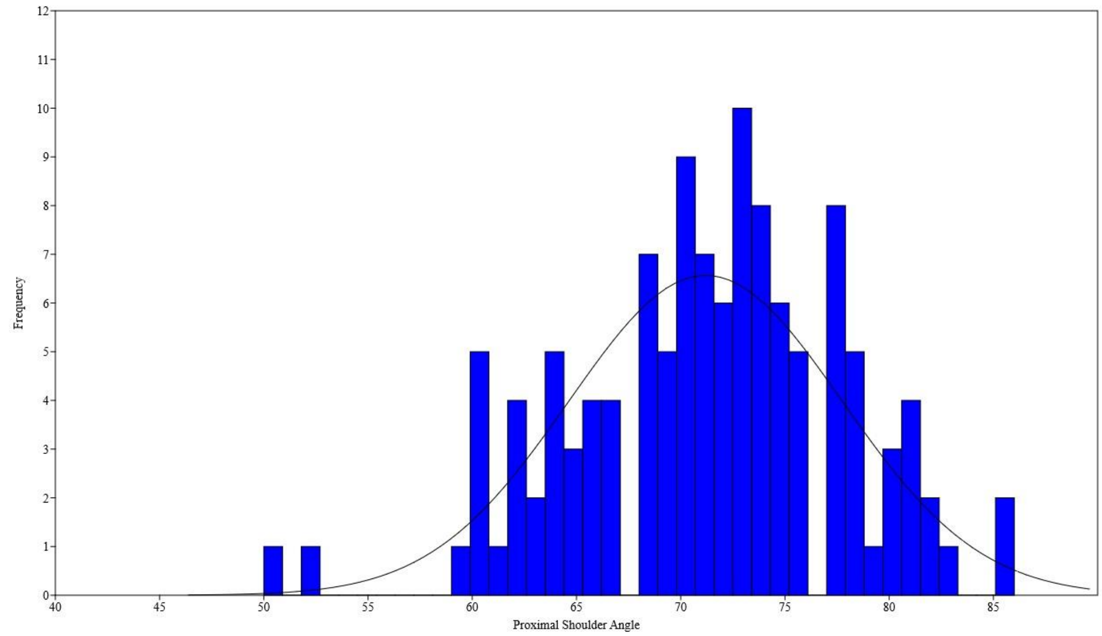

Figure 5.11

Proximal Shoulder Angle, n = 120

Figure 5.11 shows the normal distribution of the Proximal Shoulder Angle with a peak around 72.00^{o}. This is a normal distribution of the Proximal Shoulder Angles, which reflects that the recorded projectile points all have a contracting point. Since the outliers were not trimmed, one outlier is from Region 1 and the second is from Region 2.

Table 5.13

Proximal Shoulder Angle Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	
Region 1	40	69.75°	6.29°	39.53	
Region 2	40	69.58°	6.53°	42.66	
Region 3	40	72.98°	6.49°	42.13	
All Wisconsin	120	70.77°	6.57°	43.05	
ANOVA	Sum of sqrs	df	Mean square	F	*p*
Between groups:	293.217	2	146.61	3.538	0.03222
Within groups:	4848.25	117	41.44		
Total:	5141.47	119			

The maximum mean for the entire sample is 70.77° with a standard deviation of 6.57°. The means of the three regions are closely placed together with a range of 69.75° to 72.98° with a standard deviation ranging from 6.29° to 6.53°. The ANOVA test resulted in a *p*-value of 0.03222. For the Waubesa points in Wisconsin, the relationship between the Proximal Shoulder Angle and the regions has high significance (F = 3.54, $p = 0.032$). The Tukey post hoc test shows there is a high significant difference between Region 2 and Region 3 with a *p*-value of 0.05154. The tests show a significant difference between Region 1 and Region 3 with a *p*-value of 0.06876. The other regions have a *p*-value of 0.992.

Distal Shoulder Angle. This angle is defined by the intersection of the shoulder and the neck of the projectile point (Figure 4.1). This angle is measured perpendicular to the main axis and rounded to the nearest whole degree. Figure 5.12 shows the distribution of Distal Shoulder Angles with a large peak around 202.00°. This is a fairly normal distribution of the Distal

Shoulder Angles. The midspread of the histogram is between 187.00° and 220.77°. According to the PAST program's box-and-dot plot there are no outliers.

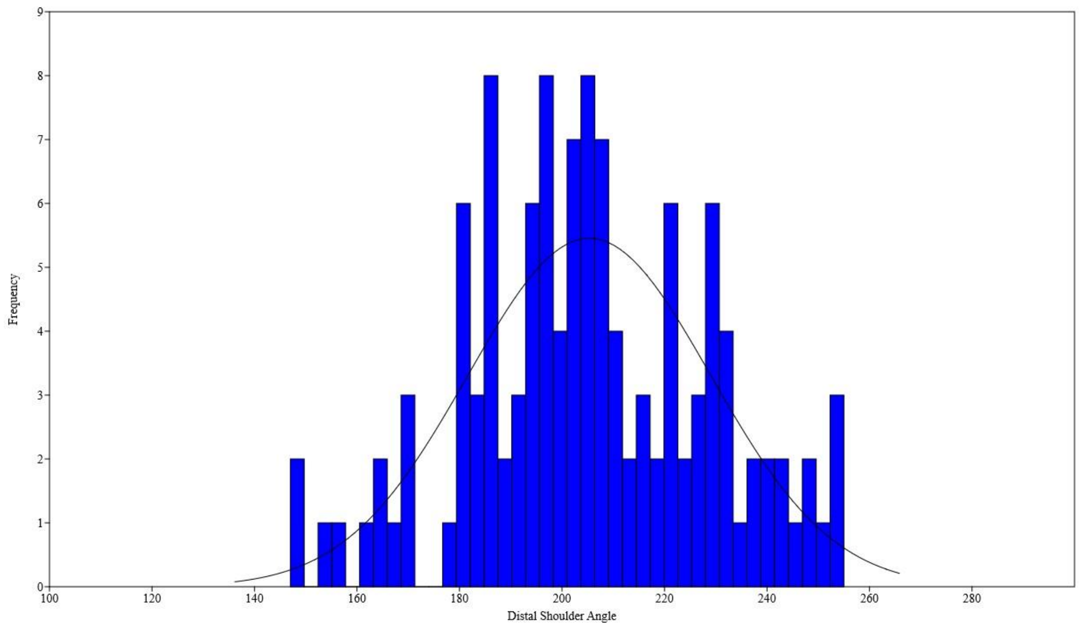

Figure 5.12

Distal Shoulder Angle, n = 120

Table 5.14

Distal Shoulder Angle Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	
Region 1	40	201.40°	23.05°	532.53	
Region 2	40	209.53°	23.01°	530.64	
Region 3	40	200.43°	26.07°	680.48	
All Wisconsin	120	203.45°	24.16°	583.61	
ANOVA	Sum of sqrs	df	Mean square	F	p
Between groups:	1564.35	2	782.175	1.348	0.2637
Within groups:	67885.4	117	580.217		
Total:	69449.7	119			

The three regions were compared and found that the means are fairly close together. The overall mean is 203.45° with a standard deviation of 24.16°. The ANOVA test results in a *p*-value of 0.2637. For the Waubesa points in Wisconsin, the relationship between the Distal Shoulder Angle and the regions has low significance ($F = 1.35$, $p = 0.264$).

Notch Opening. This angle is formed by the lines which follow the margins of the stem and shoulder of the point (Figure 4.1). This measurement is the angle between the stem and the shoulder, which was recorded through the use of digital software. This measurement is rounded to the nearest whole number. In this test the smaller angle of the two notch openings recorded for each point was used.

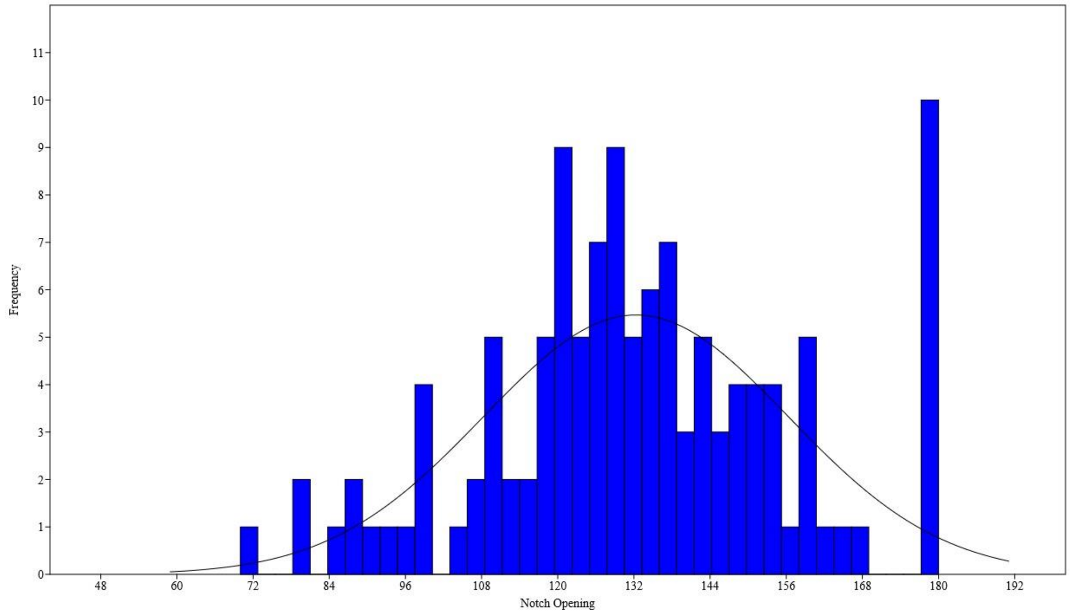

Figure 5.13

Notch Opening, n = 120

Figure 5.13 shows the distribution of recorded Notch Opening and the histogram shows a fairly normal distribution. The midspread of the histogram is between 114.00º and 143.00º. One peak is located at 115.00º through 140.00º. The second peak at 180.00º contains one point (0.8 percent) from Region 1, four points (3.33 percent) from Region 2, and five points (4.17 percent) from Region 3. According to the PAST program used to create a box-and-dot plot there is an outlier at 70.00º. The outliers caused a 0.84 percent difference in the standard deviation no trimming is required.

Table 5.15

Notch Opening Regions Data

Regions	Number (n)	Mean (X)	Standard Deviation	Variance	
Region 1	40	129.45°	21.32°	454.56	
Region 2	40	138.15°	24.95°	622.28	
Region 3	40	129.35°	25.28°	639.00	
All Wisconsin	120	132.32°	24.07°	579.50	
ANOVA	Sum of sqrs	df	Mean square	F	*p*
Between groups:	2041.87	2	1020.93	1.79	0.1723
Within groups:	66918.10	117	571.95		
Total:	68960.00	119			

The mean for the whole group is 132.32° with a standard deviation of 24.07° which covers the means of all three regions. The ANOVA test results in a *p*-value of 0.1723. For the Waubesa points in Wisconsin, the difference between the Notch Opening and the regions has no significance (F = 1.79, $p = 0.1723$).

Data Set 1 Summary

The above discussion shows how univariate analysis of cultural material attributes can provide information on the attributes of the data sets in this paper. Some variables show morphological changes to the cultural material across the three regions. It is possible that the morphological changes are related to the stylistic variations found on cultural materials. The following section covers the observations of the variables analyzed in this chapter. The 90 percent confidence interval ($p \leq 0.10$) is used for the analysis of the ANOVA. Some attributes had outliers trimmed if removing outliers caused the standard deviation to have a 10 percent or greater difference. The Thickness, Weight, and Distal Stem Width are attributes that were trimmed.

The Maximum Length measurements show that the longest points were found in Region 3 and the shortest in Region 2. The ANOVA of Total Length has high significance. The Maximum Width measurements show that the widest points were found in Region 3 and the narrowest were found in Region 1. The ANOVA of Maximum Width reveals that the differences between the three regions have high significance. The Stem Length shows that Region 3 contains the longest stem lengths and Region 2 contains the shortest stems. The ANOVA of Stem Length for the three regions has very high significance; Region 3 has a significant difference from Region 2. The Weight measurements shows that the heaviest points are found in Region 3 and lightest points are found in Region 1. Region 3 has a significant difference from Regions 1 and 2. The chi-square of subsets and regions has a significant difference. The post hoc test reveals there are three cells greater than the critical value. Subset 3 in Region 2 and Region 3 has significant difference between observed and expected values. Another cell with a significant difference between observed and expected values is Subset 1 in Region 3. The Distal Stem Width measurements show that Region 1 contains the narrowest width and Region 3 contains the widest width; but Region 2 and 3 do not have a significant difference. The Proximal Stem Width measurements show that Region 1 contains the narrowest base and Region 3 contains the widest base, but Region 2 and 3 do not have a significant difference. The Proximal Shoulder Angle measurements show that Region 3 has the widest angle and Region 2 the narrowest angle. The ANOVA shows Region 3 has a highly significant difference compared to Regions 1 and 2; however, Regions 1 and 2 do not have a significant difference. The Notch Opening measurements show that Region 3 has the narrowest angle and Region 2 has the widest angle. The ANOVA of Stem Length for the three regions has high significance. Region 3 has a significant difference from Region 2, but the other regions do not show any significance.

Compared to the attributes discussed above the ANOVA of the Thickness measurements of the points does not show any significant difference between the three regions. The histogram was revealed to be multimodal. The chi-square of the three subsets and three regions has no significance. Therefore there is no significant thickness preferred in a certain region. There was no chi-square post hoc test conducted. The Notch Opening measurements also do not show any significant difference between the different regions. The Distal Shoulder Angle measurements also do not show any significant difference between the different regions.

Data Set 2

This section focuses on the univariate analysis of the variables of Data Set 2 mentioned in this thesis. While the univariate analyses reveals some trends, it may not be able to show all the relationships between the different types of attributes. This chapter covers the non-metric attributes of the Waubesa points. The shoulder styles and raw material of the points are examined. There is a chi-square test of the raw materials of the projectiles points by each of the three regions to determine if there are preferred raw materials for the manufacture of projectile points based on shoulder style.

Data Set 2 covers a sample of Waubesa points from the three regions identified in Wisconsin and the Data Set 2 contains 180 projectile points. This sample focuses mostly on the shoulder style variations and lithic raw material. The non-metric attributes have been listed in Table 4.2.

Shoulder Style/ Region Chi-Square. This chi-square is conducted to determine if the observed shoulder style is dependent on the regions the points were recovered from a certain region.

Table 5.16

Shoulder Chi-Square Data (O = observed frequencies; E = expected frequencies)

Region	Barbed		Sloped		Straight		Total	chi-square	*p*-Value
Region 1	O	2	O	19	O	39	60	8.32	0.081
	E	6	E	17	E	37			
Region 2	O	6	O	12	O	42	60		
	E	6	E	17	E	37			
Region 3	O	9	O	20	O	31	60		
	E	6	E	17	E	37			
Total	17		51		112		180		

Table 5.16 shows the total number of barbed, straight, and sloped shoulders that are used in this section of the study. The total amount of recorded barbed shoulder points is 17 out of 180 projectile points (9.44 percent). The total amount of recorded straight shoulder points is 112 out of 180 (62.22 percent). The total amount of recorded sloped shoulder points is 51 out of 180 projectile points (28.33 percent). The barbed points were found primarily in Region 3 with the fewest in Region 1. Region 1 and Region 3 contain almost the same number of sloped shoulders and Region 2 contains less. Regions 1 and 2 contain almost the same number of straight shoulders and Region 3 contains 31 points. The difference between the recorded results and the expected results is significant (p = 0.081).

Table 5.17

Shoulder Chi-Square Post-hoc Test

Region		Barbed	Slope	Straight	Total
Region 1	Obs	2	19	39	60
	Exp	6	17	37	
	Column %	11.76	37.25	34.82	
	Res	-4	2	2	
	Std. Res	-1.63	0.49	0.33	
	Adj. Res	**-2.10**	0.70	0.66	
Region 2	Obs	6	12	42	60
	Exp	6	17	37	
	Column %	35.29	23.53	37.50	
	Res	0	-5	5	
	Std. Res	0.00	-1.21	0.82	
	Adj. Res	0.00	**-1.75**	1.64	
Region 3	Obs	9	20	31	60
	Exp	6	17	37	
	Column %	52.94	39.22	27.68	
	Res	3	3	-6	
	Std. Res	1.22	0.73	-0.99	
	Adj. Res	1.58	1.05	**-1.97**	
Total		17	51	112	180

The chi-square analysis of the defined regions of Wisconsin and shoulder styles of Waubesa points has a significant result (p = 0.081). The post hoc test is conducted in response to identify any cells that have any significant difference between the observed and expected value that contributed to the chi-square result. The critical value for significant adjusted standardized residuals (ASR) using the z-score +/- 1.65 in this post hoc test. There are three cells greater than the critical value that may have caused the high significance. The barbed shoulder style in Region 1 has significant difference between observed and expected values. In Region 2 the sloped shoulder style has significant difference between observed and expected values. The straight shoulder style in Region 3 has significant difference between observed and expected values.

Lithic Raw Material. The lithic raw materials of the projectile points is examined in this chapter. The raw materials analysis examines any relation between the different regions defined in Chapter I. The next analysis examines any relationship between raw material and the shoulder style. Figure 5.14 displays the raw materials of the projectile points by region and the quality of the lithic material. The heated state of the lithic material can be recorded, because usually heating of the lithic material results in a change of color and luster.

According to Purdy (1975), there is a relation between color change and luster change of lithic material from the physical and chemical alteration during the heat treatment process. Appendix D of the data set shows textures and lusters observed on the projectile points. The observation of color and luster was used to identify treatment stage. Any raw material usually that has a natural luster and no color change is interpreted as non-heat treated. The heated materials have slight color change and little luster change. The heated treated materials have more color change and could be darker in colors with major luster changes. The burnt raw material has evidence of charring on the raw material and may have major luster changes on portions with no charring (Purdy 1975).

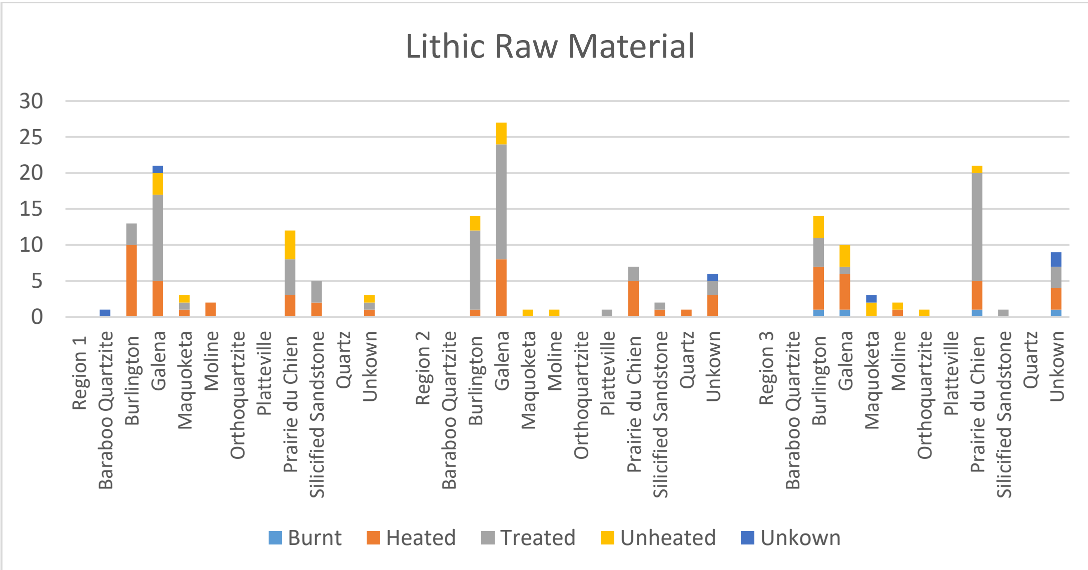

Figure 5.14

Lithic Raw Materials from the Three Regions from Wisconsin

Figure 5.14 shows that 90 percent of the lithic raw material of the projectile points has some thermal alteration. Regions 1 and 2 look fairly similar in the raw materials of the projectile points. Region 1 has a total 21 out of 60 (35.00 percent) projectile points made of Galena chert compared to Region 2, which has a total of 27 out of 60 (45.00 percent) made of Galena chert. Only a few of these projectile points are made from unheated raw materials.

Lithic Raw Material / Region Chi-Square. After observing the slight changes between the counts of raw material preferred in certain regions a chi-square analysis is conducted. However, the low frequency of some lithic materials would have violated one of the rules of the chi-square; therefore, some lithic raw materials are grouped together into the “other” category of Table 5.12. The “other” group contains 7 Maquoketa chert, 5 Moline chert, 1 Baraboo Quartzite, 1 Quartz, 1, Platteville chert, and 1 Orthoquartzite.

Table 5.18

Lithic Raw Material / Region Chi-Square Data

Style	Burlington		Galena		Prairie du Chien		Silicified Sandstone		Other		Unknown		Total	chi-square	*p*-Value
Region 1	O	13	O	21	O	12	O	5	O	6	O	3	60	22.00	0.015
	E	13	E	19	E	13	E	3	E	5	E	6			
Region 2	O	14	O	27	O	7	O	2	O	4	O	6	60		
	E	13	E	19	E	13	E	3	E	5	E	6			
Region 3	O	13	O	10	O	21	O	1	O	6	O	9	60		
	E	13	E	19	E	13	E	3	E	5	E	6			
Total	40		58		40		8		16		18		180		

The chi-square data show that all three regions have almost the same amount of Burlington chert. Region 2 has more Galena chert as compared to Regions 1 and 3. Prairie du Chien chert is most commonly found in Region 3 with a total of 21 out of 60 (35.00 percent) projectile points. The chi-square data shows Silicified Sandstone was a less common lithic material. Some lithic materials were not able to be positively identified and are categorized as "unknown". Unknown raw materials are more common in Region 3 and less common in Region 1. The other raw materials are found throughout the three regions. For the Waubesa points in Wisconsin, there is a relationship between the lithic raw materials and defined regions. The difference between the recorded results and the expected results is very significant (p = 0.015).

Figure 2.2 shows Galena chert found primarily in Region 2 and it borders Region 1, which would explain the amount of Galena found in Region 1. The Burlington chert lithic raw material is an exotic lithic material, which means that this material would have been bought into the regions either from trade exchange or direct procurement from traveling to different lithic sources. The map shows lithic raw material of Prairie du Chien can be found in each of the three regions, which correlates with the lithic raw material histogram (Figure 5.14) of Prairie du Chien found in each region. Additional statistical analysis is conducted to establish if there is any significant difference with shoulder style and lithic raw material.

Table 5.19

Lithic Raw Material / Region Chi-Square Post-hoc Test

Region		Burlington	Galena	Prairie du Chien	Silicified Sandstone	Other	Unknown	Total
Region 1	Obs	13	21	12	5	6	3	60
	Exp	13	19	13	3	5	6	
	Column %	32.50	36.21	30.00	62.50	37.50	16.67	
	Res	0	2	-1	2	1	-3	
	Std. Res	0.00	0.50	-0.30	1.20	0.40	-1.20	
	Adj. Res	0.00	0.68	-0.39	1.45	0.57	-1.58	
Region 2	Obs	14	27	7	2	4	6	60
	Exp	13	19	13	3	5	6	
	Column %	35.00	46.55	17.50	25.00	25.00	33.33	
	Res	1	8	-6	-1	-1	0	
	Std. Res	0.28	1.80	-1.70	-0.60	-0.40	0	
	Adj. Res	0.39	2.73	-2.31	-0.72	-0.57	0	
Region 3	Obs	13	10	21	1	6	9	60
	Exp	13	19	13	3	5	6	
	Column %	32.50	17.24	52.50	12.50	37.50	50.00	
	Res	0	-9	8	-2	1	3	
	Std. Res	0.00	-2.10	2.20	-1.20	0.40	1.20	
	Adj. Res	0.00	**-3.07**	**3.08**	-1.45	0.57	1.58	
Total		40	58	40	8	16	18	180

The chi-square analysis of the defined regions of Wisconsin and lithic raw materials of the Waubesa points has a significant result ($p = 0.015$). The post hoc test of adjusted standardized residuals (ASR) is conducted in response to identify any cells that have any significant difference between the observed and expected value that may have contributed to the chi-square result. The critical value for significant adjusted standardized residuals (ASR) using the Bonferroni correction is +/- 2.77 in this post hoc test. Two cells greater than the critical value, which may have caused the high significance. Waubesa point manufacture out of Galena chert and Prairie du Chien chert in Region 3 has significant difference between observed and expected values

Lithic Raw Material/ Shoulder Chi-Square. Table 5.20 is a chi-square analysis of lithic raw materials and shoulder styles. To meet Drennan (2009) requirements for the chi-square analysis the categories Silicified Sandstone, Other, and Unknown are removed from the analysis.

Table 5.20

Lithic Raw Material / Shoulder Chi-Square Data

Shoulder	Burlington		Galena		Prairie du Chien		Total	chi-square	*p*-value
Barbed	O	3	O	4	O	5	12	12.72	0.013
	E	4	E	5	E	4			
Sloped	O	16	O	10	O	18	44		
	E	13	E	19	E	13			
Straight	O	21	O	44	O	17	82		
	E	24	E	35	E	24			
Total	40		58		40		138		

The chi-square analysis shows that there is a relationship between shoulder style and lithic raw material. Barbed shoulders are primarily manufactured out of Prairie du Chien, with 5 out of 12 (41.70 percent) and Galena, with 4 out of 12 (33.30 percent). The sloped shoulders are primarily manufactured out of Burlington, with 16 out of 44 (36.36 percent) and Prairie du Chien, with 18 out of 44 (40.91 percent). The straight shoulders are primarily manufactured out of Galena, with 44 out of 82 (53.66 percent). The second most common lithic material for straight shoulders is Burlington, with 21 out of 82 (25.61 percent) and Prairie du Chien, with 17 out of 82 (20.73). For the Waubesa points in Wisconsin, there is a relationship between shoulder style and lithic raw material. The difference between the recorded results and the expected results is significant (*p* = 0.013).

Table 5.21

Lithic Raw Material / Shoulder Style Chi-Square Post-hoc Test

Shoulder		Burlington	Galena	Prairie du Chien	Total
Barbed	Obs	3	4	5	12
	Exp	4	5	4	
	Column %	7.50	6.90	12.50	
	Res	-1	-1	1	
	Std. Res	-0.50	-0.45	0.50	
	Adj. Res	-0.62	-0.61	0.62	
Sloped	Obs	16	10	18	44
	Exp	13	19	13	
	Column %	40.00	17.24	45.00	
	Res	3	-9	5	
	Std. Res	0.83	-2.06	1.39	
	Adj. Res	1.20	**-3.29**	**1.99**	

Straight	Obs	21	44	17	82
	Exp	24	35	24	
	Column %	52.50	75.86	42.50	
	Res	-3	9	-7	
	Std. Res	-0.61	1.52	-1.43	
	Adj. Res	-1.14	**3.14**	**-2.66**	
Total		40	58	40	138

The chi-square analysis of the shoulder styles of Waubesa points and raw lithic materials of the Waubesa points has a significant result. The ASR post hoc test is conducted in response to identify any cells that have any significant difference between the observed and expected value that may have contributed to the chi-square result. The critical value for significant adjusted standardized residuals (ASR) using the z-score +/- 1.65 in this post hoc test. Four cells greater than the critical value may have caused the high significance. The straight shoulder style manufactured out of Galena chert and Prairie du Chien chert has a significant difference between the observed and expected values. The straight shoulder style manufactured out of Prairie du Chien chert and Galena chert has a significant difference between the observed and expected values.

Data Set 2 Summary

The above discussion shows how non-metric analyses of cultural material attributes can provide information on the attributes of the data sets in this thesis. There are some variables that showed morphological changes to the cultural material. It is possible that the morphological changes are related to the stylistic variations found on cultural materials. The statistics used this chapter focus on the categorical data of the projectile points. The Data Set 2 contains 180 projectile points of which 17 are barbed shoulder styles, 112 are straight shoulder styles, and 51 are sloped shoulders styles. The following section covers a summary of the results.

The chi-square of the shoulder styles in each of the regions has a significant difference between the recorded results and expected results. The barbed shoulder styles were found primary in Region 3. The sloped shoulder styles were primarily found in Region 3. The observed and expected value for the sloped shoulder is nearly similar across the regions. The straight shoulder styles observed in Region 1 were fairly the same as expected. Region 2 contained more observed than expected and Region 3 contained less observed than expected for the straight shoulder style. Three cells greater than the critical value that may have caused the high significance. The barbed shoulder style in Region 1 has significant difference between observed and expected values. In Region 2 the sloped shoulder style has significant difference between observed and expected values. The straight shoulder style in Region 3 has significant difference between observed and expected values.

The lithic raw materials in this section show that Region 1 contains primarily Galena chert followed closely by Burlington chert. Region 2 is similar to Region 1, in that it contains primarily Galena chert followed closely by Burlington chert. Region 2 contains less Prairie du Chien chert than Region 1. Region 3 contains primarily Prairie du Chien chert followed closely by Burlington chert.

The chi-square analysis shows that there is a relation between Wisconsin regions and the lithic raw material. Galena chert is most common in Region 2 and has a higher frequency than expected compared to Region 1 and Region 3. Prairie du Chien chert is most common in Region 3 and has a higher frequency than expected compared to Region 1 and Region 2. Burlington chert seems to be distributed nearly evenly across the three regions. Silicified Sandstone, Other, and Unknown categories seem to be distributed nearly evenly across the three regions. Two cells greater than the critical value that may have caused the high significance. Waubesa point manufactured out of Galena chert and Prairie du Chien chert in Region 3 shows significant difference between observed and expected values.

The chi-square analysis shows that there is a relation between shoulder style and the lithic raw material. The barbed shoulder points were primarily manufactured out of Prairie du Chien chert. The sloped shoulder points were primarily manufactured out of Prairie du Chien chert, and the second most common material is Burlington chert. The straight shoulder points were primarily manufactured out of Galena chert and second most common is Prairie du Chien chert. Four cells greater than the critical value may have caused the high significance. The straight shoulder style manufactured out of Galena chert, and Prairie du Chien chert has significant difference between observed and expected values. The straight shoulder style manufactured out of Prairie du Chien chert and Galena chert has significant difference between observed and expected values.

Chapter VI: Conclusions

Introduction

The major factor analyzed in this thesis is the patterned stylistic variation of the Waubesa Contracting Stem projectile point. The stylistic variation of a diagnostic artifact can be an important source of information for the social organization of society. The presence or absence of social boundaries or social interaction can be related to the different shoulder styles and patterns in the variation of Waubesa points. A total of 214 (due to Data Set 2 including points from Data Set 1) projectile points are used in analysis out of 256 recorded from the Wisconsin repositories, have been used to identify any morphological patterns of the different variables. I believe that the samples used in the two data sets are representative of the parent populations of the different shoulder styles of the Waubesa Contracting Stems in Wisconsin. The three concentrations are located in different regions of Wisconsin, defined here as: Region 1, Region 2, and Region 3. The style variation of the Waubesa points is used to identify any spatial patterns of point style within these regions.

Conclusions

The goal of this thesis is to determine if there is any statistically significant patterned variation to the shapes of Waubesa points in the three experimental regions defined in Wisconsin. The statistics includes analysis of both metric and non-metric attributes to identify any morphological changes. I propose it is possible that the morphological changes may be related to social boundaries contained within the three regions. The chi-square analyses reveals a significant difference between the observed and expected value for shoulder styles and the regions; as well as the use of raw materials to make the points.

The range of Maximum Length in this study is slightly different than Nienow and Boszhardt (1997), which notes the length as 50.8 – 127.00 mm. This thesis reveals the length of Waubesa points between 30.00 mm and 88.00 mm. The Maximum Width in this thesis is also different than Nienow and Boszhardt (1997), which notes the width as 25.40 – 40.60 mm. This thesis reveals the width of Waubesa points between 17 - 44 mm. Justice (1987) notes Adena Stemmed points are 34.00 – 150.00 mm in length; which contains the smaller measurements of Total Length in this thesis, and not included by the Nienow and Boszhardt's (1997) length measurements. It may be possible that the shorter Waubesa points in my thesis are Adena Stemmed (Waubesa) points. The width of Adena Stemmed points is 17.00 – 43.00 mm (Justice 1987). This measurement includes the widths that are in my thesis. It may be possible that Adena Stemmed happen to have a large range of widths and Waubesa points happen to fall within the same width measurements. Another possible interpretation is that some of the points that are in this thesis are misclassified as Waubesa Contracting Stem points.

The first analysis in this thesis is the metric analysis of Waubesa Contracting Stem points to look for any metric variation in certain regions. The examination of the means of the attributes revealed some relation to geographic regions. The ANOVA analyses of the metric attributes reveals that multiple attributes have significant results. The longest, widest, and heaviest are found primarily in Region 3 compared to Region 1; which has the narrowest and lightest points, but not the shortest, which are found in Region 2. I would suggest that the weight relationship is related to the metric dimensions of the projectile points, due to the observation that the longest and widest point are found in Region 3 along with the heaviest projectile points. Region 2 contains the shortest lengths and medium widths of the projectile points (Figure 6.1).

The second analysis in this thesis is the non-metric analysis of Waubesa Contracting Stem points to look for any variation of shoulder style in the three regions. I argue that stylistic variation to projectile points would have been added during the final stages of manufacture after the creator had manufactured the relative point shape he/she wanted at that time. I propose the projectile points have portions that were created for a functional purpose, and other portions had stylistic purposes. I propose the style variation is most likely to be present on “nonfunctional” portions of the projectile point and may have slight changes to the overall form of the point, which may allow groups in Wisconsin to differentiate themselves from other groups. This is similar to the studies mentioned in Chapter III, which suggest the different styles of projectile points could be a functional aspect of identifying different social groups.

Seventeen barbed points, 112 straight points, and 51 sloped points are used in this thesis. The Shoulder Style/ Region chi-square shows a significant difference between the observed and expected values ($p = 0.081$). The barbed, straight, and sloped shoulders are observed in each region (Figure 6.1). Some shoulder styles are slightly more common in certain regions with a significant difference between the observed and expected values. The barbed shoulders and sloped shoulders were observed most in Region 3, and straight shoulders were observed most in Region 2. The adjusted standardized residual (ASR) in the post hoc test of the Style/ Region chi-square reveals there are significantly less barbed shoulder styles in Region 1; there are significantly less sloped shoulder styles in Region 2, and there are significantly less straight shoulder styles in Region 3. Figure 6.1 illustrates this with relative shapes and greater proportions indicated by darker colors.

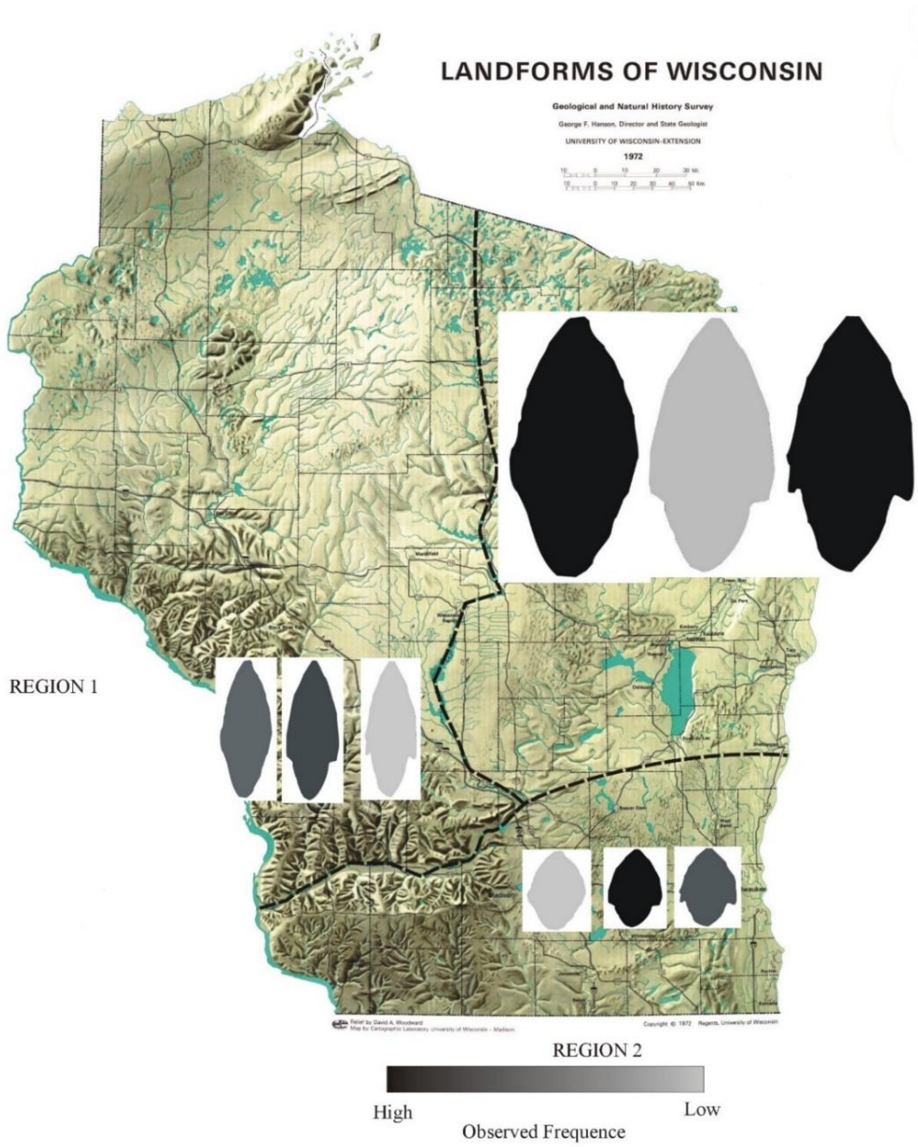

Figure 6.1

Shoulder Styles and Dimensions Found in Each of the Regions. Modified map of Woodward (1972). Reprinted from Woodward (1972) with permission from Cartographic Laboratory University of Wisconsin – Madison.

Different stylistic variations of the projectile points can also be related to the individual knapper and influenced by conditions of their society. These stylistic variations would have probably been more evident along the external boundaries of the different cultural groups' territories (Wiessner 1983). I would agree with Wiessner that stylistic variation of artifacts could reflect group of settlements. This study reveals that the shoulder variations of Waubesa Contracting Stem points are preferred in certain regions of Wisconsin defined in Chapter I. As certain shoulder styles are preferred in some regions they may be related to social boundaries.

Following the Wiessner (1983) and Wobst's (1977) studies, the higher observations of certain shoulder styles in one of the regions in Wisconsin may reflect style variation between different social clusters. These different shoulder styles in different regions of Wisconsin may be a way to announce to outside social members that an individual belongs to a certain social group. The metric attributes with significant differences may serve to carry the same stylistic message as the shoulder styles between social clusters. Sackett (1982) notes, that style is the patterning of material culture such as morphology and decoration. Following Sackett's (1982) study it is possible that the different sizes of Waubesa points (i.e., Total Length and Maximum Width) in Wisconsin are a form of style variation.

The studies by Sackett (1977, 1982) and Binford (1962) are useful for separating attributes that relates to style and function. I would argue that metric attributes of the contracting stem are functional and may relate to the Maximum Length and Maximum Width. The Stem Length follows the same pattern of the Maximum Length. The Distal Stem Width and Proximal Stem Width follow the same pattern of the Maximum Width. The Tukey post hoc test of the multiple ANOVAs reveals that the difference between the means is mostly between two of the regions, instead of a significant difference between all three regions.

The attributes Distal Shoulder Angle, Proximal Shoulder Angle, and Notch Opening require angle measurement and may be difficult to perform outside of the lab. I suggest the Proximal Shoulder Angle relates to the contracting stem of the point; therefore, the angle is not relate to the shoulder style. The Proximal Shoulder Angle follows the same pattern of the Distal Stem Width, Proximal Stem Width, and Maximum Width. The attributes Proximal Shoulder Angle and Notch Opening have no significant difference to the relationship of shoulder style to the different regions. I suggests this may be due to different shoulder styles being present in each of the three regions. The metric dimension Stem Length, Distal Stem Width, Thickness, Weight, Distal Shoulder Angle, and Proximal Shoulder Angle may be considered functional as these values change as the Maximum Length and Maximum Width dimensions change.

My observations of the Waubesa points reveals some portions of the point had more care during manufacture. On most of the Waubesa points there seems to be more pressure flaking along the shoulder and contracting stem as compared to the blade portion of the points. The blade, of Waubesa points has larger flakes removed and less pressure flaking. Areas on the blade which contains pressure flaking are portions that were reworked perhaps from damage or sharpening. It is possible that manufacturers took more care on the contracting stem, because it was the hafted portion of the Waubesa points. As Andrefsky (2012) notes, bifaces manufactured out of distant lithic raw material have more reworking than local raw materials. Since, the majority of Waubesa points in this thesis are manufactured from local lithic material, it may explain the crude manufacture of the blade of the Waubesa points.

The lithic raw material histogram shows that 90 percent of the lithic raw materials of the Waubesa points have some form of thermal alteration. The most common raw lithic material used during manufacture in the samples is: Galena chert, the second most common is Burlington chert, and the third most common is Prairie du Chien chert. Region 2 has the highest frequency of Galena chert and contains a Galena chert source. Region 1 borders the Galena chert source which may explain the high frequency of Galena chert in Region 1. One thing to note on Region 3, is the high frequency of Prairie du Chien chert which is sourced mostly in Region 1 and Region 2 with a spur into Region 3. This chert may have been acquired from the source in Region 3 or was traded with Region 1 and 2. Few Waubesa points were manufactured out of Silicified Sandstone. The “other” and “unknown” categories were distributed nearly evenly across the three regions. For the Waubesa points in Wisconsin, there is a relationship between the lithic raw materials and defined regions. The difference between the recorded results and the expected results is very significant ($p = 0.015$).

The Lithic Raw Material / Region chi-square analysis reveals that Burlington chert is distributed across the regions fairly evenly as expected. The Galena chert of Region 2 is observed higher than expected which may be due to the Galena chert source. The Prairie du Chien chert observed is higher than expected, which may be evidence of trade of this raw material. I argue this shows Burlington chert was either acquired or traded nearly evenly across these regions. I argue that the manufacturers of the Waubesa points may have preferred local chert. The adjusted standardized residual (ASR) post hoc test of the Lithic Raw Material / Region chi-square reveals there are significantly fewer Waubesa points manufactured out of

Galena chert than expected; and significantly more manufactured out of Prairie du Chien chert than expected in Region 3.

The Lithic Raw Material / Shoulder chi-square analysis shows that there is a relation between shoulder style and the lithic raw material. The barbed shoulder style of the observed values is near the expected values; which may be due to the low total frequency of barbed points and are primarily manufactured out of Prairie du Chien and Galena cherts. Straight shoulder style is mostly manufactured out of Galena and Burlington cherts. The sloped shoulder style is primarily manufactured out of Burlington and Prairie du Chien cherts. The difference between the recorded results and the expected results is very significant ($p = 0.013$). The post hoc test reveals that four cells have a significant difference between the observed and expected value. The sloped shoulder style manufactured out of Galena chert is less than expected, and manufactured out of Prairie du Chien chert is more than expected. The straight shoulder style manufactured out of Prairie du Chien chert is less than expected, and manufactured out of Galena chert is more than expected.

Overall, the ANOVA and chi-square analyses on the Data Sets reveals most of the attributes have significant differences. As mentioned above the longest and widest points were recovered in Region 3 as compared to Region 1, which contains the narrowest. Region 2 compared to Region 1 and Region 3 contains the shortest points. This may be a type of stylistic variation created during the manufacture of the projectile point. The lithic raw material reveals that Prairie du Chien chert is most common in Region 3, and Galena chert is most common in Regions 1 and 2. Barbed shoulder styles are more commonly manufactured out of Prairie du Chien chert and Galena chert. Straight shoulder styles are more commonly manufactured out of

Galena chert and Burlington chert. Sloped shoulder styles are more commonly manufactured out of Prairie du Chien chert and Burlington chert. This may be a stylistic variation of cherts used during the manufacturing process of the different shoulder styles. There are some significant differences between the three defined regions. Both shoulder styles and metric variation patterning may be evidence of different social groups in different geographic regions in Wisconsin.

Future Research

This thesis has answered some questions but has left some issues unresolved. One additional factor that can be added to this thesis is comparing shoulder styles to Early Woodland sites that have recorded chronological dates. This might reveal a shoulder style is preferred during a certain period. Next, increasing the number of projectile points in each sample could provide a more accurate morphological analysis. The three different regions identified earlier in this thesis cover large areas and may overlook slight changes in these areas. It may be possible that dividing the different regions by north, south, west and east could provide additional information on the lithic raw material and shoulder style in each region. This is related to increasing the sample number recovered in each region that will provide a large enough sample for analysis. Another method to identify the different regions in Wisconsin, is by the different watersheds which might provide more data for identifying social and territorial boundaries. One other method is to compare sites containing adequate number of Waubesa points and examining the recorded dates of those sites to see how they compare to each other. The future research on Waubesa Contracting Stems and Wisconsin landscapes may address questions about Wisconsin prehistory.

Reference Cited

Andrefsky, William Jr.
2012 Projectile Point Provisioning Strategies and Human Land Use. In *Lithic Technology: Measures of Production, Use, and Curation*. William Andrefsky Jr. (ed.), pp. 195-215. Cambridge University Press, New York.

Arzigian, Constance
2008 *2001-2006 Archaeological Studies at the Fisher Mound Site (47VE825), Stoddard, Vernon County, Wisconsin.* Mississippi Valley Archaeology Center. Report of Investigations: 535.

Bakken, Kent
1995 *Lithic Raw Material Resources in Minnesota*. Paper presented at the annual meeting of the Society for American Archaeology, Minneapolis, May 3-7, 1995.

Bartlein, P. J., Webb, T., III, and Fleri, E.
1984 Holocene Climate Change in the Northern Midwest: Pollen-derived Estimates. *Quaternary Research* 22:361-374.

Behm Jeffery A. and William Green
1982 Collections from the Copperas Creek Site (11-F-100), a multi-component site in the central Illinois Valley. *Rediscovery, Journal of the Illinois Association for the Advancement of Archaeology* 2:31-66.

Benedict, James B., Robert J. Benedict, Craig M. Lee, and Dennis M. Staley
2008 Spruce Trees from a Melting Ice Patch: Evidence for Holocene Climatic Change in the Colorado Rocky Mountains, USA. *The Holocene.*18:1067–1076

Binford, Lewis R.
1962 Archaeology as Anthropology. *American Antiquity* 28(2): 215 - 217.

Boszhardt, Robert F.
2002 Contracting Stemmed: What's the Point? *Midcontinental Journal of Archaeology* 27(1):35-67.

2003 *A Projectile Point Guide for the Upper Mississippi River Valley*. University of Iowa Press, Iowa.

Brown, James A.
1985 Long-term Tends to Sedentism and the Emergence of Complexity in the American Midwest. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity* edited by T.D. Price, and J.A. Brown. Academic Press, Orlando, pp. 201-231.

1986 Food for Thought: Where has Subsistence Analyses Gotten Us? In *Foraging, Collecting, and Harvesting: Archaic Period Subsistence and Settlement in the Eastern Woodlands*, edited by Sarah Ward Neusius. Center for Archaeological Investigations, South Illinois University – Carbondale, Occasional Paper 6:315-330.

Carpenter, F. L. and R. E. MacMillan
1976 Threshold Model of Feeding Territoriality and Test with a Hawaiian Honeycreeper. *Science* 194:639-42.

Cashden, Elizabeth
1983 Territoriality Among Human Foragers: Ecological Models and an Application to Four Bushman Groups. *Current Anthropology* 24(1):47-66.

Cavalli-Sforza, Luigi Luca and Marcus W. Feldman
1981 Cultural Transmission and Evolution: A Quantitative Approach. *Monographs in Population Biology* No. 16, Princeton University Press, Princeton.

Davis, Margaret, Christine Douglas, Randy Calcote, Kenneth L. Cole, Marjorie Green Winkler, and Robyn Flakne
2000 Holocene Climate in the Western Great Lakes National Parks and Lakeshores: Implications for Future Climate Change. *Conservation Biology* 14(4):968-983.

Dibble, Harold L. and Philip G. Chase
1981 A New Method for Describing and Analyzing Artifact Shape. *American Antiquity* 46(1): 178-187.

Drennan, Robert D.
2009 *Statistics for Archaeologists: A Common Sense Approach.* 2nd ed. Springer: New York.

Dunnell, Robert C.
1978 Style and Function: A Fundamental Dichotomy. *American Antiquity* 43(2):192-202.

Emerson, Thomas E.
1986 A Retrospective Look at the Earliest Woodland Cultures in the American Heartland. *Early Woodland Archaeology*, edited by Kenneth B. Farnsworth and Tomas E. Emerson. Center for American Archaeology Press, Kampsville, Illinois.

Flannery, Kent V.
1976 Analysis of Stylistic Variation within and Between Communities. In *The Early Mesoamerican Village*. Kent V. Flannery, (ed.), pp. (251- 254). Academic Press, New York.

Hegman, Michelle
1992 Archaeological Research on Style. *Annual Review of Anthropology* 21:517-536.

Hodder I.
1990 Style as Historical Quality. In *Uses of Style in Archaeology* edited by M. Conkey and C. Hastorf, pp. 44-51. Cambridge: Cambridge University Press.

Hodson, F. R.
1982 Some Aspects of Archaeological Classification. In *Essays of Archaeological Typology* edited by Robert Whallon and James A. Brown, pp. 22-29. Center for American Archaeology Press, Evanston, Illinois.

Hughes, Susan S.
1998 Getting to the Point: Evolutionary Change in Prehistoric Weaponry. *Journal of Archaeological Method and Theory.* 5(4): 345-408.

Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference*. Bloomington: Indiana University Press.

Kay, Marvin
1980 *The Central Missouri Hopewell Subsistence Settlement System.* Missouri Archaeology Society, Research Society, Number 15.

King, James E.
1980 Post-Pleistocene Vegetation Changes in the Midwestern United States. In *Archaic Prehistory on the Prairie-Plains Border* edited by Johnson, A. E. University of Kansas Publications in Anthropology 12: 3-11.

1981 Late Quaternary Vegetation History of Illinois. *Ecological Monographs* 51: 43-62.

Lesure, Richard G.
2005 Linking Theory and Evidence in an Archaeology of Human Agency: Iconography, Style, and Theories of Embodiment. *Journal of Archaeological Method and Theory* 12(3): 237-255.

Morrow, Toby
1985 *A Key to the Identification of Shipped-Stone Raw Material Encountered on Archaeological Sites in the State of Iowa*. Manuscript on file, Archaeology Program. University of Wisconsin – La Crosse, La Crosse, Wisconsin.

Nienow, Jeremy L. and Robert F. Boszhardt
1997*Chipped Stone Projectile Points of Western Wisconsin.* Mississippi Valley Archaeology Center at University of Wisconsin – La Crosse.

Purdy, Barbara Ann
1975 Fractures for the Archaeologists. In *Lithic Technology: Making and Using Stone Tools*, edited by Earl Swanson, pp. 133-141. The Hague: Mouton & Company.

Rondeau, Michael F.
1996 When Is an Elko? In *Stone Tools: Theoretical Insights into Human Prehistory*, edited by George H. Odell, pp. 229-243. New York: Plenum Press.

Sackett, James R.
1977 The Meaning of Style in Archaeology: A General Model. *American Antiquity* 42(3): 369-380.

1982 Approaches to Style in Lithic Technology. *Journal of Anthropological Archaeology* 1: 59 – 112.

Shott, Michael J.
1997 Transmission Theory in the Study of Stone Tools, a Midwestern North American Example. *Archeological Papers of the American Anthropological Association* 7(1):193-204.

Smith, Bruce D.
1986 The Archaeology of the Southeastern United States: From Dalton to de Soto, 10,500 – 500 B.P. *Advances in World Archaeology* 5:1-92.

Stevenson, Katherine P., Robert F. Boszhardt, Charles R. Moffat, Phillip H. Salkin, Tomas C. Pleger, James L. Theler, and Constance M. Arzigian
1997 The Woodland Tradition. *The Wisconsin Archeologists* 78:140-201.

Stoltman, James B.
1986 The Prairie Phase: An Early Woodland Manifestation in the Upper Mississippi Valley. In *Early Woodland Archaeology*, edited by Kenneth B. Farnsworth and Tomas E. Emerson. Center for American Archaeology Press, Kampsville, Illinois.

1990 The Woodland Tradition in the Prairie du Chien Locality. In *The Woodland Tradition in the Western Great Lakes: Papers Presented to Elden Johnson*, edited by Guy Gibbon. University of Minnesota Publications in Anthropology No. 4.

Theler, James L.
1986 The Early Woodland Component at the Mill Pond Site, Wisconsin. In *Early Woodland Archaeology*, edited by Kenneth B. Farnsworth and Tomas E. Emerson. Center for American Archaeology Press, Kampsville, Illinois.

Theler, James L. and Robert F. Boszhardt
2003 *Twelve Millennia: Archaeology of the Upper Mississippi River Valley*. University Iowa Press, Iowa.

Thomas, David H.
1970 Archaeology's Operational Imperative: Great Basin Projectile Points as a Test Case. Los Angeles: *University of California Archaeological Survey Annual Report* 12:27-60.

1981 How to Classify Projectile Points from Monitor Valley, Nevada. *Journal of California and Great Basin Anthropology* 3(1): 7-43.

Thulman, David K.
2012 Discriminating Paleoindian point types from Florida using landmark geometric morphometrics. *Journal of Archaeological Science* 39(5): 1599-1607.

Webb T., III, Cushing E. J., Wright H. E., Jr.
1983 Holocene Changes in the Vegetation of the Midwest. In *Late-Quaternary Environments of the United States, Vol. 2. The Holocene,* edited by Herbert. E. Wright, Jr. University of Minnesota Press, Minneapolis, pp. 142-165.

Webb, W.S.
1946 Indian Knoll, site Oh2, Ohio County, Kentucky, Reports in *Anthropology and Archaeology* 4, No. 3, Part 1. Lexington, KY: University of Kentucky.

Wiessner, Polly
1983 Style and Social Information in Kalahari San Projectile Points. *American Antiquity* 48(2): pp. 253-276.

1997 Seeking Guidelines through an Evolutionary Approach: Style Revisited among the !Kung San (Ju/ʼʼhuansi) of the 1990s. *Archeological Papers of the American Anthropological Association* 7(1): pp. 157-176.

Winkler, Daniel McGuire and Dustin Blodgett
2004 The Lithic Resources of Wisconsin: A Guide Book. Manuscript on file, Archaeology Program. University of Wisconsin - La Crosse, La Crosse, Wisconsin.

Wisconsin Historic Society (WHS)
2017 Wisconsin Historic Preservation Database. http://wisahrd.org/. Accessed 2017.

Wobst, H. Martin
1977 Stylistic Behavior and Information Exchange. In Papers for the Director: Research Essays in Honor of James B. Griffin, edited by Charles E. Cleland. *Anthropology Papers*. 61:317-342. Museum of Anthropology. University of Michigan. Ann Arbor.

Woodward, David A.
1972 Map by Cartographic Laboratory, University of Wisconsin – Madison.

Yerkes, Richard W.
1988 The Woodland and Mississippian Traditions in the Prehistory of Midwestern North America. *Journal of World Prehistory*, Vol. 2, No. 3, pp. 307-358.

Appendix A: Waubesa and Early Woodland Sites by County in Wisconsin

ASI/WHPD Sites (as of 4/10/2017)

County	Total Sites	Waubesa Sites	Early Woodland	Initial Woodland
Adams	298	0	7	0
Ashland	391	0	1	0
Barron	354	2	15	0
Bayfield	554	0	0	0
Brown	512	6	12	0
Buffalo	304	4	12	0
Burnett	295	1	7	0
Calumet	265	12	16	0
Chippewa	265	1	2	0
Clark	201	6	14	0
Columbia	500	3	7	0
Crawford	842	21	49	0
Dane	1591	52	85	1
Dodge	884	6	66	0
Door	533	0	6	0
Douglas	209	0	0	0
Dunn	532	2	17	0
Eau Claire	163	0	1	0
Florence	231	0	0	0
Fond du Lac	691	14	32	2
Forest	917	0	1	0
Grant	897	12	24	0
Green	392	2	8	0
Green Lake	312	1	8	0
Iowa	582	11	21	0
Iron	48	0	0	0
Jackson	742	7	23	0
Jefferson	1290	17	81	0
Juneau	524	5	9	0
Kenosha	464	5	17	0
Kewaunee	157	0	2	0
La Crosse	883	19	50	1

Lafayette	376	5	5	0
Langlade	166	0	0	0
Lincoln	182	1	3	0
Manitowoc	581	4	11	0
Marathon	307	1	6	0
Marinette	345	2	9	2
Marquette	244	0	5	0
Menominee	423	0	0	0
Milwaukee	587	6	21	0
Monroe	1005	25	71	0
Oconto	682	4	11	1
Oneida	343	0	9	0
Outagamie	391	3	14	0
Ozaukee	402	12	28	0
Pepin	151	4	6	0
Pierce	716	4	16	0
Polk	296	0	3	0
Portage	448	1	6	3
Price	232	0	2	0
Racine	351	3	16	0
Richland	604	8	22	0
Rock	541	4	16	0
Rusk	225	0	4	0
Sauk	841	5	17	1
Sawyer	372	0	0	0
Shawano	317	2	3	0
Sheboygan	536	18	48	0
St. Croix	221	0	1	0
Taylor	234	0	0	0
Trempealeau	486	8	16	0
Vernon	1469	24	52	0
Vilas	393	0	4	1
Walworth	410	4	11	0
Washburn	196	0	2	0
Washington	457	1	13	0
Waukesha	692	10	30	1
Waupaca	394	4	10	0
Waushara	326	7	13	0

Winnebago	875	28	77	0
Wood	268	0	2	0
Total	34908	407	1174	13

Appendix B: Total Recorded Collection

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
1	MVAC	47VE825	1	Set 2	2005.1342.01	Medial-Proximal
2	MVAC	47VE825	1		2002.1366.01	Shoulder Broken
3	MVAC	47VE825	1		2006.0032.01	Shoulder Broken
4	MVAC	47VE825	1	Set 2	2001.1219.01	Tip Broken
5	MVAC	47VE825	1	Set 1	2005.1341.02	Complete
6	MVAC	47TR40	1	Set 1	2003.0010.01	Complete
7	MVAC	47JA522	1	Set 2	2008.0042.??	Medial-Proximal
8	MVAC	47JA522	1	Set 2		Medial-Proximal
9	MVAC	47JA522	1	Set 2		Tip Broken
10	MVAC	47CR356	1		2004.0038.18	Complete
11	MVAC	47CR356	1	Set 1	2004.38.17	Complete
12	MVAC	47CR356	1	Set 1	2004.38.20	Complete
13	MVAC	47CR356	1	Set 1	2004.38.19	Complete
14	MVAC	47CR356	1	Set 1	2004.38.21	Complete
15	MVAC	47CR312	1	Set 2	2004.25.15	Base Broken
16	MVAC	47CR312	1	Set 2	2004.25.16	Base Broken
17	MVAC	47CR312	1	Set 1	2004.25.20	Complete
18	MVAC	47CR312	1	Set 1	2004.25.19	Complete
19	MVAC	47CR312	1	Set 1	2004.25.18	Complete
20	MVAC	47CR354	1	Set 1	2004,20.340	Complete
21	MVAC	47CR312	1		2004.25.17	Complete
22	MVAC	47CR354	1	Set 1	2004.20.359	Complete
23	MVAC	47CR354	1	Set 2	2004.20.352	Complete
24	MVAC	47CR354	1	Set 1	2004.20.354	Complete
25	MVAC	47CR354	1	Set 2	2004.20.351	Complete
26	MVAC	47CR354	1	Set 2	2004.20.348	Base Broken
27	MVAC	47CR354	1	Set 1	2004.20.345	Complete
28	MVAC	47CR354	1		2004.20.349	Base Broken
29	MVAC	47CR354	1		2004.20.350	Complete
30	MVAC	47CR354	1	Set 1	2004.20.346	Complete
31	MVAC	47CR354	1	Set 1	2004.20.347	Complete
32	MVAC	47CR354	1	Set 1	2004.20.221	Complete
33	MVAC	47CR354	1	Set 1	2004.20.320	Complete
34	MVAC	47CR354	1	Set 2	2004.20.319	Complete

Appendix B (contd.)

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
1	~ 45.7	24.80	14.50	12.00	18.90	144.00	157.00	71.00	79.00
2	~ 49.09	N/A	13.84	15.01	8.3	114.35	N/A	112.2	N/A
3	49.43	N/A	11.82	14.5	11.62	148	N/A	103	N/A
4	35.35	21.71	16.24	18	8.28	172.00	162.00	71.00	70.00
5	52.55	26.9	11	13.45	8.63	119.32	132.70	76.22	73.15
6	30.64	16.7	7.35	12	8.35	145.4	156.47	75.77	73.27
7	N/A	26.58	17.1	19.68	9.5	107.00	102.00	73.00	79.00
8	N/A	42.8	16.1	24.1	14.1	110.00	111.00	70.00	69.00
9	58.2	26.6	11.3	13.4	1.6	97.00	99.00	82.00	81.00
10	49.1	29.1	13	14.2	11.9	131.25	108.28	99.45	102.3
11	49.4	19.9	16.2	10.2	6.4	140	128.00	69.98	81.18
12	47.5	25.7	20	20.3	11.6	180	147.42	70.95	76.63
13	88.6	27.12	25.7	23.4	10.1	127.98	145.73	84.07	80.78
14	43.09	22.24	10.52	16.6	10.6	180	158.58	73.73	77.62
15	53.4	25.1	N/A	16.3	N/A	149.00	168.00	71.00	70.00
16	48.8	21.9	N/A	10.3	N/A	151.00	148.00	80.00	71.00
17	73.8	32.9	16.8	17.8	14	110.83	121.85	78.97	78.88
18	50.2	22.8	7.25	16.1	11.8	122.55	127.08	67.68	59.73
19	50.8	24.4	13.8	16.7	10.9	156.42	153.60	79.67	76.67
20	77.6	20.5	20.7	11.4	7	163.08	110.72	63.40	72.63
21	* 59.4	28.8	9.1	19.2	6.2	108.38	155.02	105.3	121.33
22	66.5	24.9	14.4	15.6	8.3	80.42	141.35	74.88	74.93
23	44.7	22.4	11.6	15.7	7.4	109.00	139.00	72.00	65.00
24	36.6	18.3	9.1	9.7	6.7	140.73	114.40	68.70	66.83
25	43.8	19.6	9.6	11.6	6.8	140.00	112.00	68.00	66.00
26	53.8	23.57	17.1	19.8	11	155.00	154.00	71.00	77.00
27	48.6	20.5	11.8	13.8	7.6	146.82	123.75	74.43	75.53
28	75.2	38.2	14.3	18.1	14.7	111.9	99.2	93.33	95.58
29	40.3	19.4	9.2	14	8.7	151.15	169.17	114.72	103.93
30	81.2	38.5	25.2	32.7	14.9	180.00	180.00	71.65	69.77
31	49.8	31.3	21.9	20.2	8.5	129.10	127.85	74.42	72.08
32	55.3	22.8	13.7	13.7	7.3	138.58	123.53	72.73	65.77
33	61.6	25.6	15	20.1	10.7	180.00	142.65	67.83	74.38
34	53.3	22.6	11.5	17.7	9.9	180.00	180.00	70.00	72.00

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
1	215.00	236.00	10.80	6.51	Slope	Slope	Slope	Absent
2	226.55	N/A	9	9.03	Straight	N/A	Straight	Absent
3	251.00	N/A	11.9	8.69	Slope	N/A	Slope	Absent
4	243.00	232.00	9.17	5.06	Slope	Slope	Slope	Absent
5	195.54	205.85	12.8	11.95	Straight	Straight	Straight	Absent
6	221.17	229.74	6.05	2.83	Slope	Slope	Slope	Absent
7	180.00	181.00	10.3	8.88	Straight	Straight	Straight	Absent
8	180.00	180.00	11.3	26.1	Straight	Straight	Straight	Absent
9	179.00	180.00	11.7	16.9	Straight	Straight	Straight	Absent
10	230.70	210.58	8.07	8.66	Slope	Straight	Straight	Absent
11	209.98	209.18	8.3	7.3	Straight	Straight	Straight	Absent
12	250.95	224.05	10.96	8.85	Slope	Straight	Straight	Absent
13	212.05	226.51	8.4	17.98	Slope	Slope	Slope	Absent
14	253.73	236.20	9.25	8.33	Slope	Slope	Slope	Absent
15	220.00	238.00	8.8	9.59	Slope	Slope	Slope	Absent
16	231.00	219.00	9.85	7.2	Slope	Slope	Slope	Absent
17	189.80	200.73	10.67	18.39	Straight	Straight	Straight	Absent
18	190.23	186.81	6.4	7.09	Straight	Straight	Straight	Absent
19	236.09	230.27	7.7	7.8	Slope	Slope	Slope	Absent
20	226.48	183.35	10.5	11.8	Straight	Straight	Straight	Absent
21	213.68	276.35	9	10	Straight	Slope	Straight	Absent
22	155.30	216.28	9.3	15.43	Barbed	Barbed	Barbed	Absent
23	181.00	204.00	6.4	5.85	Straight	Slope	Straight	Absent
24	209.43	181.23	7.7	3.4	Straight	Straight	Straight	Absent
25	208.00	178.00	8.8	6.17	Straight	Slope	Straight	Absent
26	226.00	231.00	8.9	10.6	Slope	Slope	Slope	Absent
27	221.25	199.28	7.4	6.3	Straight	Straight	Straight	Absent
28	205.23	194.78	10.7	22.96	Straight	Straight	Straight	Absent
29	265.87	273.10	4.2	3.7	Straight	Slope	Straight	Absent
30	251.65	249.77	16.5	41.8	Slope	Slope	Slope	Absent
31	203.52	199.93	9.3	12.9	Straight	Straight	Straight	Absent
32	211.31	189.30	10.3	10.57	Straight	Straight	Straight	Absent
33	247.83	217.03	10.8	11.9	Slope	Straight	Straight	Absent
34	250.00	252.00	7.3	7.4	Slope	Slope	Slope	Absent

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color Chart		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
1	Heated	10YR 8/2	N6	Very Fine	Pearly	Opaque
2	Heated	5YR8/4, 10YR8/2	10YR 6/2	Very Fine	Pearly	Slightly Translucent
3	Treated	10YR 7/4	5Y 8/1	Very Fine	Greasy	Slightly Translucent
4	Unheated	10YR 8/2	N7	Very Fine	Dull	Slightly Translucent
5	Treated	10YR 7/4	5YR 7/2	Very Fine	Waxy	Opaque
6	Treated	5R 6/2	5R 8/2	Fine	Pearly	Slightly Translucent
7	Treated	N8, N4	5YR 5/2	Fine	Dull	Opaque
8	Treated	10YR 6/2, 5Y 7/2	10YR 5/4	Course	Metallic	Highly Translucent
9	Unheated	10YR 8/2, 5Y 8/1	10YR 6/2	Fine	Pearly	Slightly Translucent
10	Heated	10YR 6/2	N5	Fine	Dull	Opaque
11	Heated	5Y 8/1	5Y 7/2	Very Fine	Silky	Slightly Translucent
12	Heated	5Y 8/1	5Y 7/2	Fine	Dull	Opaque
13	Treated	5Y 8/1; 10YR 6/6	N6	Fine	Greasy	Opaque
14	Treated	10R 7/4	10R 5/4	Very Fine	Pearly	Opaque
15	Treated	10YR 8/2	10YR 6/2	Very Fine	Pearly	Opaque
16	Heated	10YR 6/2	10YR 6/6	Very Fine	Pearly	Opaque
17	Heated	5Y 8/1	N7	Fine	Pearly	Opaque
18	Treated	5R 3/4	5R 2/2	Very Fine	Waxy	Opaque
19	Unheated	5Y 7/2	10YR 7/4	Fine	Waxy	Slightly Translucent
20	Treated	10YR 8/2	5Y 7/2	Fine	Dull	Opaque
21	Treated	10YR 8/2	5Y 7/2	Fine	Dull	Opaque
22	Unknown	10YR 6/6	10YR 5/4	Very Fine	Waxy	Slightly Translucent
23	Unheated	5Y 5/2	10YR 5/4	Very Fine	Waxy	Slightly Translucent
24	Unheated	10YR 8/2	5YR 7/2	Fine	Pearly	Opaque
25	Unheated	5B 5/1, N3	5B 7/1	Very Fine	Waxy	Opaque
26	Unknown	5RP 4/2; 5P 6/2	5P 4/2	Very Course	Dull	Opaque
27	Treated	10YR 5/4		Course	Pearly	Translucent
28	Treated	10YR 4/2		Course	Pearly	Slightly Translucent
29	Heated	10YR 5/4	5Y 8/1	Very Course	Pearly	Translucent
30	Treated	5Y 7/2	5YR 7/4	Course	Pearly	Slightly Translucent
31	Heated	10YR 6/2		Course	Pearly	Translucent
32	Heated	5PB 7/2	N4	Fine	Waxy	Opaque
33	Heated	5Y8/1	N6	Course	Dull	Opaque
34	Treated	10YR 8/2	10YR 7/4	Fine	Metallic	Opaque

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
1	Fossil Inclusions, Banded	White Speckles and Brown Speckles	Prairie du Chien
2	Marbled		Prairie du Chien
3	Speckles, Oolitic, Fossil Inclusions		Unknown
4	Oolitic, Mottled	Triangular Blade	Prairie du Chien
5	Fossil Inclusions, Vugs	Speckles	Prairie du Chien
6	Oolitic		Prairie du Chien
7	Fossil Inclusions, Mottled, Vugs		Galena
8	Lighter Color Linear Lines Could be Vugs		Silicified Sandstone
9	Oolitic, Mottled		Prairie du Chien
10	Vugs, Fossil Inclusions, Mottled		Galena
11	Oolitic		Prairie du Chien
12	Banding , Vugs, Fossil Burrows		Prairie du Chien
13	Marbled, Mottled, Fossil Inclusions	White Speckles and Brown Speckles	Unknown
14	Banding	Speckles	Prairie du Chien
15	Mottled, Vugs, Fossil Burrows		Burlington
16	Vugs, Fossil Burrows, Specks,		Burlington
17	Mottled, Speckles, Fossil Burrows, Marbled		Galena
18	Fossil Burrows, Fossil Inclusions, Mottled		Unknown
19	Banded, Fossil Burrows		Prairie du Chien
20	Vugs, Fossil Inclusions		Burlington
21	Vugs, Fossil Inclusions		Unknown
22	White Fossil Frags, Fossil Burrows	Speckled	Unknown
23	Fossil Burrows, White Fossil Frags		Galena
24	Vugs, Fossil Burrows		Galena
25	Speckled, Fossil Burrows		Galena
26	Fossil Burrows		Baraboo Quartzite
27	Fossil Burrows		Silicified Sandstone
28	Fossil Burrows		Silicified Sandstone
29	Fossil Burrows	Flakes	Silicified Sandstone
30	Fossil Burrows, Banding, Marbled		Silicified Sandstone
31	Fossil Burrows		Silicified Sandstone
32	Fossil Burrows, White Fossil Frags	Speckles	Burlington
33	Vugs, Fossil Burrows, Mottled, White Fossil Frags		Burlington
34	Fossil Burrows	Speckles	Burlington

Appendix B

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
35	MVAC	47CR354	1	Set 1	2004.20.314	Complete
36	MVAC	47CR354	1	Set 1	2004.20.315	Complete
37	MVAC	47CR354	1	Set 2	2004.20.323	Complete
38	MVAC	47CR354	1	Set 1	2004.20.318	Complete
39	MVAC	47CR354	1	Set 1	2004.20.322	Complete
40	MVAC	47CR354	1	Set 1	2004.20.317	Complete
41	MVAC	47CR354	1	Set 1	2004.20.316	Complete
42	MVAC	47CR354	1	Set 1	2004.20.328	Complete
43	MVAC	47CR354	1		2004.20.336	Complete
44	MVAC	47CR354	1	Set 1	2004.20.335	Complete
45	MVAC	47CR354	1	Set 1	2004.20.334	Complete
46	MVAC	47CR354	1	Set 1	2004.20.324	Complete
47	MVAC	47CR354	1	Set 1	2004.20.331	Complete
48	MVAC	47CR354	1	Set 1	2004.20.337	Complete
49	MVAC	47CR354	1	Set 1	2004.20.339	Complete
50	MVAC	47CR354	1	Set 2	2004.20.332	Complete
51	MVAC	47CR354	1	Set 1	2004.20.338	Complete
52	MVAC	47CR354	1	Set 2	2004.20.325	Complete
53	MVAC	47CR354	1	Set 1	2004.20.376	Complete
54	MVAC	47CR354	1	Set 1	2004.20.329	Complete
55	MVAC	47CR354	1	Set 1	2204.20.330	Complete
56	MVAC	47CR354	1	Set 1	2004.20.327	Complete
57	MVAC	47CR354	1	Set 2	2004.20.333	Complete
58	MVAC	47GT670	2	Set 1	2004.102.11	Complete
59	MVAC	47GT670	2	Set 1	2004.102.12	Complete
60	MVAC	47GT670	2	Set 1	2004.102.13	Complete
61	MVAC	47GT697	2	Set 1	2004.94.01	Complete
62	Madison	47CR460	1	Set 2		Complete
63	Madison	47CR460	1	Set 2		Medial-Proximal
64	Madison	47CR460	1	Set 2		Medial-Proximal
65	Madison	47DO47	2	Set 1		Complete
66	Madison	47DO47	2	Set 1		Complete
67	Madison	47CR451	1	Set 2		Medial-Proximal
68	Madison	47CR451	1	Set 2		Tip Broken
69	Madison	47CR451	1	Set 2		Medial-Proximal
70	Madison	47CR451	1	Set 1		Complete

Appendix B (contd.)

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
35	49.5	21.6	10.4	8.2	6.8	113.65	117.58	80.98	78.04
36	44.2	21.8	12.45	16.07	9.07	132.33	139.10	69.92	70.18
37	58.8	25.7	12.1	13.9	7.1	110.00	139.00	70.00	71.00
38	57.1	31.2	11.8	15.2	8.9	116.50	128.33	68.58	72.28
39	57.8	25.2	14	14.4	7	108.67	136.85	72.00	76.00
40	60	27.2	17.9	14.2	12.9	160.65	145.70	85.80	86.82
41	51.6	28.4	11.4	15.2	7.3	135.97	156.36	72.82	66.43
42	55.7	23.7	11.8	12.2	6.4	88.20	96.49	76.70	71.73
43	67.5	24.4	10.9	17.07	8.68	132.48	144.4	110.68	111.48
44	50.8	28.3	12.3	20.1	9.6	142.68	150.68	52.25	65.53
45	69.1	28.6	16.9	21.3	8.7	99.60	122.40	67.20	71.07
46	62.3	26.8	10.6	16.5	11.4	133.95	106.95	70.75	64.08
47	47.3	25.9	13	15.6	8.6	136.03	160.23	60.75	65.38
48	49.1	24.15	12.6	15.1	9	127.27	180.00	70.95	69.25
49	43.8	22.1	13.9	16.8	8.5	80.17	86.71	68.08	68.37
50	49.6	22.9	8	13.1	5.9	120.00	116.00	61.00	64.00
51	43.4	25.2	14.4	15.9	7.5	122.20	153.85	72.68	61.57
52	47.7	21.3	11.4	13.5	5.4	112.00	143.00	65.00	69.00
53	37.9	23	11.1	14.2	7.5	147.73	134.33	65.78	74.02
54	40.1	22.1	13.2	13.6	7.6	128.12	137.95	81.82	71.35
55	44.6	20.6	13.4	14	6.7	139.20	156.57	75.70	65.73
56	47.9	18.8	15.1	14.6	4.8	154.77	180.00	72.13	74.80
57	49.5	13.7	15	12.5	4.2	180.00	180.00	71.00	72.00
58	41.7	23.5	14.3	16.9	6.9	180.00	180.00	64.00	67.00
59	48.1	21.4	12.7	17.4	7.2	180.00	180.00	72.00	65.00
60	55.9	24.7	11.8	15.1	3.4	132.42	120.83	71.00	64.00
61	51.5	25.2	11.9	16.1	8.6	138.20	180.00	70.35	68.00
62	56.33	23.22	13.78	17.55	8.66	155.00	162.00	69.00	72.00
63	N/A	28.1	19.42	19.37	10.49	110.00	102.00	69.00	75.00
64	N/A	28.16	18.33	22.64	17.92	160.00	156.00	77.00	78.00
65	45.4	25.66	12.49	16.54	11.1	142.58	126.53	70.80	76.65
66	38.3	21.58	14.69	19.46	15.32	145.50	150.00	83.27	88.65
67	~ 20.00	29.09	13.19	15.98	8.7	108.00	116.00	73.00	64.00
68	42.72	23.22	12.78	17.82	9.56	155.00	139.00	70.00	66.00
69	N/A	27	12.88	15.27	11.87	115.00	109.00	77.00	79.00
70	66.05	32.28	13.03	18.59	14.58	123.92	120.03	69.85	70.67

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
35	194.63	195.62	9.5	5.92	Straight	Straight	Straight	Absent
36	202.25	209.28	11.2	9.75	Straight	Straight	Straight	Absent
37	180.00	210.00	12.1	13.6	Straight	Slope	Straight	Absent
38	185.08	200.61	8.1	11.2	Straight	Straight	Straight	Absent
39	180.67	212.85	8.3	8.65	Straight	Straight	Straight	Absent
40	246.45	232.52	12	13.5	Straight	Straight	Straight	Absent
41	208.79	222.79	11.1	12.13	Straight	Straight	Straight	Absent
42	164.90	168.22	8.7	9.15	Barbed	Barbed	Barbed	Present
43	243.16	255.88	10.8	15.86	Straight	Straight	Straight	Absent
44	194.93	216.21	9.4	9.5	Straight	Straight	Straight	Absent
45	166.80	193.47	9	18.06	Straight	Straight	Straight	Absent
46	204.70	171.03	11.4	16.79	Barbed	Straight	Barbed	Present
47	196.78	225.61	9.4	8.82	Straight	Straight	Straight	Absent
48	198.22	249.25	7.8	7.5	Straight	Straight	Straight	Absent
49	148.25	155.08	10.3	7.6	Barbed	Barbed	Barbed	Absent
50	181.00	180.00	7.9	8.03	Straight	Straight	Straight	Absent
51	194.88	215.42	10.2	8.5	Straight	Straight	Straight	Absent
52	177.00	212.00	10.5	8.82	Straight	Slope	Straight	Absent
53	213.51	208.35	10.1	7.7	Straight	Straight	Straight	Absent
54	209.94	209.30	7.7	5.5	Straight	Straight	Straight	Absent
55	214.90	222.30	9.3	7.68	Straight	Straight	Straight	Absent
56	226.90	254.80	8.2	6.3	Straight	Slope	Straight	Absent
57	251.00	252.00	11.75	6.92	Slope	Slope	Slope	Absent
58	244.00	247.00	10.3	7.7	Slope	Slope	Slope	Slope
59	252.00	245.00	7.8	5.5	Slope	Slope	Slope	Slope
60	203.42	184.83	11.1	12.13	Straight	Straight	Straight	Absent
61	208.55	248.00	10.6	7.6	Straight	Slope	Straight	Present
62	224.00	234.00	12.19	13.5	Slope	Slope	Slope	Absent
63	179.00	177.00	N/A	N/A	Straight	Straight	Straight	Absent
64	237.00	234.00	N/A	N/A	Slope	Slope	Slope	Absent
65	213.38	203.18	11.39	10.3	Straight	Straight	Straight	Absent
66	228.77	238.65	10.59	6.8	Straight	Straight	Straight	Absent
67	181.00	180.00	N/A	N/A	Straight	Straight	Straight	Absent
68	225.00	205.00	9.37	7.5	Slope	Slope	Slope	Absent
69	192.00	188.00	N/A	N/A	Straight	Straight	Straight	Absent
70	193.77	190.70	10.85	18.1	Straight	Straight	Straight	Absent

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color Chart		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
35	Treated	10YR 8/2	10YR 7/4	Fine	Pearly	Opaque
36	Treated	10YR 8/2	10R 8/2	Very Fine	Waxy	Slightly Translucent
37	Heated	10YR 6/2	10YR 8/2	Very Fine	Waxy	Opaque
38	Heated	5Y 8/1	N8	Very Fine	Pearly	Opaque
39	Treated	10YR 8/2	10YR 6/2	Fine	Metallic	Opaque
40	Heated	5Y 8/1	N6	Fine	Dull	Opaque
41	Heated	10YR 8/2	5G 2/1	Very Fine	Waxy	Opaque
42	Treated	5YR 5/4	10R 3/4	Very Fine	Waxy	Opaque
43	Treated	5PB 5/2	5Y 7/2	Very Fine	Waxy	Opaque
44	Treated	5PB 5/2	10R 3/4	Very Fine	Waxy	Opaque
45	Treated	10YR 6/2	10R 3/4	Very Fine	Waxy	Opaque
46	Treated	5PB 5/2	5YR 5/6	Very Fine	Waxy	Opaque
47	Heated	5PB 5/2	5G 2/1	Very Fine	Waxy	Opaque
48	Heated	5PB 5/2	5G 2/1	Very Fine	Waxy	Opaque
49	Treated	10YR 6/2	5YR 7/2	Very Fine	Waxy	Opaque
50	Heated	5Y 8/1	N7	Very Fine	Waxy	Opaque
51	Treated	N4	10YR 6/2; 10YR 8/2	Fine	Pearly	Opaque
52	Treated	10YR 7/2; N5	5YR 6/1	Fine	Pearly	Opaque
53	Heated	N4; 10R 4/2	5RP 4/2	Fine	Pearly	Opaque
54	Heated	5PB 5/2	5G 2/1	Very Fine	Waxy	Opaque
55	Treated	10YR 6/2	10YR 8/2	Very Fine	Waxy	Opaque
56	Heated	10YR 8/2	10YR 6/2	Very Fine	Waxy	Opaque
57	Unheated	N8; N4	5YR 5/2	Course	Dull	Opaque
58	Heated	10R 6/2	10R 5/4	Fine	Pearly	Opaque
59	Heated	10R 6/6	5YR 7/2	Fine	Pearly	Opaque
60	Treated	10R 4/2	5YR 4/4	Very Fine	Waxy	Opaque
61	Treated	5YR 7/2	5R 6/6	Fine	Pearly	Opaque
62	Heated	10YR 7/4	10YR 8/2	Fine	Pearly	Opaque
63	Heated	10YR 6/2	5Y R5/6	Course	Sugary	Semi-Translucent
64	Unheated	5YR 8/1	5PB 7/2; 5B 7/1	Fine	Pearly	Opaque
65	Heated	10YR 6/2	10YR 8/2	Very Fine	Waxy	Opaque
66	Unheated	10YR 8/2	5YR 8/1	Fine	Pearly	Opaque
67	Treated	5YR 7/2	10YR 6/2	Fine	Waxy	Opaque
68	Treated	5YR 4/4; 5Y 3/2	5YR 7/2	Fine	Waxy	Opaque
69	Heated	10R 6/2	N7; 10Y R7/4	Very Fine	Waxy	Opaque
70	Unknown	10R 5/4; 5R 3/4	10YR 8/2	Fine	Waxy	Opaque

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
35	Mottled, Oolites	Speckles	Prairie du Chien
36	Speckled, Oolites		Prairie du Chien
37	Mottled, Inclusion, Fossil Burrow, Vugs		Galena
38	Fossil Burrows, Mottled		Burlington
39	White Fossil Frags, Fossil Burrows, Mottled, Specks		Burlington
40	Speckles, Mottled		Burlington
41	Fossil Burrows, Mottled		Burlington
42	Fossil Burrows		Galena
43	Fossil Burrows, Mottled, Fossil Inclusions		Galena
44	Fossil Burrows		Galena
45	Fossil Burrows, Mottled, White Fossil Frags, Specks		Galena
46	Fossil Burrows, Fossil Inclusions		Galena
47	Fossil Burrows, Vugs, White Fossil Frags		Moline
48	Fossil Burrows		Moline
49	Fossil Burrows		Galena
50	Fossil Burrows, White Fossil Frags		Galena
51	Fossil Burrows, Mottled, White Fossil Frags, Specks		Galena
52	Fossil Burrows, White Fossil Frags		Galena
53	Fossil Burrows, White Fossil Frags		Galena
54	White Fossil Frags		Maquoketa
55	White Fossil Frags		Galena
56	White Fossil Frags, Fossil Burrows, Mottled, Specks		Burlington
57	White Fossil Frags		Maquoketa
58	White Fossil Frags, Fossil Inclusions		Galena
59	Marbling, Banding, Oolites		Prairie du Chien
60	Fossil Inclusions, Fossil Burrows, Specks		Galena
61	Oolites, Speckled		Prairie du Chien
62	Fossil Burrows	Speckles	Burlington
63	Fossil Inclusions		Silicified Sandstone
64	Vugs, Fossil Inclusions, Burrows	Speckles	Prairie du Chien
65	Banding, Fossil Inclusions	Speckles	Galena
66	Vugs, Fossil, Inclusions,		Burlington
67	Speckles, Fossil Burrows, Fossil Inclusions	Speckles	Galena
68	Fossil Inclusions,	Speckles	Galena
69	Fossil Inclusions, Fossil Burrows	Speckles	Galena
70	Fossil Inclusions , Fossil Burrows, Marbling, White Fossils		Galena

Appendix B

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
71	Madison	47CR186	1	Set 1		Complete
72	Madison	47CR186	1	Set 1		Complete
73	Madison	47CR186	1	Set 2		Complete
74	Madison	47CR186	1	Set 1		Complete
75	Madison	47CR186	1	Set 2		Medial-Proximal
76	Madison	47CR186	1	Set 2		Medial-Proximal
77	Madison	47CR186	1	Set 1		Complete
78	Madison	47DO47	2	Set 1		Complete
79	Madison	47DO47	2	Set 1		Complete
80	Madison	47WP26/70	3		Drower	Complete
81	Madison	47WP26/70	3	Set 1		Complete
82	Madison	47WP26/70	3	Set 1		Complete
83	Madison	47WP26/70	3	Set 1		Complete
84	Madison	47WP26/70	3	Set 1		Complete
85	Madison	47WP26/70	3	Set 1		Complete
86	Madison	47WP26/70	3	Set 1		Complete
87	Madison	47WP26/70	3	Set 1		Complete
88	Madison	47WP26/70	3	Set 1		Complete
89	Madison	47WP26/70	3	Set 1		Complete
90	Madison	47WP26/70	3			Medial-Proximal
91	Madison	47LT149	2	Set 2		Medial-Proximal
92	Madison	47LT149	2	Set 2		Medial-Proximal
93	Madison	47DA457	2	Set 1		Complete
94	Madison	47DA457	2	Set 1		Complete
95	Madison	47DA457	2	Set 1		Complete
96	Madison	47DA457	2	Set 1		Complete
97	Madison	47DA3	2	Set 1		Complete
98	Madison	47DA3	2	Set 2		Medial-Proximal
99	Madison	47JE1	2	Set 2		Medial-Proximal
100	Madison	47JE1	2	Set 2		Medial-Proximal
101	Madison	47JE1	2	Set 2		Medial-Proximal
102	Madison	47JE1	2			Medial-Proximal
103	Madison	47JE1	2	Set 2		Medial-Proximal
104	Madison	47JE1	2	Set 2		Medial-Proximal
105	Madison	47JE1	2	Set 2		Medial-Proximal
106	Madison	47JE1	2	Set 2		Medial-Proximal

Appendix B

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
71	47.8	20.18	14.17	15.49	8.81	155.93	180.00	75.90	75.67
72	49.73	17.08	16.16	11.62	4.43	163.98	160.00	65.17	75.42
73	44.98	22.90	15.09	15.50	8.70	135.00	148.00	70.00	71.00
74	46.98	20.58	12.4	13.38	4.63	156.72	148.92	72.93	77.12
75	N/A	24.26	14.23	15.75	8.88	125.00	118.00	74.00	78.00
76	N/A	23.21	20.77	13.99	5.53	131.00	141.00	71.00	72.00
77	51.41	28.1	13.64	15	6.25	139.93	134.58	62.12	63.72
78	32.3	23.43	14.38	19	12.53	180.00	180.00	64.00	66.00
79	41.73	21.79	12.5	16.89	7.49	180.00	180.00	71.00	67.00
80	45.23	26.15	15.51	16.35	9.66	111.42	137.02	108.43	100.03
81	36.14	26.48	14.17	17.8	8.03	124.00	120.33	77.78	73.93
82	47.08	21.6	16.69	13.75	12.19	90.00	147.00	80.38	82.67
83	47.05	31.52	15.06	19.54	11.68	120.88	80.25	72.62	78.43
84	33.98	19.82	9.2	13.37	9.37	158.62	129.68	58.92	76.58
85	43.67	24.97	12.13	17.18	10.25	135.00	125.00	64.23	61.85
86	44.24	20.62	13.91	12.97	8.01	152.22	159.25	81.00	71.48
87	33.73	24.31	9.8	14.15	8.6	131.62	135.42	80.00	75.55
88	46.73	24.22	16.08	14.77	9.4	127.42	104.88	77.00	93.00
89	36.02	23.96	13.39	14.32	9.58	123.00	120.00	81.75	84.64
90	N/A	19.08	15.67	16.46	12.27	160.15	N/A	99.78	N/A
91	N/A	16.77	11.89	16.29	10.12	148.52	N/A	65.63	N/A
92	N/A	33.11	21.85	21.50	15.83	118.38	117.50	80.18	75.87
93	79.49	33.97	14.42	22.39	14.2	150.00	130.00	72.77	75.78
94	55.51	23.2	11.46	15.55	7.58	167.00	126.45	73.97	83.00
95	40.51	24.5	15.55	17.59	9.96	154.45	127.87	74.33	75.50
96	49.9	27.25	11.62	12.44	7.37	151.27	180.00	67.48	50.00
97	94.5	35.68	26.18	33.3	19.53	N/A	N/A	N/A	N/A
98	N/A	34	21.76	19.69	8.8	95.93	123.83	75.08	75.48
99	N/A	33.66	14.74	16.63	10.56	165.17	123.02	72.05	75.72
100	N/A	55.97	16.08	17.95	11.56	141.82	131.95	82.50	77.55
101	N/A	32.71	17.89	17.90	10.05	101.62	113.28	71.10	71.25
102	N/A	28.13	14.05	18.42	12.91	132.38	138.25	104.75	104.2
103	N/A	23.92	14.83	16.21	13.81	154.83	131.28	77.27	84.45
104	N/A	26.72	N/A	20.50	14.14	142.85	157.47	78.98	82.82
105	N/A	23.14	11.47	8.22	1.05	152.40	116.13	66.37	65.30
106	N/A	26.22	9.07	15.36	5.66	147.32	182.97	54.20	52.92

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
71	231.83	255.67	9.57	7.9	Straight	Straight	Straight	Absent
72	229.15	235.42	10.02	7.6	Slope	Slope	Slope	Absent
73	205.00	219.00	8.43	6.50	Slope	Slope	Slope	Absent
74	229.65	226.04	6.86	5.4	Straight	Straight	Straight	Absent
75	199.00	196.00	N/A	N/A	Straight	Straight	Straight	Absent
76	202.00	213.00	N/A	N/A	Straight	Straight	Straight	Absent
77	202.05	198.30	9.71	10.7	Straight	Straight	Straight	Absent
78	244.00	246.00	9.66	6.6	Slope	Slope	Slope	Absent
79	251.00	247.00	6.58	6.2	Slope	Slope	Slope	Absent
80	219.85	237.05	8.21	6.7	Straight	Straight	Straight	Absent
81	201.78	194.26	7.29	5.5	Straight	Straight	Straight	Absent
82	170.38	229.67	10.77	7.5	Barbed	Straight	Barbed	Absent
83	193.50	158.68	9.75	10.5	Barbed	Straight	Barbed	Present
84	217.54	206.26	9.56	5.1	Straight	Straight	Straight	Absent
85	199.23	186.85	8.39	7.7	Straight	Straight	Straight	Absent
86	233.22	230.73	10.83	7.7	Slope	Slope	Slope	Absent
87	211.62	210.97	8.36	5.8	Straight	Straight	Straight	Absent
88	204.42	197.88	7.6	7.4	Straight	Straight	Straight	Absent
89	204.75	204.64	5.86	4.8	Straight	Straight	Straight	Absent
90	259.93	N/A	N/A	N/A	N/A	Slope	Slope	Absent
91	214.15	N/A	N/A	N/A	Slope	Slope	Slope	Absent
92	198.56	193.37	11.31	N/A	Straight	Straight	Straight	Absent
93	222.77	205.78	11.43	28.5	Straight	Straight	Straight	Absent
94	240.97	209.45	9.78	11.8	Straight	Slope	Straight	Absent
95	228.78	203.37	9.33	7.6	Straight	Straight	Straight	Absent
96	218.75	230.00	8.8	10	Straight	Straight	Straight	Absent
97	N/A	N/A	12.48	43.8	Slope	Slope	Slope	Absent
98	171.01	199.31	N/A	N/A	Straight	Straight	Absent	Absent
99	237.22	198.74	N/A	N/A	Slope	Straight	Absent	Absent
100	224.32	209.50	9.99	N/A	Slope	Slope	Absent	Absent
101	172.72	184.53	9.58	N/A	Barbed	Straight	Absent	Absent
102	237.13	242.45	N/A	N/A	Slope	Slope	Slope	Present
103	232.10	215.73	N/A	N/A	Slope	Slope	Slope	Absent
104	221.83	240.29	N/A	N/A	Slope	Straight	Straight	Absent
105	218.77	181.43	8.15	N/A	Slope	Straight	Straight	Absent
106	201.52	235.89	12.47	N/A	Slope	Slope	Slope	Absent

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
71	Treated	10YR 6/1	10R 5/3	Fine	Pearly	Opaque
72	Heated	5YR 8/4	10YR 8/2	Very Fine	Waxy	Opaque
73	Heated	5Y 8/1	10YR 8/6	Fine	Pearly	Opaque
74	Treated	10YR 7/4	10YR 6/2	Fine	Pearly	Opaque
75	Treated	10YR 5/4	5R 2/6; 5GY 6/1	Very Fine	Waxy	Opaque
76	Treated	10YR 6/2		Fine	Pearly	Opaque
77	Heated	5YR 8/1	N3	Fine	Dull	Opaque
78	Treated	10YR 6/2	5Y 8/1	Very Fine	Waxy	Opaque
79	Heated	N6; 10YR 6/2	10R 5/4; 10R 6/6	Very Fine	Waxy	Opaque
80	Heated	5YR 4/1	10YR 6/2	Course	Dull	Opaque
81	Heated	5YR 8/1	10YR 8/2	Very Fine	Dull	Opaque
82	Unheated	N8, N6	10YR 8/2	Very Fine	Waxy	Opaque
83	Heated	N8	10YR 8/2	Fine	Pearly	Opaque
84	Treated	N6, N5	10YR 8/2	Fine	Pearly	Opaque
85	Heated	N3	10YR 6/2	Fine	Pearly	Opaque
86	Treated	10YR 7/4	5YR 5/2; N6	Fine	Waxy	Very Slightly Opaque
87	Treated	5Y 7/2	5R 7/4	Very Fine	Waxy	Opaque
88	Heated	N4; 5GY 4/1	5Y 4/1	Very Fine	Waxy	Opaque
89	Heated	5GY 5/1	5B 7/1	Very Fine	Waxy	Opaque
90	Treated	10YR 8/2	5YR 8/4	Very Fine	Waxy	Opaque
91	Heated	N6	N5; 5Y 8/1	Very Fine	Waxy	Opaque
92	Heated	10YR 5/4	10YR 6/2	Very Course	Sugary	Semi-Translucent
93	Heated	10YR 6/2	5Y 7/2	Very Fine	Waxy	Opaque
94	Treated	5YR 7/2	N6	Very Fine	Waxy	Opaque
95	Heated	N5	5YR 8/4	Very Fine	Waxy	Opaque
96	Treated	10R 5/4; 5R 3/4; N6		Fine	Pearly	Opaque
97	Unheated	5Y 7/2	10YR 8/2	Fine	Pearly	Slightly Translucent
98	Treated	5YR 4/4	10YR 8/2	Course	Dull	Opaque
99	Unheated	N7	10YR 6/2	Fine	Pearly	Slightly Translucent
100	Treated	10YR 6/2	5YR 7/2	Fine	Pearly	Opaque
101	Heated	N7	10YR 8/2	Very Fine	Waxy	Slightly Translucent
102	Heated	10YR 6/2	10YR 8/2	Fine	Pearly	Opaque
103	Heated	10R 5/4; 5R 3/4; 10 R7/4		Fine	Pearly	Opaque
104	Unheated	5Y 4/1	5B 5/1	Fine	Waxy	Opaque
105	Heated	10YR 6/2	10YR 8/2	Fine	Pearly	Opaque
106	Heated	N8	10YR 8/6	Course	Waxy	Translucent

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
71	Banding, Fossil Inclusions, Crinoid Columnals, Specks		Galena
72	Marbling, White Fossils, Oolites	Speckles	Burlington
73	Fossil Inclusions	Speckles	Burlington
74	Specks, White Fossil Frags, Fossil Inclusions		Galena
75	White Fossil Frags, Fossil Inclusions	Speckles	Maquoketa
76	White Fossil Frags, Specks	Speckles	Galena
77	Large Speckles, Fossil Vugs		Unknown
78	Fossil Inclusions, Fossil Burrow, Specks		Galena
79	Fossil Inclusions, Fossil Burrows, Marbled		Prairie du Chien
80	Speckles		Galena
81	Fossil Inclusions, Fossil Burrows		Burlington
82	Oolites, Marbling, Banding, Fossil Inclusions		Prairie du Chien
83		Oolites, Banding, Speckles	Galena
84	Oolites, Banding, Speckles		Prairie du Chien
85		Fossil Inclusions	Galena
86		Fossil Inclusions, Vugs, Speckles	Burlington
87	Oolites, Marbled		Prairie du Chien
88	Speckles		Galena
89	Fossil Burrow, Fossil Inclusions		Galena
90		Oolites, Fossil Inclusions	Prairie du Chien
91	Fossil Inclusions, Fossil Burrow, Speckles		Galena
92	Fossil Burrows	Speckles	Silicified Sandstone
93	Vug, Fossil Inclusions, Burrows, Marble		Prairie du Chien
94	Fossil Inclusions, Fossil Burrows		Burlington
95	Fossil Burrows, Fossil Inclusions	Speckles	Unknown
96	Fossil Inclusions, Fossil Burrows, Specks		Galena
97		Fossil Inclusions, Oolites	Burlington
98	Fossil Inclusions, Fossil Burrow		Unknown
99	Fossil Inclusions, Fossil Burrow		Maquoketa
100	Fossil Inclusions, Vugs		Burlington
101	Oolites		Prairie du Chien
102		Oolites, Speckles, Fossil Inclusion	Prairie du Chien
103	Fossil Inclusions, Fossil Burrow, Speckles		Unknown
104	Fossil Inclusions, Fossil Burrow		Moline
105	Marbled, Oolites, Fossil Inclusion		Prairie du Chien
106			Quartz

Appendix B

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
107	Madison	47DA17	2	Set 1		Complete
108	Madison	47DA10	2	Set 1		Complete
109	Madison	47DA10	2	Set 2		Medial-Proximal
110	Madison	47DA10	2	Set 2		Medial-Proximal
111	Madison	47DA411	2	Set 2		Medial-Proximal
112	Madison	47DA411	2	Set 2		Medial-Proximal
113	Madison	47DA3	2	Set 1		Complete
114	Madison	47DA3	2	Set 2		Medial-Proximal
115	Madison	47DA3	2			Medial-Proximal
116	Madison	47DA14	2	Set 1		Complete
117	Madison	47DA459	2	Set 1		Complete
118	Madison	47DA459	2	Set 1		Complete
119	Madison	47DA459	2	Set 1		Complete
120	Madison	47DA459	2	Set 1		Complete
121	Madison	47DA459	2	Set 1		Complete
122	Madison	47DA459	2	Set 1		Complete
123	Madison	47DA459	2	Set 1		Complete
124	Madison	47DA459	2	Set 1		Complete
125	Madison	47DA459	2	Set 1		Complete
126	Madison	47DA459	2	Set 1		Complete
127	Madison	47DA459	2	Set 1		Complete
128	Madison	47DA459	2	Set 2		Complete
129	Madison	47DA459	2	Set 1		Base to Midsection
130	Madison	47DA459	2	Set 1		Complete
131	Madison	47DA459	2	Set 1		Complete
132	Madison	47DA459	2	Set 1		Complete
133	Madison	47DA459	2	Set 1		Complete
134	Madison	47DA459	2	Set 1		Complete
135	Madison	47DA459	2	Set 1		Complete
136	Madison	47DA459	2	Set 1		Complete
137	Glarc	47GT594	2	Set 1	03.050.0480	Complete
138	Glarc	47GT693	2		04.032-1163	Broken
139	Glarc	47GT593	2	Set 2	03.049-2326	Base Broken
140	Glarc	47GT593	2	Set 1	03.049-2190	Complete
141	Glarc	47GT593	2	Set 1	03.049-1899	Complete

Appendix B (contd.)

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
107	46.83	29.91	10.94	16.89	10.07	160.73	157.87	70.42	68.37
108	37.62	23.76	11.35	14.4	7.49	128.82	149.83	75.38	67.62
109	N/A	25.13	9.89	15.70	11.33	168.12	99.38	63.43	70.47
110	N/A	33.97	14.02	18.65	9.03	156.35	109.90	58.38	68.25
111	N/A	30.93	14.00	18.22	8.24	135.78	113.68	63.80	70.45
112	N/A	25.37	16.79	18.50	6.56	169.27	152.22	63.37	74.20
113	43.23	23.38	9.79	15.7	10.66	133.58	137.45	70.85	60.40
114	N/A	27.95	15.46	17.81	8.85	111.97	130.37	77.48	70.82
115	N/A	32.97	17	18.7	10.4	119.93	126.87	105.42	108.68
116	70.03	26.4	16.39	18.92	8.45	137.45	157.07	71.72	75.80
117	48.88	29.97	13.99	19.93	10.33	159.50	141.38	69.53	70.00
118	45.42	24.25	17.65	17.26	9.71	131.32	150.55	71.17	67.53
119	42.28	26.91	14.06	17.18	10.12	147.20	138.60	75.37	87.50
120	58.25	24.76	14.52	14.6	5.96	134.22	157.52	71.55	68.88
121	57.95	27.81	17.04	20.06	16.95	160.00	69.78	136.18	77.47
122	38.12	21.13	9.78	12.07	7.27	107.78	118.60	77.90	81.55
123	55.01	25.6	12.78	16.87	8.25	150.18	180.00	70.45	60.00
124	52.97	24.8	13.01	18.52	14.74	155.25	156.05	62.67	62.87
125	49.98	20.66	11.26	15	9.75	153.48	134.55	75.92	78.05
126	N/A	29.48	18.28	20.22	9.5	125.87	N/A	108.67	N/A
127	58.23	28.6	11.21	17.6	10.11	154.27	150.00	70.42	79.92
128	37.79	22.72	9.40	15.09	10.61	154.32	125.18	80.05	76.30
129	N/A	28.15	18.07	18.59	9.84	209.87	119.48	68.53	83.27
130	N/A	30.17	16.89	18.47	10.88	154.25	116.35	107.4	100.52
131	41.32	17.08	12.74	11.61	10.03	157.83	139.05	80.62	79.25
132	N/A	29.37	14.5	18.8	14.32	133.4	136.23	105.6	108.53
133	43.27	21.26	8.35	13.94	9.91	151.20	143.68	84.37	76.05
134	33.49	17.81	9.2	11.35	8.1	150.58	146.60	71.12	81.90
135	79.79	33.26	17.58	18.3	12.27	85.72	118.52	70.07	79.20
136	57.41	35.63	17.88	21.11	16.55	127.00	122.00	77.23	80.83
137	41.70	18.25	10.26	5.83	12.73	165.08	180.00	73.75	69.00
138	N/A	N/A	18.9	11.4	19.5	135.93	136.28	100.4	99.98
139	N/A	24.30	N/A	16.99	N/A	114.00	157.00	70.00	65.00
140	53.16	22.81	13	16.65	8.72	136.30	138.37	69.38	75.63
141	40.04	24.2	13.33	15.57	11.83	117.12	136.83	76.72	78.12

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
107	231.15	226.24	7.67	10.4	Straight	Straight	Straight	Absent
108	204.20	217.45	8.6	5.8	Straight	Straight	Straight	Absent
109	231.55	169.85	N/A	N/A	Slope	Barbed	Barbed	Absent
110	214.73	178.15	N/A	N/A	Slope	Straight	Straight	Absent
111	199.58	184.13	9.56	N/A	Straight	Straight	Straight	Present
112	232.64	226.42	N/A	N/A	Slope	Slope	Slope	Absent
113	204.43	197.85	10.58	8.8	Straight	Straight	Straight	Absent
114	189.45	201.19	N/A	N/A	Straight	Straight	Straight	Absent
115	225.35	235.55	N/A	N/A	Straight	Straight	Straight	Absent
116	209.17	232.87	12.12	18.3	Straight	Straight	Straight	Absent
117	229.03	211.38	11.1	12.8	Straight	Straight	Straight	Absent
118	202.49	218.08	8.19	6.3	Straight	Straight	Straight	Absent
119	222.57	226.10	7.92	7.7	Straight	Straight	Straight	Absent
120	205.77	226.40	10.64	11	Straight	Straight	Straight	Absent
121	296.18	147.25	8.95	11.5	Barbed	Barbed	Barbed	Absent
122	185.68	200.15	9.42	6.3	Straight	Slope	Straight	Absent
123	220.63	240.00	9.5	12.4	Straight	Straight	Straight	Treated
124	217.92	218.92	10.73	11.7	Straight	Straight	Straight	Absent
125	229.40	212.60	10.77	6.5	Straight	Straight	Straight	Absent
126	234.54	N/A	9.02	N/A	N/A	Straight	Straight	Absent
127	224.69	229.92	12.1	11.9	Straight	Slope	Straight	Absent
128	234.37	201.48	9.00	6.50	Slope	Straight	Straight	Absent
129	278.40	202.75	N/A	N/A	Slope	Slope	Slope	Absent
130	261.65	216.87	N/A	N/A	Slope	Straight	Straight	Absent
131	238.45	218.30	8.95	7.7	Straight	Slope	Straight	Present
132	239.00	244.76	N/A	N/A	Slope	Slope	Slope	Absent
133	235.57	219.73	9.05	7.6	Straight	Straight	Straight	Absent
134	221.70	228.50	9.16	4.4	Straight	Straight	Straight	Absent
135	157.12	197.72	11.76	24.2	Barbed	Barbed	Barbed	Absent
136	204.23	202.83	10.47	17	Straight	Straight	Straight	Absent
137	238.83	249.00	7.96	5.00	Straight	Slope	Straight	Absent
138	236.33	236.26	N/A	N/A	Slope	N/A	Slope	Absent
139	184.00	222.00	10.58	10.00	Straight	Slope	Straight	Absent
140	205.68	214.00	8.97	9	Straight	Straight	Straight	Absent
141	193.84	214.95	6.97	5	Straight	Straight	Straight	Absent

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
107	Treated	N5	10YR 6/6; 10R 5/4	Course	Sugary	Translucent
108	Treated	5YR 8/4	10YR 8/2; 10YR 6/2	Very Fine	Waxy	Opaque
109	Treated	10YR 8/2	5Y 8/1	Very Fine	Waxy	Opaque
110	Unheated	5B 5/1	N4	Very Fine	Waxy	Opaque
111	Treated	10YR 4/2	10YR 6/2	Fine	Waxy	Opaque
112	Treated	10YR 7/4	10YR 8/2; N5	Very Fine	Waxy	Opaque
113	Heated	10YR 8/2	N6; 5Y 8/1	Very Fine	Waxy	Opaque
114	Heated	10YR 6/2	5YR 7/2	Fine	Dull	Opaque
115	Heated	5YR 5/2	N5	Very Fine	Waxy	Opaque
116	Heated	10YR 8/2	N6	Fine	Pearly	Opaque
117	Treated	10YR 6/2	5YR 7/2	Very Fine	Waxy	Opaque
118	Treated	5YR 7/2	5YR 6/4	Fine	Waxy	Opaque
119	Treated	10YR 6/2	5YR 7/2	Very Fine	Waxy	Opaque
120	Treated	10R 8/2	10YR 6/2; N5	Fine	Pearly	Opaque
121	Unknown	10YR 7/4	10YR 5/4	Fine	Pearly	Opaque
122	Treated	5YR 5/6	10YR 8/2	Fine	Waxy	Opaque
123	Heated	N6, N5	5YR 7/2	Very Fine	Waxy	Opaque
124	Burnt	10YR 6/2	10YR 8/2	Fine	Pearly	Opaque
125	Treated	N7	5YR 7/2	Fine	Pearly	Opaque
126	Treated	10YR 8/2	5Y 7/2	Fine	Pearly	Opaque
127	Treated	5R 6/2	10R 5/4	Fine	Dull	Opaque
128	Treated	10R 6/2	5R 6/6	Fine	Waxy	Opaque
129	Heated	10R 6/2	10R 8/2	Fine	Pearly	Opaque
130	Treated	10R 8/2	10YR 7/4	Fine	Waxy	Opaque
131	Treated	10R 8/2	5Y 8/1; 10R 8/2	Fine	Pearly	Opaque
132	Treated	10R 6/2	5R5/4	Fine	Waxy	Opaque
133	Treated	10R 6/2	10R 8/2; 10YR 8/6	Fine	Pearly	Opaque
134	Heated	N3	5B 5/1	Fine	Waxy	Opaque
135	Treated	10R 6/2	10R 8/2	Very Fine	Pearly	Opaque
136	Unheated	10YR 8/2	N1	Fine	Dull	Opaque
137	Treated	10YR 5/4	10R 8/2	Fine	Dull	Opaque
138	Treated	N5	10R 8/2; 5YR 5/2	Fine	Dull	Opaque
139	Heated	10YR 8/2	10YR 5/4	Fine	Dull	Opaque
140	Heated	10YR 8/2	5Y 8/1	Fine	Peary	Opaque
141	Treated	N6	10R 8/2	Very Fine	Waxy	Opaque

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
107	Fossil Inclusions		Silicified Sandstone
108	Fossil Inclusions, Fossil Burrow		Burlington
109	Fossil Inclusions, Fossil Burrow	Speckles	Burlington
110	Fossil Inclusions, Fossil Burrow		Galena
111	Fossil Inclusion	Speckles	Galena
112	Fossil Inclusions, Fossil Burrow		Burlington
113	Fossil Inclusions, Vugs		Burlington
114	Fossil Inclusions, Fossil Burrow	Speckles	Unknown
115		Small Oolites, Speckles	Unknown
116	Vugs, Oolites, Speckles, Fossil Inclusions		Unknown
117	Fossil Inclusions, Fossil Burrow		Galena
118	Fossil Burrow, Fossil Inclusions		Unknown
119	Speckles, Fossil inclusion		Galena
120	Fossil Burrow, Fossil Inclusions, Oolites		Unknown
121	Speckles		Unknown
122		Oolites, Large Speckles	Unknown
123	Fossil Burrow, Fossil Inclusions		Burlington
124		Oolites, Speckles	Galena
125	Fossil Burrow, Fossil Inclusions		Burlington
126	Oolites, Speckles, Fossil Inclusions		Unknown
127		Oolites Fossil Inclusions	Unknown
128	Voided Out Fossils, Speckles, Fossil Inclusions		Platteville Formation Chert
129	Oolites, Speckles		Prairie du Chien
130		Oolites Fossil Inclusions	Prairie du Chien
131	Oolites, Fossil Inclusions		Prairie du Chien
132	Speckles, Fossil Inclusions		Burlington
133	Fossil Inclusions, Fossil Burrows, Specks		Burlington
134	Fossil Inclusions, Fossil Burrow		Galena
135	Speckles, Fossil Inclusions, Fossil Burrow		Burlington
136	Large Speckles, Fossil Burrows		Burlington
137	Fossil Vugs,	Speckles	Galena
138	Fossil Vugs, Fossil Burrows, Speckles		Galena
139	Fossil Vugs, Fossil Burrows	Speckles	Galena
140	Speckles, Fossil Inclusions, Oolites		Burlington
141	Fossil Inclusions, Fossil Burrow		Galena

Appendix B

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
142	Glarc	47GT593	2	Set 1	03.049-1452	Complete
143	Glarc	47GT593	2	Set 1	03.049-5693	Tip Broken
144	Glarc	47GT593	2	Set 1	03.049-5666	Complete
145	Glarc	47GT593	2	Set 2	03.049-3674	Broken
146	Glarc	47GT593	2	Set 2	03.049-3655	Broken
147	Glarc	47GT593	2	Set 2	03.049-5185	Broken
148	Glarc	47GT593	2	Set 2	03.049-5190	Broken
149	Glarc	47GT593	2	Set 2	03.049-3581	Broken
150	Glarc	47GT593	2	Set 2	03.049-0353	Complete
151	Glarc	47GT593	2	Set 2	03.049-0281	Tip Broken
152	Glarc	47GT593	2	Set 2	03.049-0278	Broken
153	Glarc	47GT593	2	Set 1	03.049-0280	Complete
154	Glarc	47GT593	2	Set 1	03.049-5315	Tip Broken
155	Glarc	47GT593	2	Set 1	03.049-0638	Complete
156	Glarc	47GT593	2	Set 2	03.049-0882	Base to Midsection
157	Nellis	47BR116	3	Set 1		Complete
158	Nellis	BR-310	3		.1929/222	Complete
159	Nellis	Clay Banks	3		.1543/2845	Complete
160	Nellis	Brown	3	Set 2		Complete
161	Nellis	Brown	3		.1128/229	Complete
162	Nellis	Brown	3			Complete
163	Nellis	Brown	3	Set 2		Complete
164	Nellis	Door	3	Set 2		Complete
165	Nellis	Door	3	Set 2		Tip Broken
166	Nellis	Manitowoc Co.	3	Set 2		Complete
167	Nellis	Brown	3	Set 1		Complete
168	Nellis	Brown	3			Complete
169	Nellis	Brown	3	Set 1		Complete
170	Nellis	Brown	3			Complete
171	Nellis	Door	3	Set 2		Complete
172	Nellis	47BR437	3	Set 1		Complete
173	Nellis	47BR437	3	Set 2		Complete
174	Nellis	47BR437	3	Set 2		Complete
175	Nellis	Manitowoc	3	Set 1		Complete
176	Nellis	Shawano	3			Complete

Appendix B (contd.)

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
142	82.48	37.85	16.11	25.98	16.97	165.48	163.18	65.00	74.37
143	50.82	28.35	17.54	20.53	10.12	113.42	115.18	77.27	80.12
144	37.27	20.25	8.2	11.1	7.66	136.00	143.93	61.72	66.40
145	N/A	N/A	15.98	16.41	8.10	137.00	95.00	84.00	67.00
146	N/A	26.10	17.70	18.40	14.93	157.00	164.00	79.00	83.00
147	N/A	19.00	11.00	13.70	6.00	110.00	180.00	70.00	66.00
148	N/A	N/A	17.60	18.90	12.30	129.05	N/A	78.03	N/A
149	N/A	N/A	18.00	19.40	6.60	110.92	N/A	69.93	N/A
150	N/A	N/A	14.40	13.70	4.70	147.70	N/A	80.07	N/A
151	N/A	28.87	14.67	20.67	10.58	103.00	149.00	77.00	72.00
152	N/A	24.30	15.40	19.20	8.30	110.00	109.00	70.00	72.00
153	64.54	32.45	14.75	18.83	7.64	136.43	126.17	66.35	60.37
154	41.7	21.65	14.02	14.58	9.27	106.67	100.00	73.00	79.00
155	55.5	23.18	10.27	14.49	8.8	95.10	99.65	67.10	68.83
156	N/A	31.53	17.96	21.19	11.58	55.00	109.00	71.00	71.00
157	92.73	27.6	16.09	13.34	19.78	121.98	112.07	77.60	73.95
158	184.1	78.74	78.55	11.9	22.8	105.82	103.93	108.58	107.15
159	92.2	36.06	17.9	13.67	22.36	129.95	130.45	105.98	97.5
160	75.9	30.2	22.8	12.78	19.87	133.42	110.77	81.05	85.72
161	84.02	28.55	17.06	7.5	18.5	79.65	100.17	68.1	68.35
162	84.1	31.25	19.2	7.08	20.37	102.78	113.98	65.57	109.3
163	89.6	30.20	19.55	11.8	19.3	93.03	96.62	76.80	76.62
164	79.6	N/A	14.09	14.1	18.27	83.27	N/A	86.40	N/A
165	N/A	36.15	15.07	14.14	22.1	128.50	135.97	67.57	57.07
166	63.6	30.5	14.8	12.66	19.1	120.58	110.55	74.45	73.32
167	78.35	35.8	20.58	14.2	20.1	125.82	123.62	80.35	81.25
168	61.4	24.67	12.1	12.08	16.05	95.92	93.7	71.7	69.9
169	76.94	34.01	11.09	10.9	17.2	124.68	100.17	66.03	67.73
170	92.1	31.58	15.1	7.4	16.8	98.75	118.2	67.73	116.22
171	72.6	33.2	16.7	14.6	17.5	96.75	92.62	84.32	85.42
172	100.75	38.1	19.4	10.8	18.7	102.15	100.98	101.83	108.37
173	93.09	36.19	20.68	14.5	24.5	149.45	153.17	81.68	76.42
174	60.91	30.09	13.9	9.7	16.9	126.75	111.57	72.00	77.17
175	81.7	32.7	21.2	11.9	19.8	120.00	121.00	80.30	78.08
176	168.28	65.2	25.48	13.8	23.5	99.72	101.92	103.97	98.52

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
142	230.48	237.55	17.9	41	Slope	Slope	Slope	Absent
143	190.69	195.30	11.06	14	Straight	Straight	Straight	Absent
144	197.72	210.33	7.65	4	Straight	Straight	Straight	Absent
145	221.00	162.00	9.73	6.00	Straight	Slope	Straight	Absent
146	236.00	247.00	8.94	9.00	Slope	Slope	Slope	Absent
147	180.00	246.00	7.90	6.00	Slope	N/A	Slope	Absent
148	207.08	N/A	N/A	N/A	Straight	N/A	Straight	Absent
149	180.85	N/A	N/A	N/A	Straight	N/A	Straight	Absent
150	227.77	N/A	N/A	N/A	Slope	Slope	Slope	Absent
151	180.00	221.00	8.35	12.00	Straight	Slope	Straight	Absent
152	180.00	181.00	10.00	11.00	Straight	Straight	Straight	Absent
153	202.78	186.54	11.51	17	Straight	Straight	Straight	Absent
154	179.67	179.00	10.08	9	Straight	Straight	Straight	Absent
155	162.00	167.28	12.49	11	Barbed	Barbed	Barbed	Absent
156	126.00	180.00	9.66	16.00	Barbed	Straight	Barbed	Absent
157	199.58	186.02	12.8	32	Straight	Straight	Straight	Absent
158	214.40	211.08	7.4	85	Straight	Straight	Straight	Absent
159	235.93	227.95	13.86	41	Slope	Slope	Slope	Absent
160	214.47	196.49	9.96	21	Slope	Straight	Straight	Absent
161	147.75	168.52	8.21	17	Barbed	Barbed	Barbed	Present
162	168.35	223.28	8.46	21	Barbed	Straight	Barbed	Absent
163	169.83	173.24	12.1	23	Barbed	Barbed	Barbed	Absent
164	169.67	N/A	11.1	25	Barbed	N/A	Barbed	Absent
165	196.07	193.04	13.86	21	Straight	Straight	Straight	Absent
166	195.03	183.87	12.11	19	Straight	Straight	Straight	Absent
167	206.18	204.73	11.4	28	Straight	Straight	Straight	Absent
168	167.62	163.60	8.9	13	Barbed	Barbed	Barbed	Absent
169	190.47	169.73	10.2	23	Straight	Barbed	Barbed	Absent
170	166.48	234.42	8.68	22	Straight	Barbed	Barbed	Absent
171	181.07	178.04	10.5	24	Straight	Straight	Straight	Absent
172	203.98	209.35	12.2	37	Straight	Straight	Straight	Absent
173	231.13	229.59	10.5	31	Slope	Slope	Slope	Absent
174	198.75	188.74	11.5	15	Slope	Straight	Straight	Absent
175	199.73	198.12	11.4	27	Straight	Straight	Straight	Absent
176	203.69	200.44	14.06	123	Straight	Straight	Straight	Absent

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
142	Treated	10R 8/2	10YR 8/2	Fine	Dull	Opaque
143	Treated	5Y 8/1	10R 8/2; 10R 7/2	Very Fine	Waxy	Opaque
144	Treated	5R 6/2	10R 6/6	Very Fine	Waxy	Opaque
145	Heated	N5	5YR 8/1	Fine	Peary	Opaque
146	Treated	10R 8/2; 10R 4/6; N5		Fine	Peary	Opaque
147	Treated	10R 4/6	10R 8/2	Fine	Peary	Opaque
148	Heated	10R 6/2	N5	Fine	Dull	Opaque
149	Unheated	5Y 7/2	N6	Fine	Dull	Opaque
150	Unheated	5PB 5/2	N5; 10YR 4/2	Fine	Peary	Opaque
151	Treated	10YR 8/2	10R 8/2; 10R 7/4	Fine	Dull	Opaque
152	Treated	10YR 8/2	5YR 5/6	Fine	Dull	Opaque
153	Treated	N6; 5R 6/2	5YR 8/4	Fine	Pearly	Opaque
154	Heated	10YR 6/2	5R 7/2	Fine	Pearly	Opaque
155	Heated	10YR 8/2	10YR 6/2	Fine	Dull	Opaque
156	Treated	N5	10R 6/2	Very	Waxy	Opaque
157	Unknown	5Y 6/1	5Y 4/1	Fine	Dull	Opaque
158	Treated	10YR 8/2	N9; 5Y 7/2	Very Fine	Waxy	Slightly Translucent
159	Treated	5Y 7/2	10YR 6/6	Very Course	Pearly	Slightly Translucent
160	Unheated	10YR 7/4	N5	Fine	Pearly	Opaque
161	Treated	10YR 6/2	5Y 7/2; 10YR 7/4	Course	Pearly	Very Slightly Translucent
162	Unheated	10YR 8/2	10YR 6/2	Very Fine	Waxy	Very Slightly Translucent
163	Unheated	5YR 7/2	5R 6/2	Course	Dull	Opaque
164	Treated	10YR 8/2	10YR 6/6; 10R 7/4	Fine	Pearly	Opaque
165	Unheated	N6	N5	Very Fine	Waxy	Translucent
166	Treated	5YR 5/6	5YR 8/4	Fine	Pearly	Very Slightly Translucent
167	Treated	N5	10YR 5/4	Very Fine	Pearly	Opaque
168	Heated	5Y 7/2	N6; N7	Fine	Dull	Opaque
169	Heated	5Y 8/1	10YR 8/2	Very Fine	Pearly	Opaque
170	Heated	10YR 6/2	10YR 8/2	Very Fine	Pearly	Opaque
171	Heated	5YR 8/1	N6	Fine	Pearly	Slightly Translucent
172	Heated	5Y 7/2	10YR 8/2; N7	Fine	Dull	Opaque
173	Heated	10YR 8/2	10YR 7/4	Very Fine	Pearly	Opaque
174	Unknown	5Y 7/2	5G 5/2	Very Fine	Waxy	Opaque
175	Heated	10YR 6/2	10YR 7/4	Very Fine	Waxy	Opaque
176	Treated	10YR 8/2	5R 5/4; 5Y 7/2	Fine	Pearly	Very Slightly Translucent

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
142	Fossil Inclusions, Fossil Burrow	Speckles	Galena
143	Fossil Inclusions		Galena
144	Fossil Inclusions, Fossil Burrow, Specks		Galena
145	Fossil Inclusions, Fossil Burrow		Galena
146	Fossil Inclusions, Fossil Burrow		Galena
147	Fossil Vugs, Fossil Burrows		Galena
148	Fossil Inclusions, Fossil Burrow, Specks		Galena
149	Fossil Vugs, Fossil Burrows		Galena
150	Fossil Inclusions, Fossil Burrow		Galena
151	Fossil Inclusions, Fossil Vugs		Burlington
152	Fossil Inclusions, Fossil Burrow	Speckles	Galena
153	Fossil Inclusions, Fossil Burrow	Speckles	Galena
154	Fossil Inclusions, Fossil Burrow		Galena
155	Fossil Inclusions, Fossil Burrow	Speckles	Galena
156	Fossil Inclusions, Fossil Burrow		Galena
157	Fossil Burrow		Unknown
158	Banding, Oolites, Fossil Burrows, Marbling		Burlington
159	Oolites, Speckles		Prairie du Chien
160	Speckles, Mottled		Galena
161	Speckles, Oolite, Mottled		Unknown
162	Oolites, Mottled, Veining	Some Dark Brown Veins Pattern	Prairie du Chien
163	Fossil Burrow, Fossil Vugs, Speckles		Maquoketa
164	Banded, Speckled, Fossil Inclusions, Oolites		Unknown
165	Mottled		Orthoquartzite
166	Oolites, Banded, Vugs		Prairie du Chien
167	Speckled, Mottled, Fossil Burrow		Galena
168	Speckled, Fossil Burrow, Mottled		Galena
169	Fossil Burrow, Speckled, Fossil Inclusion		Burlington
170	Speckles, Mottled, Oolites		Burlington
171	Mottled, Speckled		Burlington
172	Mottled, Inclusion, Fossil Inclusions, Speckled		Unknown
173	Mottled, Speckled	Fossil Inclusion	Burlington
174	Mottled, Speckled		Maquoketa
175	Marbled, Mottled		Galena
176	Speckled, Oolites, Fossil Burrows		Prairie du Chien

Appendix B

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
177	Nellis	Brown	3	Set 2		Complete
178	Nellis	Brown	3			Complete
179	Nellis	Kewaunee Co.	3			Complete
180	Nellis	Brown	3	Set 1		Complete
181	Nellis	Brown	3	Set 1		Complete
182	Nellis	Brown	3	Set 1		Complete
183	Nellis	Allouez, 47BR116	3			Complete
184	Nellis	47BR437, Red Banks	3	Set 1		Complete
185	Nellis	Michicott	3			Complete
186	Nellis	47BR437, Red Banks	3	Set 1		Complete
187	Nellis	Potter, WI	3			Complete
188	Nellis		3			Complete
189	Nellis	47BR437, Red Banks	3	Set 1		Complete
190	Nellis	Brown	3	Set 1		Complete
191	Nellis	Brown	3	Set 1		Complete
192	Nellis	Brown	3	Set 2		Complete
193	Nellis	Brown	3	Set 1		Complete
194	Nellis	Suamico or Two Rivers	3			Complete
195	Nellis	Kewaunnee	3	Set 2		Complete
196	Nellis	Red Banks	3	Set 2		Complete
197	Nellis	Brown	3	Set 2		Complete
198	Nellis	Brown	3	Set 1		Complete
199	Nellis	Brown	3	Set 2		Base Missing
200	Nellis	Brown	3	Set 1		Complete
201	Nellis	Brown	3			Complete
202	Nellis	Howard, WI	3			Complete
203	Nellis	Big Suamico	3	Set 2		Complete
204	Nellis	Duck Creek	3			Complete
205	Nellis	Big Suamico	3	Set 2		Complete
206	Nellis	Suamico	3			Complete
207	Nellis	Borthertown	3			Complete
208	Nellis	Beaver Dam, WI	3			Complete
209	Nellis	Brown	3	Set 2		Base Missing
210	Nellis	Big Suamico	3	Set 2		Complete
211	Nellis	Michicott	3			Complete

Appendix B (contd.)

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
177	93.8	35.3	20.6	14.4	24.1	109.45	107.00	71.18	78.45
178	65.36	N/A	22.7	9.19	20.65	138.45	151.47	94.15	99.9
179	85.96	31.17	26.07	20.12	24	126.53	144.92	92.55	91.95
180	65.4	35.13	19.5	10.4	18.5	104.77	88.27	72.35	75.35
181	71.6	40.76	17.25	14.13	19.98	97.52	93.35	73.80	76.28
182	73.3	35.99	12.03	7.41	14.63	93.97	111.33	65.95	70.67
183	111.66	45.31	23.81	11.11	23.21	104.78	117.12	103.12	104.36
184	59.66	26.9	17.1	15.7	17.79	140.55	129.20	87.32	81.15
185	65.88	22.13	20.93	9.57	20.05	180	180	76.5	74.72
186	52.27	23.88	12.89	7.93	15.19	148.27	121.35	72.80	81.70
187	83.49	30.66	24.67	13.86	25.35	N/A	133.82	N/A	105.83
188	56.14	30.16	13.93	6.12	15.79	107.73	113.62	108.13	110.03
189	56.24	21.94	18.41	12.54	16.58	151.40	136.15	89.12	85.52
190	67.51	30.11	19.48	15.48	22.13	143.00	144.83	78.00	80.40
191	69.56	29.9	13.01	10.4	18.7	123.70	112.60	70.68	71.70
192	61.41	29.02	14.25	11.53	16.13	96.23	105.85	71.50	79.62
193	78.85	31.1	20.55	12.19	22	91.67	154.30	71.00	77.00
194	50.29	25.79	15.2	11.64	17.24	99.98	132.47	101.53	102.25
195	43.18	29.44	14.66	8.36	17.83	116.82	108.52	63.74	66.52
196	50.28	24.56	14.81	N/A	15.84	140.25	140.47	73.35	73.98
197	72.83	29.80	14.26	13.62	16.90	126.03	114.93	78.13	78.03
198	65.04	27.7	14.67	13.06	19.85	125.77	135.33	73.88	68.18
199	N/A	30.68	N/A	N/A	21.30	133.42	127.55	67.53	68.97
200	62.45	27.87	15.59	13.97	18.97	131.88	124.73	76.00	83.13
201	47.65	28.74	11.33	11.93	17.46	124.92	116.3	167.2	11.4
202	71.02	32.54	15.33	12.4	22.28	132.65	106.82	125.03	100.23
203	69.53	38.15	14.34	14.61	22.16	98.68	119.18	80.98	60.80
204	59.79	25.52	12.09	10.08	16.12	94.3	134.72	78.55	114.95
205	44.44	21.75	13.49	14.86	21.98	141.88	157.03	69.07	71.07
206	59.04	28.53	14.37	7.09	21.05	158.6	129.45	113.13	109.27
207	61.84	30.25	13.28	11.98	17.47	129.28	137.8	119.13	102.72
208	73.7	25.82	15.87	9.23	18.5	160.35	136.37	107.53	105.48
209	N/A	25.24	N/A	N/A	16.36	99.60	106.27	73.15	72.70
210	73.46	28.04	20.17	10.41	20.62	105.27	109.90	72.33	79.55
211	81.37	27.05	13.62	10.19	18.55	111.68	119.68	108.9	104.42

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
177	180.63	185.45	10.4	32	Straight	Straight	Straight	Absent
178	232.60	251.37	8.68	16	Slope	Slope	Slope	Absent
179	219.08	236.87	10.12	23	Slope	Slope	Slope	Absent
180	177.12	163.62	10.66	20	Barbed	Barbed	Barbed	Absent
181	171.32	169.63	11.22	26	Barbed	Barbed	Barbed	Absent
182	159.92	182.00	12.54	21	Straight	Barbed	Barbed	Absent
183	207.9	221.48	11.26	45	Straight	Straight	Straight	Absent
184	227.87	210.35	10.39	12	Straight	Straight	Straight	Absent
185	256.5	254.72	7.54	12	Slope	Slope	Slope	Absent
186	221.07	203.05	9.22	10	Straight	Straight	Straight	Absent
187	N/A	239.65	10.72	27	N/A	Straight	Straight	Absent
188	215.86	223.65	10.04	13	Straight	Straight	Straight	Absent
189	240.52	221.67	9.12	11	Slope	Slope	Slope	Absent
190	221.00	225.23	9.94	21	Slope	Slope	Slope	Absent
191	194.38	184.30	10.4	18	Straight	Straight	Straight	Absent
192	167.73	185.47	8.08	13.00	Barbed	Straight	Barbed	Absent
193	162.67	231.30	9.41	20	Slope	Barbed	Barbed	Absent
194	201.51	234.72	11.08	11	Straight	Straight	Straight	Absent
195	180.56	175.04	9.32	7.00	Straight	Straight	Straight	Present
196	213.60	214.45	11.61	10	Slope	Slope	Slope	Absent
197	204.16	192.96	9.28	17.00	Slope	Slope	Slope	Absent
198	199.65	203.51	8.71	16	Straight	Straight	Straight	Absent
199	200.95	196.52	9.72	16.00	Slope	Slope	Slope	Absent
200	207.88	207.86	10.83	17	Slope	Slope	Slope	Absent
201	292.12	127.7	10.48	10	Straight	Straight	Straight	Absent
202	257.68	207.05	40.44	25	Straight	Straight	Straight	Absent
203	179.66	179.98	8.63	20.00	Straight	Straight	Straight	Absent
204	172.85	249.67	7.15	10	Barbed	Straight	Barbed	Absent
205	210.95	228.10	9.87	10.00	Slope	Slope	Slope	Absent
206	271.73	238.72	10.63	16	Slope	Straight	Straight	Absent
207	248.41	240.52	11.02	16	Slope	Straight	Straight	Absent
208	267.88	241.85	10.63	18	Slope	Slope	Slope	Present
209	172.75	178.97	8.44	11.00	Barbed	Straight	Barbed	Absent
210	177.60	189.45	10.57	18.00	Straight	Straight	Straight	Absent
211	220.58	224.1	9.51	24	Straight	Straight	Straight	Absent

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
177	Treated	5Y 8/1	N5	Very Fine	Waxy	Translucent
178	Treated	10YR 6/2	10YR 6/6	Very Fine	Waxy	Opaque
179	Unheated	5PB 3/2; 5PB 7/2	N6	Very Fine	Waxy	Opaque
180	Unheated	5PB 3/2	10YR 6/2	Very Fine	Pearly	Opaque
181	Unheated	5PB 3/2	5YR 4/1	Very Fine	Waxy	Opaque
182	Heated	10YR 6/2	10YR 8/2	Course	Dull	Opaque
183	Heated	10YR 6/2	5Y 7/2	Very Fine	Waxy	Very Slightly Translucent
184	Heated	5Y 7/2	10YR 8/2	Very Fine	Pearly	Very Slightly Translucent
185	Treated	10YR 6/2		Very Course	Waxy	Translucent
186	Treated	10YR 6/2	5YR 7/2	Fine	Pearly	Opaque
187	Treated	5Y 8/1	N7, N6	Fine	Waxy	Opaque
188	Heated	5Y 8/1	N6, N5	Fine	Pearly	Opaque
189	Heated	5Y 7/2	5Y 5/6	Very Fine	Waxy	Opaque
190	Treated	10YR 4/2; 10YR 6/2; 10YR8/2		Fine	Pearly	Opaque
191	Treated	10YR 8/2	10YR 7/4	Very Fine	Waxy	Opaque
192	Unheated	5Y 8/1	N7	Very Fine	Waxy	Opaque
193	Heated	10YR 8/2	10YR 6/2	Course	Pearly	Very Slightly Translucent
194	Heated	10YR 6/2	10YR 8/2	Course	Pearly	Opaque
195	Heated	N6	N8	Fine	Pearly	Opaque
196	Treated	5Y 8/1	N6; N7	Fine	Pearly	Opaque
197	Heated	5Y 8/1	N6	Course	Pearly	Opaque
198	Unheated	N5; 5B 5/1	N8	Fine	Waxy	Opaque
199	Heated	5YR 8/1	N8	Fine	Waxy	Opaque
200	Treated	10YR 8/2	N5; N9; N8	Fine	Pearly	Opaque
201	Treated	10YR 6/2	5 YR 7/2	Fine	Pearly	Opaque
202	Heated	5YR 7/2	5Y 8/1; N5	Fine	Pearly	Opaque
203	Treated	10YR 6/2; N5	5Y 8/1	Very Course	Sugary	Translucent
204	Heated	5Y 8/1	N6	Fine	Pearly	Opaque
205	Treated	10YR 8/2	N6	Fine	Pearly	Opaque
206	Treated	10YR 6/2		Course	Pearly	Opaque
207	Treated	10YR 6/2	10YR 8/2	Course	Pearly	Opaque
208	Heated	10YR 8/2	N7	Course	Dull	Opaque
209	Treated	5Y 7/2	10YR 8/2	Course	Waxy	Opaque
210	Treated	10YR 8/2	5Y 7/2	Fine	Pearly	Opaque
211	Treated	10YR 8/2	N8, N6	Fine	Pearly	Opaque

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
177	Marbled, Banding, Mottled		Unknown
178	Fossil Burrow, Fossil Inclusions		Galena
179	Mottled, Marbled		Maquoketa
180	Marbled, Fossil Inclusions		Maquoketa/ Hornstone
181	Mottled		Galena
182	Speckled		Unknown
183	Mottled, Fossil Inclusions, Very Small Oolites		Unknown
184	Fossil Burrows, Fossil Vugs, Speckles	Light Pink Heat Treatment	Unknown
185	Fossil Burrow		Quartzite
186	Fossil Burrow, Fossil Inclusions	Light Pink Heat Treatment, Black Speckles	Galena
187	Mottled, Marbled, Oolites, Fossil Burrows		Prairie du Chien
188	Mottled, Fossil Inclusions, Fossil Vugs, Fossil Borrow, Speckles		Unknown
189	Fossil Burrow, Very Small Oolites		Prairie du Chien
190	Speckles, Mottled, Fossil Vugs, Fossil Burrow		Burlington
191	Mottled, Fossil Inclusions		Burlington
192	Speckled, Banding, Fossil Inclusions		Burlington
193	Specks, Fossil Burrow, Fossil Inclusion, Oolites		Prairie du Chien
194	Speckles, Fossil Forrow, Mottled		Galena
195	Mottled		Galena
196	Banded, Fossil Inclusions		Burlington
197	Mottled, Vug, Very Small Oolites		Burlington
198	Marbled	Streaking, Marbling	Maquoketa
199	Mottled, Fossil Burrow		Burlington
200	Banding, Fossil Inclusions, Oolites, Fossil Burrows		Prairie du Chien
201	Fossil, Inclusions, Fossil Furrow	Black and White Speckles	Galena
202	Banding, Oolites, Fossil Burrows		Prairie du Chien
203	Mottled		Silicified Sandstone
204	Banding, Oolites, Fossil Burrow, Fossil Inclusion		Prairie du Chien
205	Banding, Marbling, Fossil Burrow		Prairie du Chien
206	Fossil Burrow		Unknown
207	Fossil Burrow, Oolites, Mottled		Unknown
208	Banded, Oolites, Fossil Burrow, Fossil Vugs		Prairie du Chien
209	Banded, Marbled, Speckled, Oolites, Vugs		Prairie du Chien
210	Mottled, Oolites, Fossil Burrow		Prairie du Chien
211	Mottled, Fossil Inclusions, Speckles, Fossil Burrow		Galena

Appendix B

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
212	Nellis	Oconto Co.	3	Set 2		Complete
213	Nellis	Brothertown, WI	3			Complete
214	Nellis	Bay Settlement	3			Complete
215	Nellis	Montello, WI	3			Complete
216	Nellis	Juneau Co.	3			Complete
217	Nellis	Allouez, 47BR116	3	Set 1		Complete
218	Nellis	Duck Creek Brown	3			Complete
219	Nellis	T. of Preble	3			Complete
220	Nellis	Manitowoc	3	Set 2		Complete
221	Nellis	Big Suamico	3	Set 2		Complete
222	Nellis	Rockland	3			Complete
223	Nellis	Rockland	3			Complete
224	Nellis	Suamico	3			Complete
225	UW-Oshkosh	Winnebago	3	Set 1	129	Complete
226	UW-Oshkosh	Winnebago	3	Set 2	131	Complete
227	UW-Oshkosh		3		68	Complete
228	UW-Oshkosh		3		137	Complete
229	UW-Oshkosh	Winnebago	3	Set 1	45	Complete
230	UW-Oshkosh	Winnebago	3	Set 2	136	Complete
231	UW-Oshkosh	Winnebago	3	Set 2	140	Complete
232	UW-Oshkosh	Winnebago	3	Set 2	142	Complete
233	UW-Oshkosh	Winnebago	3	Set 1	56	Complete
234	UW-Oshkosh	Winnebago	3	Set 1	96	Complete
235	UW-Oshkosh	Winnebago	3	Set 1	65	Complete
236	UW-Oshkosh		3		109	Complete
237	UW-Oshkosh		3		111	Complete
238	UW-Oshkosh	Winnebago	3	Set 1	58	Complete
239	UW-Oshkosh	Winnebago	3	Set 1	72	Complete
240	UW-Oshkosh	Winnebago	3	Set 1	87	Complete
241	UW-Oshkosh	Winnebago	3	Set 1	99	Complete
242	UW-Oshkosh	47WN154	3	Set 1	1	Complete
243	UW-Oshkosh	47WS131	3	Set 1	1	Complete
244	UW-Oshkosh	Winnebago	3	Set 2	46	Complete
245	UW-Oshkosh		3		80	Complete
246	UW-Oshkosh	Winnebago	3	Set 2	48	Complete

Appendix B (contd.)

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
212	52.23	27.75	12.61	10.76	18.62	103.60	109.20	77.15	68.78
213	51.07	27.69	15.45	13.81	16.5	105.17	114.28	103.4	103.88
214	75.79	30.35	23.31	11.6	22.86	112.6	137.45	97.87	103.98
215	50.55	28.99	12.54	7.88	15.9	121.72	119.47	118.17	108.92
216	57.75	30.47	17.11	12.14	21.68	142.82	103.53	99.58	105.32
217	69.36	26.53	19.31	12.03	20.62	155.38	124.48	77.47	74.38
218	66.3	27.4	19.02	10.35	19.62	102.92	117.73	101.62	102.35
219	67.95	24.87	15.8	11.95	22.6	91.63	100.78	75.75	62.33
220	91.72	32.37	17.04	16.99	25.35	141.60	166.10	77.58	70.95
221	48.25	26.64	13.04	14.72	18.20	127.12	141.68	74.38	75.17
222	54.83	25.15	14.3	10.52	16.54	138.92	143.43	104.03	103.62
223	81.32	29.42	16.83	12.01	20.37	148.82	135.75	106.1	107.13
224	46.45	24.79	14.84	10.73	23.56	180	180	69.22	65.67
225	57.5	23	15.44	16.5	13.99	140.52	157.12	89.15	80.35
226	73.86	26.58	17.91	19.31	11.95	141.05	153.15	73.92	72.13
227	45.8	21.36	14.52	16.12	5.77	154.6	150.3	107.63	105.3
228	84.64	31.29	19.8	20.37	7.3	166.98	143.78	111.08	99.52
229	81.36	29.13	18.43	20.86	9.9	106.47	136.65	74.00	73.28
230	85.58	31.26	19.54	18.66	5.85	145.83	113.88	70.95	68.18
231	87.9	34.7	26	24.96	9	109.93	109.30	70.73	72.93
232	58.65	26.11	17.59	16.91	9.26	138.37	145.23	70.62	73.42
233	56	27.79	17.74	20.33	7.7	180.00	143.38	61.00	72.83
234	46.55	24.23	14.02	17.16	11.14	140.00	132.00	71.37	70.00
235	62.7	29.21	11.53	20.64	12.82	126.38	147.00	65.00	64.00
236	75.19	26.66	13.4	14.6	11.13	116.1	156.57	103.47	103.68
237	64.15	24.19	14.46	20.08	12.53	167.48	N/A	110	N/A
238	52.34	23.18	14.13	16.59	12.44	134.23	157.57	81.00	79.60
239	62.5	26.62	15.58	13.38	6.84	118.32	125.52	63.92	73.78
240	49.02	21.41	13.03	15.81	8.6	180.00	180.00	69.00	77.00
241	51.9	26.36	19.81	26.37	10.36	180.00	180.00	73.00	73.00
242	56.85	25.72	14.92	17.42	7.53	110.00	180.00	73.93	60.00
243	44.8	22.86	13.95	15.68	8.7	109.65	138.63	74.88	76.40
244	58.09	24.64	17.79	19.34	8.79	123.33	149.95	73.50	79.80
245	94.53	33.11	15.72	17.27	9.62	124.03	121.9	100.43	97.35
246	60.91	24.16	16.64	16.9	8.26	119.68	125.73	81.07	82.43

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
212	180.75	177.98	10.67	12.00	Straight	Straight	Straight	Absent
213	208.57	218.16	11.87	12	Straight	Straight	Straight	Absent
214	210.47	241.43	9.44	19	Straight	Straight	Straight	Absent
215	239.89	228.39	10.07	9	Straight	Straight	Straight	Absent
216	242.4	208.85	9.46	17	Slope	Straight	Straight	Absent
217	232.85	198.86	8.7	17	Slope	Straight	Straight	Absent
218	204.54	220.08	11.38	17	Straight	Straight	Straight	Absent
219	167.38	163.11	12.49	25	Barbed	Barbed	Barbed	Absent
220	219.18	237.05	7.87	26.00	Slope	Slope	Slope	Absent
221	201.50	216.85	7.28	9.00	Slope	Slope	Slope	Absent
222	242.95	247.05	11.67	12	Slope	Slope	Slope	Absent
223	254.92	242.88	11.39	23	Slope	Slope	Slope	Absent
224	249.22	245.67	11.67	11	Slope	Slope	Slope	Absent
225	229.67	237.47	9.25	10	Slope	Slope	Slope	Absent
226	214.97	225.28	11.89	18	Slope	Slope	Slope	Absent
227	262.23	255.60	10.6	7	Slope	Slope	Slope	Absent
228	278.06	243.30	9.97	23	Slope	Slope	Slope	Absent
229	180.47	209.93	10.72	18	Straight	Straight	Straight	Absent
230	216.78	182.06	10.58	27	Slope	Straight	Straight	Absent
231	180.66	182.23	7.59	20	Straight	Straight	Straight	Absent
232	208.99	218.65	8.41	11	Slope	Slope	Slope	Absent
233	241.00	216.21	10.9	16	Slope	Straight	Straight	Absent
234	211.37	202.00	9.79	8	Straight	Straight	Straight	present
235	191.38	211.00	10.42	21	Straight	Straight	Straight	Present
236	219.57	260.25	10.32	17	Slope	Slope	Slope	Absent
237	277.48	N/A	9.84	15	Slope	N/A	Slope	Absent
238	215.23	237.17	10.23	10	Slope	Straight	Straight	Absent
239	182.24	199.30	10.38	14	Barbed	Straight	Barbed	Absent
240	249.00	257.00	9.19	8	Slope	Slope	Slope	Present
241	253.00	253.00	10.32	12	Slope	Slope	Slope	Absent
242	183.93	240.00	11.19	3	Slope	Straight	Straight	Absent
243	184.53	215.03	7.45	8	Straight	Straight	Straight	Present
244	196.83	229.75	10.15	12	Slope	Slope	Slope	Absent
245	224.46	219.25	10.86	30	Straight	Straight	Straight	Absent
246	200.75	208.16	8.9	12	Slope	Slope	Slope	Absent

7

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
212	Heated	10YR 6/2	10YR 8/2	Course	Pearly	Opaque
213	Heated	10YR 6/2	N4; 10YR 8/2	Fine	Waxy	Opaque
214	Heated	10YR 8/2	N6	Fine	Pearly	Opaque
215	Heated	10YR 6/2	10YR 8/2	Fine	Pearly	Opaque
216	Treated	N6	N5; 5Y 7/2	Fine	Waxy	Opaque
217	Heated	N4	5B 5/1	Fine	Pearly	Opaque
218	Heated	5Y 7/2	5YR 8/1	Fine	Dull	Opaque
219	Heated	N6	N7	Fine	Pearly	Opaque
220	Unheated	N4; 5B 5/1		Fine	Waxy	Opaque
221	Treated	10YR 8/2	10YR 6/2	Course	Pearly	Opaque
222	Treated	10YR 8/2	N9; 5Y 7/2	Course	Pearly	Opaque
223	Heated	10YR 8/2	5Y 7/2	Course	Pearly	Very Slightly Translucent
224	Treated	5Y 7/2	N5; 5Y 6/1	Fine	Waxy	Opaque
225	Treated	N2	10YR 6/2	Med Fine	Pearly	Opaque
226	Treated	5Y 7/2		Med Fine	Dull	Opaque
227	Heated	5Y 7/2	10YR 4/2	Med Fine	Pearly	Opaque
228	Treated	10YR 8/2	10YR 6/6	Fine	Silky	Slightly Translucent
229	Treated	10YR 8/2	10YR 6/2	Fine	Silky	Opaque
230	Treated	5Y 8/1	10YR 6/2	Med Fine	Pearly	Opaque
231	Burnt	N4	N2	Fine	Glassy	Opaque
232	Unknown	N1	5P 4/2	Fine	Glassy	Opaque
233	Treated	10YR 4/2, 5Y 7/2, 5YR 4/4		Fine	Glassy	Opaque
234	Treated	10R 7/4, 5YR 5/2, 5Y7/2		Fine	Pearly	Opaque
235	Treated	10YR 8/2; 10YR 6/2; 5YR 7/2		Med Fine	Pearly	Opaque
236	Treated	10YR 8/2	10YR 5/4	Med Fine	Glassy	Slight Translucent
237	Unheated	10YR 4/2		Course	Dull	Opaque
238	Heated	5YR 8/1	10YR 6/2	Fine	Silky	Opaque
239	Heated	N3	5YR 5/2	Course	Dull	Opaque
240	Burnt	10YR 8/2	N2	Med Fine	Silky	Opaque
241	Heated	10YR 6/2	10YR 8/2	Fine	Silky	Opaque
242	Unheated	5YR 2/2	5YR 3/4	Fine	Glassy	Translucent
243	Heated	5Y 7/2	10YR 6/6	Med Fine	Dull	Opaque
244	Treated	5Y 7/2	10YR 6/2	Med Fine	Pearly	Opaque
245	Unheated	N4	N3	Med Fine	Pearly	Opaque
246	Treated	10YR 5/4	10YR 6/2	Fine	Silky	Opaque

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
212	Fossil Burrow, Speckled		Unknown
213	Mottled, Speckled		Unknown
214	Mottled, Speckled, Fossil Burrow, Fossil Vugs		Burlington
215	Oolites		Prairie du Chien
216	Mottled, Fossil Vugs, Fossil Burrow		Galena
217	Fossil Burrow, Fossil Inclusions		Moline Chert
218	Speckles, Oolites		Burlington
219	Fossil Burrow, Fossil Vugs, Possible Oolites		Unknown
220	Fossil Inclusions		Galena
221	Banding, Fossil Inclusions, Oolites		Prairie du Chien
222	Mottled, Fossil Inclusions, Oolites		Prairie du Chien
223	Oolites, Fossil Inclusions, Speckles, Fossil Burrow		Prairie du Chien
224	Fossil Burrow, Oolites, Mottled		Prairie du Chien
225	Inclusions		Unknown
226	Fossil Burrows, Oolites		Prairie du Chien
227			Unknown
228		Oolites, Black Speckles, Inclusions	Burlington
229	Oolites, Black Speckles , Fossil Inclusions		Prairie du Chien
230	Fossil, Burrow, Fossils, White Speckles, Specks		Burlington
231	Few White Specks		Galena
232			Unknown
233	Banded, Speckles, Fossil Inclusions		Unknown
234	Speckles		Galena
235	Inclusions, Oolites, Fossil Burrows		Prairie du Chien
236		Oolites, Fossil Inclusion, Fossil Burrow	Unknown
237		Small White Specks	Unknown
238	Fossil, Burrow, Oolites		Prairie du Chien
239	Banded		Unknown
240	Oolites, Speckles		Prairie du Chien
241	Oolites, Fossil Inclusion, Fossil Burrow		Prairie du Chien
242		Fossils	Unknown
243		Speckles, Inclusions	Galena
244	Banded, Oolites, Speckles		Prairie du Chien
245			Unknown
246	Oolites, Fossil Burrow		Prairie du Chien

Appendix B

Reference Information						
Point Number	Repository	Site Number/ County	Region	Sample	Artifact Identification	Complete/Broken
247	UW-Oshkosh	Winnebago	3	Set 2	66	Complete
248	UW-Oshkosh	Winnebago	3	Set 2	74	Complete
249	UW-Oshkosh	Winnebago	3	Set 2	64	Complete
250	UW-Oshkosh	Winnebago	3	Set 1	40	Complete
251	UW-Oshkosh	Winnebago	3	Set 1	63	Complete
252	UW-Oshkosh	Winnebago	3	Set 1	49	Complete
253	UW-Oshkosh	Winnebago	3	Set 1	70	Complete
254	UW-Oshkosh	Winnebago	3	Set 1	55	Complete
255	UW-Oshkosh	47WN9	3	Set 2	1	Complete
256	UW-Oshkosh	47WN9	3	Set 2	2	Complete

Appendix B (contd.)

Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)									
Point Number	Max Length	Max Width (at shoulders)	Stem Length	Stem Width Proximal	Stem Width Distal	Left Shoulder No	Right Shoulder No	Left PSA	Right PSA
247	79.66	29.41	19.05	21.02	14.79	112.12	106.70	84.17	77.17
248	45.81	22.26	8.89	13.73	7.97	160.33	136.05	70.80	68.43
249	51.15	25.3	14.37	17.34	7.18	116.08	113.53	62.82	64.60
250	51.28	23.84	13.08	16.77	8.63	180.00	180.00	75.00	75.00
251	55.03	28.79	16.72	15.68	7.27	98.72	126.27	81.71	90.80
252	55.93	25.23	13.72	13.95	12.45	130.70	133.42	77.50	84.30
253	52.88	18.4	15.69	14.18	9.87	180.00	180.00	75.00	80.00
254	66.77	29.94	17.15	20.68	9	122.17	107.80	75.00	76.70
255	46.19	25.32	10.98	14.35	8.99	130.80	132.52	62.82	71.07
256	58.66	20.66	10.76	13.73	10.23	121.10	N/A	83.18	N/A

Appendix B (contd.)

Metric Measurements mm					Style			Cortex
Point Number	Left DSA	Right DSA	Max Thickness	Weight (g)	Left	Right	Overall	Present / Absent
247	196.29	183.87	8.85	21	Straight	Straight	Straight	Absent
248	231.13	204.48	10.82	8	Slope	Slope	Slope	Absent
249	178.90	178.13	10.06	11	Straight	Straight	Straight	Absent
250	255.00	255.00	11.82	13	Slope	Slope	Slope	Absent
251	180.43	217.07	11.3	12	Straight	Straight	Straight	Absent
252	208.20	217.72	9.06	10	Straight	Straight	Straight	Absent
253	255.00	260.00	11.13	8	Slope	Slope	Slope	Absent
254	197.17	184.50	10.24	18	Straight	Straight	Straight	Absent
255	193.62	203.59	9.62	9	Slope	Slope	Slope	Absent
256	204.28	N/A	11.01	9	Slope	N/A	Slope	Absent

Appendix B (contd.)

	Heat Treated	Raw Material Munsell Rock Color		Description of Raw Material		
Point Number	Unheated, Heat Treated, Heated, Burnt, and Unknown	Primary Color	Secondary Color	Texture	Luster	Translucent
247	Unheated	N3	5B 7/1	Fine	Glassy	Opaque
248	Heated	10YR 8/2	10YR 4/2	Fine	Pearly	Opaque
249	Burnt	10YR 6/2	10YR 2/2	Fine	Silky	Opaque
250	Burnt	10YR 6/2	10YR 4/2	Fine	Silky	Opaque
251	Heated	10YR 8/2	10R 6/6; 10YR 6/2	Med Fine	Pearly	Opaque
252	Burnt	N1	5YR 8/4; 5R 4/6	Fine	Silky	Opaque
253	Treated	10YR 6/2	10YR 8/2	Fine	Silky	Opaque
254	Unheated	10YR 5/4	5YR 3/4	Fine	Silky	Opaque
255	Treated	10YR 6/2	10YR 8/2	Fine	Silky	Opaque
256	Unheated	5Y 7/2	10YR 6/2	Med Fine	Pearly	Opaque

Appendix B (contd.)

	Description of Raw Material		Identified
Point Number	Minerals and Fossils	Distinguishing Characteristics	Raw Material
247	Banding		Moline
248	Speckles		Burlington
249	Fossil Burrow, Fossil Inclusions		Burlington
250		Fossil Burrow, Speckles	Burlington
251	Oolites, Fossil Borrows		Prairie du Chien
252			Unknown
253		Oolites	Galena
254		Speckles, Fossil Inclusions	Unknown
255	Fossil Burrow, Fossil Inclusions		Prairie du Chien
256	Speckles		Burlington

Appendix C: Data Set 1

		Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)													Style
Point Number	Region	ML	MW	ST	DSW	PSW	Left NO	Right NO	Left PSA	Right PSA	Left DSA	Right DSA	MT	g	Overall
70	1	66.05	32.28	13.03	18.59	14.58	123.92	120.03	69.85	70.67	193.77	190.70	10.85	18.10	Straight
71	1	47.80	20.18	14.17	15.49	8.81	155.93	180.00	75.90	75.67	231.83	255.67	9.57	7.90	Slope
72	1	49.73	17.08	16.16	11.62	4.43	163.98	160.00	65.17	75.42	229.15	235.42	10.02	7.60	Straight
74	1	46.98	20.58	12.40	13.38	4.63	156.72	148.92	72.93	77.12	229.65	226.04	6.86	5.40	Straight
77	1	51.41	28.10	13.64	15.00	6.25	139.93	134.58	62.12	63.72	202.05	198.30	9.71	10.70	Straight
5	1	52.55	26.90	11.00	13.45	8.63	119.32	132.70	76.22	73.15	195.54	205.85	12.80	11.95	Straight
6	1	30.64	16.70	7.35	12.00	8.35	145.40	156.47	75.77	73.27	221.17	229.74	6.05	2.83	Slope
11	1	49.40	19.90	16.20	10.20	6.40	140.00	128.00	69.98	81.18	209.98	209.18	8.30	7.30	Straight
12	1	47.50	25.70	20.00	20.30	11.60	180.00	147.42	70.95	76.63	250.95	224.05	10.96	8.85	Straight
13	1	88.60	27.12	25.70	23.40	10.10	127.98	145.73	84.07	80.78	212.05	226.51	8.40	17.98	Slope
14	1	43.09	22.24	10.52	16.60	10.60	180.00	158.58	73.73	77.62	253.73	236.20	9.25	8.33	Slope
17	1	73.80	32.90	16.80	17.80	14.00	110.83	121.85	78.97	78.88	189.80	200.73	10.67	18.39	Straight
18	1	50.20	22.80	7.25	16.10	11.80	122.55	127.08	67.68	59.73	190.23	186.81	6.40	7.09	Straight
19	1	50.80	24.40	13.80	16.70	10.90	156.42	153.60	79.67	76.67	236.09	230.27	7.70	7.80	Slope
20	1	77.60	20.50	20.70	11.40	7.00	163.08	110.72	63.40	72.63	226.48	183.35	10.50	11.80	Straight
22	1	66.50	24.90	14.40	15.60	8.30	80.42	141.35	74.88	74.93	155.30	216.28	9.30	15.43	Barbed
24	1	36.60	18.30	9.10	9.70	6.70	140.73	114.40	68.70	66.83	209.43	181.23	7.70	3.40	Straight
27	1	48.60	20.50	11.80	13.80	7.60	146.82	123.75	74.43	75.53	221.25	199.28	7.40	6.30	Straight
30	1	81.20	38.50	25.20	32.70	14.90	180.00	180.00	71.65	69.77	251.65	249.77	16.50	41.80	Slope
31	1	49.80	31.30	21.90	20.20	8.50	129.10	127.85	74.42	72.08	203.52	199.93	9.30	12.90	Straight

32	1	55.30	22.80	13.70	13.70	7.30	138.58	123.53	72.73	65.77	211.31	189.30	10.30	10.57	Straight
33	1	61.60	25.60	15.00	20.10	10.70	180.00	142.65	67.83	74.38	247.83	217.03	10.80	11.90	Straight
35	1	49.50	21.60	10.40	8.20	6.80	113.65	117.58	80.98	78.04	194.63	195.62	9.50	5.92	Straight
36	1	44.20	21.80	12.45	16.07	9.07	132.33	139.10	69.92	70.18	202.25	209.28	11.20	9.75	Straight
38	1	57.10	31.20	11.80	15.20	8.90	116.50	128.33	68.58	72.28	185.08	200.61	8.10	11.20	Straight
39	1	57.80	25.20	14.00	14.40	7.00	108.67	136.85	72.00	76.00	180.67	212.85	8.30	8.65	Straight
40	1	60.00	27.20	17.90	14.20	12.90	160.65	145.70	85.80	86.82	246.45	232.52	12.00	13.50	Straight
41	1	51.60	28.40	11.40	15.20	7.30	135.97	156.36	72.82	66.43	208.79	222.79	11.10	12.13	Straight
42	1	55.70	23.70	11.80	12.20	6.40	88.20	96.49	76.70	71.73	164.90	168.22	8.70	9.15	Barbed
44	1	50.80	28.30	12.30	20.10	9.60	142.68	150.68	52.25	65.53	194.93	216.21	9.40	9.50	Straight
45	1	69.10	28.60	16.90	21.30	8.70	99.60	122.40	67.20	71.07	166.80	193.47	9.00	18.06	Straight
46	1	62.30	26.80	10.60	16.50	11.40	133.95	106.95	70.75	64.08	204.70	171.03	11.40	16.79	Barbed
47	1	47.30	25.90	13.00	15.60	8.60	136.03	160.23	60.75	65.38	196.78	225.61	9.40	8.82	Straight
48	1	49.10	24.15	12.60	15.10	9.00	127.27	180.00	70.95	69.25	198.22	249.25	7.80	7.50	Straight
49	1	43.80	22.10	13.90	16.80	8.50	80.17	86.71	68.08	68.37	148.25	155.08	10.30	7.60	Barbed
51	1	43.40	25.20	14.40	15.90	7.50	122.20	153.85	72.68	61.57	194.88	215.42	10.20	8.50	Straight
53	1	37.90	23.00	11.10	14.20	7.50	147.73	134.33	65.78	74.02	213.51	208.35	10.10	7.70	Straight
54	1	40.10	22.10	13.20	13.60	7.60	128.12	137.95	81.82	71.35	209.94	209.30	7.70	5.50	Straight
55	1	44.60	20.60	13.40	14.00	6.70	139.20	156.57	75.70	65.73	214.90	222.30	9.30	7.68	Straight
56	1	47.90	18.80	15.10	14.60	4.80	154.77	180.00	72.13	74.80	226.90	254.80	8.20	6.30	Straight
137	2	41.70	18.25	10.26	12.73	5.83	165.08	180.00	73.75	69.00	238.83	249.00	7.96	5.00	Straight
140	2	53.16	22.81	13.00	16.65	8.72	136.30	138.37	69.38	75.63	205.68	214.00	8.97	9.00	Straight

141	2	40.04	24.20	13.33	15.57	11.83	117.12	136.83	76.72	78.12	193.84	214.95	6.97	5.00	Straight
142	2	82.48	37.85	16.11	25.98	16.97	165.48	163.18	65.00	74.37	230.48	237.55	17.90	41.00	Slope
143	2	50.82	28.35	17.54	20.53	10.12	113.42	115.18	77.27	80.12	190.69	195.30	11.06	14.00	Straight
144	2	37.27	20.25	8.20	11.10	7.66	136.00	143.93	61.72	66.40	197.72	210.33	7.65	4.00	Straight
153	2	64.54	32.45	14.75	18.83	7.64	136.43	126.17	66.35	60.37	202.78	186.54	11.51	17.00	Straight
154	2	41.70	21.65	14.02	14.58	9.27	106.67	100.00	73.00	79.00	179.67	179.00	10.08	9.00	Straight
155	2	55.50	23.18	10.27	14.49	8.80	95.10	99.65	67.10	68.83	162.00	167.28	12.49	11.00	Barbed
65	2	45.40	25.66	12.49	16.54	11.10	142.58	126.53	70.80	76.65	213.38	203.18	11.39	10.30	Straight
66	2	38.30	21.58	14.69	19.46	15.32	145.50	150.00	83.27	88.65	228.77	238.65	10.59	6.80	Straight
78	2	32.30	23.43	14.38	19.00	12.53	180.00	180.00	64.00	66.00	244.00	246.00	9.66	6.60	Slope
79	2	41.73	21.79	12.50	16.89	7.49	180.00	180.00	71.00	67.00	251.00	247.00	6.58	6.20	Slope
93	2	79.49	33.97	14.42	22.39	14.20	150.00	130.00	72.77	75.78	222.77	205.78	11.43	28.50	Straight
94	2	55.51	23.20	11.46	15.55	7.58	167.00	126.45	73.97	83.00	240.97	209.45	9.78	11.80	Straight
95	2	40.51	24.50	15.55	17.59	9.96	154.45	127.87	74.33	75.50	228.78	203.37	9.33	7.60	Straight
96	2	49.90	27.25	11.62	12.44	7.37	151.27	180.00	67.48	50.00	218.75	230.00	8.80	10.00	Straight
107	2	46.83	29.91	10.94	16.89	10.07	160.73	157.87	70.42	68.37	231.15	226.24	7.67	10.40	Straight
108	2	37.62	23.76	11.35	14.40	7.49	128.82	149.83	75.38	67.62	204.20	217.45	8.60	5.80	Straight
113	2	43.23	23.38	9.79	15.70	10.66	133.58	137.45	70.85	60.40	204.43	197.85	10.58	8.80	Straight
116	2	70.03	26.40	16.39	18.92	8.45	137.45	157.07	71.72	75.80	209.17	232.87	12.12	18.30	Straight
117	2	48.88	29.97	13.99	19.93	10.33	159.50	141.38	69.53	70.00	229.03	211.38	11.10	12.80	Straight
118	2	45.42	24.25	17.65	17.26	9.71	131.32	150.55	71.17	67.53	202.49	218.08	8.19	6.30	Straight
119	2	42.28	26.91	14.06	17.18	10.12	147.20	138.60	75.37	87.50	222.57	226.10	7.92	7.70	Straight

120	2	58.25	24.76	14.52	14.60	5.96	134.22	157.52	71.55	68.88	205.77	226.40	10.64	11.00	Straight
121	2	57.95	27.81	17.04	20.06	16.95	160.00	69.78	136.18	77.47	296.18	147.25	8.95	11.50	Barbed
122	2	38.12	21.13	9.78	12.07	7.27	107.78	118.60	77.90	81.55	185.68	200.15	9.42	6.30	Straight
123	2	55.01	25.60	12.78	16.87	8.25	150.18	180.00	70.45	60.00	220.63	240.00	9.50	12.40	Straight
124	2	52.97	24.80	13.01	18.52	14.74	155.25	156.05	62.67	62.87	217.92	218.92	10.73	11.70	Straight
125	2	49.98	20.66	11.26	15.00	9.75	153.48	134.55	75.92	78.05	229.40	212.60	10.77	6.50	Straight
127	2	58.23	28.60	11.21	17.60	10.11	154.27	150.00	70.42	79.92	224.69	229.92	12.10	11.90	Straight
131	2	41.32	17.08	12.74	11.61	10.03	157.83	139.05	80.62	79.25	238.45	218.30	8.95	7.70	Straight
133	2	43.27	21.26	8.35	13.94	9.91	151.20	143.68	84.37	76.05	235.57	219.73	9.05	7.60	Straight
134	2	33.49	17.81	9.20	11.35	8.10	150.58	146.60	71.12	81.90	221.70	228.50	9.16	4.40	Straight
135	2	79.79	33.26	17.58	18.30	12.27	85.72	118.52	70.07	79.20	157.12	197.72	11.76	24.20	Barbed
136	2	57.41	35.63	17.88	21.11	16.55	127.00	122.00	77.23	80.83	204.23	202.83	10.47	17.00	Straight
58	2	41.70	23.50	14.30	16.90	6.90	180.00	180.00	64.00	67.00	244.00	247.00	10.30	7.70	Slope
59	2	48.10	21.40	12.70	17.40	7.20	180.00	180.00	72.00	65.00	252.00	245.00	7.80	5.50	Slope
60	2	55.90	24.70	11.80	15.10	3.40	132.42	120.83	71.00	64.00	203.42	184.83	11.10	12.13	Straight
61	2	51.50	25.20	11.90	16.10	8.60	138.20	180.00	70.35	68.00	208.55	248.00	10.60	7.60	Straight
167	3	78.35	35.80	20.58	20.10	14.20	125.82	123.62	80.35	81.25	206.18	204.73	11.40	28.00	Straight
169	3	76.94	34.01	11.09	17.20	8.70	124.68	100.17	66.03	67.73	190.47	148.77	10.20	23.00	Barbed
175	3	81.70	32.70	21.20	19.80	11.90	120.00	121.00	80.30	78.08	199.73	198.12	11.40	27.00	Straight
180	3	65.40	35.13	19.50	18.50	10.40	104.77	88.27	72.35	75.35	177.12	163.62	10.66	20.00	Barbed
181	3	71.60	40.76	17.25	19.98	14.13	97.52	93.35	73.80	76.28	171.32	169.63	11.22	26.00	Barbed
182	3	73.30	35.99	12.03	14.63	7.41	93.97	111.33	65.95	70.67	159.92	182.00	12.54	21.00	Barbed

184	3	59.66	26.90	17.10	17.79	8.82	140.55	129.20	87.32	81.15	227.87	210.35	10.39	12.00	Straight
186	3	52.27	23.88	12.89	15.19	7.93	148.27	121.35	72.80	81.70	221.07	203.05	9.22	10.00	Straight
189	3	56.24	21.94	18.41	16.58	12.54	151.40	136.15	89.12	85.52	240.52	221.67	9.12	11.00	Slope
190	3	67.51	30.11	19.48	22.13	15.48	143.00	144.83	78.00	80.40	221.00	225.23	9.94	21.00	Slope
191	3	69.56	29.90	13.01	18.70	10.40	123.70	112.60	70.68	71.70	194.38	184.30	10.40	18.00	Straight
193	3	78.85	31.10	20.55	22.00	12.19	91.67	154.30	71.00	77.00	162.67	231.30	9.41	20.00	Barbed
198	3	65.04	27.70	14.67	19.85	13.06	125.77	135.33	73.88	68.18	199.65	203.51	8.71	16.00	Straight
200	3	62.45	27.87	15.59	18.97	13.97	131.88	124.73	76.00	83.13	207.88	207.86	10.83	17.00	Slope
217	3	69.36	26.53	19.31	20.62	12.03	155.38	124.48	77.47	74.38	232.85	198.86	8.70	17.00	Straight
81	3	36.14	26.48	14.17	17.80	8.03	124.00	120.33	77.78	73.93	201.78	194.26	7.29	5.50	Straight
82	3	47.08	21.60	16.69	13.75	12.19	90.00	147.00	80.38	82.67	170.38	229.67	10.77	7.50	Barbed
83	3	47.05	31.52	15.06	19.54	11.68	120.88	80.25	72.62	78.43	193.50	158.68	9.75	10.50	Barbed
86	3	44.24	20.62	13.91	12.97	8.01	152.22	159.25	81.00	71.48	233.22	230.73	10.83	7.70	Slope
87	3	33.73	24.31	9.80	14.15	8.60	131.62	135.42	80.00	75.55	211.62	210.97	8.36	5.80	Straight
88	3	46.73	24.22	16.08	14.77	9.40	127.42	104.88	77.00	93.00	204.42	197.88	7.60	7.40	Straight
89	3	36.02	23.96	13.39	14.32	9.58	123.00	120.00	81.75	84.64	204.75	204.64	5.86	4.80	Straight
84	3	33.98	19.82	9.20	13.37	9.37	158.62	129.68	58.92	76.58	217.54	206.26	9.56	5.10	Straight
85	3	43.67	24.97	12.13	17.18	10.25	135.00	125.00	64.23	61.85	199.23	186.85	8.39	7.70	Straight
225	3	57.50	23.00	15.44	16.50	13.99	140.52	157.12	89.15	80.35	229.67	237.47	9.25	10.00	Slope
229	3	81.36	29.13	18.43	20.86	9.90	106.47	136.65	74.00	73.28	180.47	209.93	10.72	18.00	Straight
233	3	56.00	27.79	17.74	20.33	7.70	180.00	143.38	61.00	72.83	241.00	216.21	10.90	16.00	Straight
234	3	46.55	24.23	14.02	17.16	11.14	140.00	132.00	71.37	70.00	211.37	202.00	9.79	8.00	Straight

235	3	62.70	29.21	11.53	20.64	12.82	126.38	147.00	65.00	64.00	191.38	211.00	10.42	21.00	Straight
238	3	52.34	23.18	14.13	16.59	12.44	134.23	157.57	81.00	79.60	215.23	237.17	10.23	10.00	Straight
239	3	62.50	26.62	15.58	13.38	6.84	118.32	125.52	63.92	73.78	182.24	199.30	10.38	14.00	Barbed
240	3	49.02	21.41	13.03	15.81	8.60	180.00	180.00	69.00	77.00	249.00	257.00	9.19	8.00	Slope
241	3	51.90	26.36	19.81	26.37	10.36	180.00	180.00	73.00	73.00	253.00	253.00	10.32	12.00	Slope
242	3	56.85	25.72	14.92	17.42	7.53	110.00	180.00	73.93	60.00	183.93	240.00	11.19	3.00	Straight
243	3	44.80	22.86	13.95	15.68	8.70	109.65	138.63	74.88	76.40	184.53	215.03	7.45	8.00	Straight
250	3	51.28	23.84	13.08	16.77	8.63	180.00	180.00	75.00	75.00	255.00	255.00	11.82	13.00	Slope
251	3	55.03	28.79	16.72	15.68	7.27	98.72	126.27	81.71	90.80	180.43	217.07	11.30	12.00	Straight
252	3	55.93	25.23	13.72	13.95	12.45	130.70	133.42	77.50	84.30	208.20	217.72	9.06	10.00	Straight
253	3	52.88	18.40	15.69	14.18	9.87	180.00	180.00	75.00	80.00	255.00	260.00	11.13	8.00	Slope
254	3	66.77	29.94	17.15	20.68	9.00	122.17	107.80	75.00	76.70	197.17	184.50	10.24	18.00	Straight

Appendix D: Data Set 2

		Metric Measurements mm (*incomplete measurement; ~extrapolated measurement)													Style	Identified
Point Number	Region	ML	MW	ST	DSW	PSW	Left NO	Right NO	Left PSA	Right PSA	Left DSA	Right DSA	MT	g	Overall	Raw Material
25	1	53.8	23.57	17.1	19.8	11	155.00	154.00	71.00	77.00	226.00	231.00	8.9	10.6	Slope	Baraboo Quartzite
32	1	55.30	22.80	13.70	13.70	7.30	138.58	123.53	72.73	65.77	211.31	189.30	10.30	10.57	Straight	Burlington
33	1	61.60	25.60	15.00	20.10	10.70	180.00	142.65	67.83	74.38	247.83	217.03	10.80	11.90	Straight	Burlington
34	1	53.3	22.6	11.5	17.7	9.9	180.00	180.00	70.00	72.00	250.00	252.00	7.3	7.4	Slope	Burlington
38	1	57.10	31.20	11.80	15.20	8.90	116.50	128.33	68.58	72.28	185.08	200.61	8.10	11.20	Straight	Burlington
39	1	57.80	25.20	14.00	14.40	7.00	108.67	136.85	72.00	76.00	180.67	212.85	8.30	8.65	Straight	Burlington
40	1	60.00	27.20	17.90	14.20	12.90	160.65	145.70	85.80	86.82	246.45	232.52	12.00	13.50	Straight	Burlington
56	1	47.90	18.80	15.10	14.60	4.80	154.77	180.00	72.13	74.80	226.90	254.80	8.20	6.30	Straight	Burlington
62	1	56.33	23.22	13.78	17.55	8.66	155.00	162.00	69.00	72.00	224.00	234.00	12.19	13.5	Slope	Burlington
72	1	49.73	20.18	14.17	15.49	8.81	160.00	180.00	75.90	75.67	235.90	255.67	9.57	7.90	Slope	Burlington
73	1	44.98	22.90	15.09	15.50	8.70	135.00	148.00	70.00	71.00	205.00	219.00	8.43	6.50	Slope	Burlington
15	1	53.4	25.1	N/A	16.3	N/A	149.00	168.00	71.00	70.00	220.00	238.00	8.8	9.59	Slope	Burlington
16	1	48.8	21.9	N/A	10.3	N/A	151.00	148.00	80.00	71.00	231.00	219.00	9.85	7.2	Slope	Burlington
20	1	77.6	20.5	20.7	11.4	7	130.00	158.00	83.00	75.00	213.00	233.00	10.5	11.8	Slope	Burlington
67	1	~ 20.00	29.09	13.19	15.98	8.7	108.00	116.00	73.00	64.00	181.00	180.00	N/A	N/A	Straight	Galena
68	1	42.72	23.22	12.78	17.82	9.56	155.00	139.00	70.00	66.00	225.00	205.00	9.37	7.5	Slope	Galena
70	1	66.05	32.28	13.03	18.59	14.58	123.92	120.03	69.85	70.67	193.77	190.70	10.85	18.10	Straight	Galena
7	1	N/A	26.58	17.1	19.68	9.5	107.00	102.00	73.00	79.00	180.00	181.00	10.3	8.88	Straight	Galena

17	1	73.80	32.90	16.80	17.80	14.00	110.83	121.85	78.97	78.88	189.80	200.73	10.67	18.39	Straight	Galena
23	1	44.7	22.4	11.6	15.7	7.4	109.00	139.00	72.00	65.00	181.00	204.00	6.4	5.85	Straight	Galena
24	1	36.60	18.30	9.10	9.70	6.70	140.73	114.40	68.70	66.83	209.43	181.23	7.70	3.40	Straight	Galena
25	1	43.8	19.6	9.6	11.6	6.8	140.00	112.00	68.00	66.00	208.00	178.00	8.8	6.17	Straight	Galena
37	1	58.8	25.7	12.1	13.9	7.1	110.00	139.00	70.00	71.00	180.00	210.00	12.1	13.6	Straight	Galena
44	1	50.80	28.30	12.30	20.10	9.60	142.68	150.68	52.25	65.53	194.93	216.21	9.40	9.50	Straight	Galena
45	1	69.10	28.60	16.90	21.30	8.70	99.60	122.40	67.20	71.07	166.80	193.47	9.00	18.06	Straight	Galena
49	1	43.80	22.10	13.90	16.80	8.50	80.17	86.71	68.08	68.37	148.25	155.08	10.30	7.60	Barbed	Galena
50	1	49.6	22.9	8	13.1	5.9	120.00	116.00	61.00	64.00	181.00	180.00	7.9	8.03	Straight	Galena
51	1	43.40	25.20	14.40	15.90	7.50	122.20	153.85	72.68	61.57	194.88	215.42	10.20	8.50	Straight	Galena
52	1	47.7	21.3	11.4	13.5	5.4	112.00	143.00	65.00	69.00	177.00	212.00	10.5	8.82	Straight	Galena
53	1	37.90	23.00	11.10	14.20	7.50	147.73	134.33	65.78	74.02	213.51	208.35	10.10	7.70	Straight	Galena
55	1	44.60	20.60	13.40	14.00	6.70	139.20	156.57	75.70	65.73	214.90	222.30	9.30	7.68	Straight	Galena
69	1	N/A	27	12.88	15.27	11.87	115.00	109.00	77.00	79.00	192.00	188.00	N/A	N/A	Straight	Galena
71	1	47.80	17.08	16.16	11.62	4.43	153.00	160.00	67.00	75.42	220.00	235.42	10.02	7.60	Straight	Galena
74	1	46.98	20.58	12.40	13.38	4.63	156.72	148.92	72.93	77.12	229.65	226.04	6.86	5.40	Slope	Galena
76	1	N/A	23.21	20.77	13.99	5.53	131.00	141.00	71.00	72.00	202.00	213.00	N/A	N/A	Straight	Galena
75	1	N/A	24.26	14.23	15.75	8.88	125.00	118.00	74.00	78.00	199.00	196.00	N/A	N/A	Straight	Maquoketa
54	1	40.10	22.10	13.20	13.60	7.60	128.12	137.95	81.82	71.35	209.94	209.30	7.70	5.50	Straight	Maquoketa
57	1	49.5	13.7	15	12.5	4.2	180.00	180.00	71.00	72.00	251.00	252.00	11.75	6.92	Slope	Maquoketa
47	1	47.30	25.90	13.00	15.60	8.60	136.03	160.23	60.75	65.38	196.78	225.61	9.40	8.82	Straight	Moline
48	1	49.10	24.15	12.60	15.10	9.00	127.27	180.00	70.95	69.25	198.22	249.25	7.80	7.50	Straight	Moline

64	1	N/A	28.16	18.33	22.64	17.92	160.00	156.00	77.00	78.00	237.00	234.00	N/A	N/A	Slope	Prairie du Chien
1	1	~ 45.7	24.80	14.50	12.00	18.90	144.00	157.00	71.00	79.00	215.00	236.00	10.80	6.51	Slope	Prairie du Chien
4	1	35.35	21.71	16.24	18	8.28	172.00	162.00	71.00	70.00	243.00	232.00	9.17	5.06	Slope	Prairie du Chien
5	1	52.55	26.90	11.00	13.45	8.63	119.32	132.70	76.22	73.15	195.54	205.85	12.80	11.95	Straight	Prairie du Chien
6	1	30.64	16.70	7.35	12.00	8.35	145.40	156.47	75.77	73.27	221.17	229.74	6.05	2.83	Slope	Prairie du Chien
9	1	58.2	26.6	11.3	13.4	1.6	97.00	99.00	82.00	81.00	179.00	180.00	11.7	16.9	Straight	Prairie du Chien
11	1	49.40	19.90	16.20	10.20	6.40	140.00	128.00	69.98	81.18	209.98	209.18	8.30	7.30	Slope	Prairie du Chien
12	1	47.50	25.70	20.00	20.30	11.60	180.00	147.42	70.95	76.63	250.95	224.05	10.96	8.85	Slope	Prairie du Chien
14	1	43.09	22.24	10.52	16.60	10.60	180.00	158.58	73.73	77.62	253.73	236.20	9.25	8.33	Straight	Prairie du Chien
19	1	50.80	24.40	13.80	16.70	10.90	156.42	153.60	79.67	76.67	236.09	230.27	7.70	7.80	Slope	Prairie du Chien
35	1	49.50	21.60	10.40	8.20	6.80	113.65	117.58	80.98	78.04	194.63	195.62	9.50	5.92	Straight	Prairie du Chien
36	1	44.20	21.80	12.45	16.07	9.07	132.33	139.10	69.92	70.18	202.25	209.28	11.20	9.75	Straight	Prairie du Chien
63	1	N/A	28.1	19.42	19.37	10.49	110.00	102.00	69.00	75.00	179.00	177.00	N/A	N/A	Straight	Silicified Sandstone
8	1	N/A	42.8	16.1	24.1	14.1	110.00	111.00	70.00	69.00	180.00	180.00	11.3	26.1	Straight	Silicified Sandstone
27	1	48.90	20.20	12.30	9.70	6.70	140.73	114.40	68.70	66.83	209.43	181.23	7.70	3.40	Straight	Silicified Sandstone
30	1	81.20	38.50	25.20	13.60	14.90	180.00	180.00	71.65	69.77	251.65	249.77	16.50	41.80	Slope	Silicified Sandstone
31	1	49.80	31.30	21.90	20.20	5.30	115.45	139.23	73.53	74.25	188.98	213.48	9.30	12.90	Straight	Silicified Sandstone
77	1	51.41	28.10	13.64	15.00	6.25	139.93	134.58	62.12	63.72	202.05	198.30	9.71	10.70	Straight	Unknown
18	1	50.20	22.80	7.25	16.10	11.80	122.55	127.08	67.68	59.73	190.23	186.81	6.40	7.09	Straight	Unknown
22	1	66.50	24.90	14.40	15.60	8.30	80.42	141.35	74.88	74.93	155.30	216.28	9.30	15.43	Barbed	Unknown
151	2	N/A	28.87	14.67	20.67	10.58	103.00	149.00	77.00	72.00	180.00	221.00	8.35	12.00	Straight	Burlington
94	2	55.51	23.20	11.46	15.55	7.58	167.00	126.45	73.97	83.00	240.97	209.45	9.78	11.80	Straight	Burlington

100	2	N/A	55.97	16.08	17.95	11.56	141.82	131.95	82.50	77.55	224.32	209.50	9.99	N/A	Slope	Burlington
108	2	37.62	23.76	11.35	14.40	7.49	128.82	149.83	75.38	67.62	204.20	217.45	8.60	5.80	Straight	Burlington
109	2	N/A	25.13	9.89	15.70	11.33	168.12	99.38	63.43	70.47	243.84	336.60	N/A	N/A	Barbed	Burlington
112	2	N/A	25.37	16.79	18.50	6.56	169.27	152.22	63.37	74.20	236.27	403.22	N/A	N/A	Slope	Burlington
113	2	43.23	23.38	9.79	15.70	10.66	133.58	137.45	70.85	60.40	209.36	360.22	10.58	8.80	Straight	Burlington
123	2	55.01	25.60	12.78	16.87	8.25	150.18	180.00	70.45	60.00	203.10	381.52	9.50	12.40	Straight	Burlington
125	2	49.98	20.66	11.26	15.00	9.75	153.48	134.55	75.92	78.05	229.35	333.11	10.77	6.50	Straight	Burlington
132	2	N/A	29.37	14.50	18.80	14.32	116.15	150.95	78.38	74.30	200.60	383.05	N/A	N/A	Straight	Burlington
133	2	43.27	21.26	8.35	13.94	9.91	151.20	143.68	84.37	76.05	222.02	328.42	9.05	7.60	Straight	Burlington
135	2	79.79	33.26	17.58	18.30	12.27	85.72	118.52	70.07	79.20	157.12	197.72	11.76	24.20	Barbed	Burlington
136	2	57.41	35.63	17.88	21.11	16.55	127.00	122.00	77.23	80.83	204.23	202.83	10.47	17.00	Straight	Burlington
137	2	41.70	18.25	10.26	5.83	12.73	165.08	180.00	73.75	69.00	238.83	249.00	7.96	5.00	Straight	Galena
139	2	N/A	24.30	N/A	16.99	N/A	114.00	157.00	70.00	65.00	184.00	222.00	10.58	10.00	Straight	Galena
141	2	40.04	24.20	13.33	15.57	11.83	117.12	136.83	76.72	78.12	193.84	214.95	6.97	5.00	Straight	Galena
142	2	82.48	37.85	16.11	25.98	16.97	165.48	163.18	65.00	74.37	230.48	237.55	17.90	41.00	Slope	Galena
143	2	50.82	28.35	17.54	20.53	10.12	113.42	115.18	77.27	80.12	190.69	195.30	11.06	14.00	Straight	Galena
144	2	37.27	20.25	8.20	11.10	7.66	136.00	143.93	61.72	66.40	197.72	210.33	7.65	4.00	Straight	Galena
145	2	N/A	N/A	15.98	16.41	8.10	137.00	95.00	84.00	67.00	221.00	162.00	9.73	6.00	Straight	Galena
146	2	N/A	26.10	17.70	18.40	14.93	157.00	164.00	79.00	83.00	236.00	247.00	8.94	9.00	Slope	Galena
147	2	N/A	19.00	11.00	13.70	6.00	110.00	180.00	70.00	66.00	180.00	246.00	7.90	6.00	Slope	Galena
148	2	N/A	N/A	17.60	18.90	12.30	129.05	N/A	78.03	N/A	207.08	N/A	N/A	N/A	Straight	Galena
149	2	N/A	N/A	18.00	19.40	6.60	110.92	N/A	69.93	N/A	180.85	N/A	N/A	N/A	Straight	Galena

150	2	N/A	N/A	14.40	13.70	4.70	147.70	N/A	80.07	N/A	227.77	N/A	N/A	N/A	Slope	Galena
152	2	N/A	24.30	15.40	19.20	8.30	110.00	109.00	70.00	72.00	180.00	181.00	10.00	11.00	Straight	Galena
153	2	64.54	32.45	14.75	18.83	7.64	136.43	126.17	66.35	60.37	202.78	186.54	11.51	17.00	Straight	Galena
154	2	N/A	21.65	14.02	14.58	9.27	106.67	100.00	73.00	79.00	179.67	179.00	10.08	9.00	Straight	Galena
155	2	55.50	23.18	10.27	14.49	8.80	95.10	99.65	67.10	68.83	162.00	167.28	12.49	11.00	Barbed	Galena
156	2	N/A	31.53	17.96	21.19	11.58	55.00	109.00	71.00	71.00	126.00	180.00	9.66	16.00	Barbed	Galena
78	2	32.30	23.43	14.38	19.00	12.53	180.00	180.00	64.00	66.00	244.00	246.00	9.66	6.60	Slope	Galena
91	2	N/A	16.77	11.89	16.29	10.12	148.52	N/A	65.63	N/A	214.15	N/A	N/A	N/A	Slope	Galena
96	2	49.90	27.25	11.62	12.44	7.37	151.27	180.00	67.48	50.00	218.75	230.00	8.80	10.00	Straight	Galena
110	2	N/A	33.97	14.02	18.65	9.03	156.35	109.90	58.38	68.25	239.17	331.73	N/A	N/A	Straight	Galena
111	2	N/A	30.93	14.00	18.22	8.24	135.78	113.68	63.80	70.45	212.08	348.18	9.56	N/A	Straight	Galena
117	2	48.88	29.97	13.99	19.93	10.33	159.50	141.38	69.53	70.00	224.80	360.15	11.10	12.80	Straight	Galena
119	2	42.28	26.91	14.06	17.18	10.12	147.20	138.60	75.37	87.50	226.45	370.76	7.92	7.70	Straight	Galena
134	2	33.49	17.81	9.20	11.35	8.10	150.58	146.60	71.12	81.90	218.11	344.29	9.16	4.40	Straight	Galena
60	2	55.90	24.70	11.80	15.10	3.40	132.42	120.83	71.00	64.00	203.42	184.83	11.10	12.13	Straight	Galena
99	2	N/A	33.66	14.74	16.63	10.56	165.17	123.02	72.05	75.72	237.22	198.74	N/A	N/A	Straight	Maquoketa
104	2	N/A	26.72	N/A	20.50	14.14	142.85	157.47	78.98	82.82	221.83	240.29	N/A	N/A	Straight	Moline
128	2	37.79	22.72	9.40	15.09	10.61	154.32	125.18	80.05	76.30	222.69	356.33	9.00	6.50	Straight	Platteville Formation
79	2	41.73	21.79	12.50	16.89	7.49	180.00	180.00	71.00	67.00	251.00	247.00	6.58	6.20	Slope	Prairie du Chien
93	2	79.49	33.97	14.42	22.39	14.20	150.00	130.00	72.77	75.78	222.77	205.78	11.43	28.50	Straight	Prairie du Chien
101	2	N/A	32.71	17.89	17.90	10.05	101.62	113.28	71.10	71.25	251.10	138.73	9.58	N/A	Barbed	Prairie du Chien
105	2	N/A	23.14	11.47	8.22	1.05	152.40	116.13	66.37	65.30	218.77	181.43	8.15	N/A	Straight	Prairie du Chien

129	2	N/A	28.15	18.07	18.59	9.84	209.87	119.48	68.53	83.27	285.37	348.26	N/A	N/A	Slope	Prairie du Chien
131	2	41.32	17.08	12.74	11.61	10.03	157.83	139.05	80.62	79.25	233.31	310.06	8.95	7.70	Straight	Prairie du Chien
61	2	51.50	25.20	11.90	16.10	8.60	138.20	180.00	70.35	68.00	208.55	248.00	10.60	7.60	Straight	Prairie du Chien
106	2	N/A	26.22	9.07	15.36	5.66	147.32	182.97	54.20	52.92	201.52	235.89	12.47	N/A	Slope	Quartz
92	2	N/A	33.11	21.85	21.50	15.83	118.38	117.50	80.18	75.87	198.56	193.37	11.31	N/A	Straight	Silicified Sandstone
107	2	46.83	29.91	10.94	16.89	10.07	160.73	157.87	70.42	68.37	231.15	226.24	7.67	10.40	Straight	Silicified Sandstone
95	2	40.51	24.50	15.55	17.59	9.96	154.45	127.87	74.33	75.50	228.78	203.37	9.33	7.60	Straight	Unknown
98	2	N/A	34	21.76	19.69	8.8	95.93	123.83	75.08	75.48	171.01	199.31	N/A	N/A	Straight	Unknown
103	2	N/A	23.92	14.83	16.21	13.81	154.83	131.28	77.27	84.45	232.10	215.73	N/A	N/A	Slope	Unknown
114	2	N/A	27.95	15.46	17.81	8.85	111.97	130.37	77.48	70.82	183.22	349.99	N/A	N/A	Straight	Unknown
118	2	45.42	24.25	17.65	17.26	9.71	131.32	150.55	71.17	67.53	214.59	430.84	8.19	6.30	Straight	Unknown
121	2	57.95	27.81	17.04	20.06	16.95	136.18	77.47	160.00	69.78	204.18	286.02	8.95	11.50	Barbed	Unknown
65	2	38.30	21.58	14.69	19.46	15.32	145.50	150.00	83.27	88.65	228.77	238.65	10.59	6.80	Straight	Burlington
66	2	* 45.4	25.66	12.49	16.54	11.10	142.58	126.53	70.80	76.65	213.38	203.18	11.39	10.30	Straight	Galena
81	3	36.14	26.48	14.17	17.80	8.03	124.00	120.33	77.78	73.93	201.78	194.26	7.29	5.50	Straight	Burlington
171	3	72.6	33.2	16.7	14.6	17.5	96.75	92.62	84.32	85.42	181.07	178.04	10.5	24	Straight	Burlington
173	3	93.09	36.19	20.68	14.5	24.5	149.45	153.17	81.68	76.42	231.13	229.59	10.5	31	Slope	Burlington
190	3	67.51	30.11	19.48	15.48	22.13	144.78	157.93	78.53	76.85	223.31	234.78	9.94	21.00	Slope	Burlington
191	3	69.56	29.90	13.01	10.40	18.70	121.58	109.58	67.98	69.92	189.56	179.50	10.40	18.00	Straight	Burlington
192	3	61.41	29.02	14.25	11.53	16.13	96.23	105.85	71.50	79.62	167.73	185.47	8.08	13.00	Barbed	Burlington
196	3	50.28	24.56	14.81	N/A	15.84	140.25	140.47	73.35	73.98	213.60	214.45	11.61	10	Slope	Burlington
197	3	72.83	29.80	14.26	13.62	16.90	126.03	114.93	78.13	78.03	204.16	192.96	9.28	17.00	Slope	Burlington

199	3	N/A	30.68	N/A	N/A	21.30	133.42	127.55	67.53	68.97	200.95	196.52	9.72	16.00	Slope	Burlington
230	3	85.58	31.26	19.54	18.66	5.85	145.83	113.88	70.95	68.18	216.78	182.06	10.58	27	Straight	Burlington
248	3	45.81	22.26	8.89	13.73	7.97	160.33	136.05	70.80	68.43	231.13	204.48	10.82	8	Slope	Burlington
249	3	51.15	25.3	14.37	17.34	7.18	116.08	113.53	62.82	64.60	178.90	178.13	10.06	11	Straight	Burlington
256	3	58.66	20.66	10.76	13.73	10.23	121.10	N/A	83.18	N/A	204.28	N/A	11.01	9	Slope	Burlington
80	3	45.23	26.15	15.51	16.35	9.66	114.33	116.85	82.97	69.42	197.30	186.27	8.21	6.70	Straight	Galena
88	3	46.73	24.22	16.08	14.77	9.40	127.42	104.88	77.00	93.00	204.42	197.88	7.60	7.40	Straight	Galena
89	3	36.02	23.96	13.39	14.32	9.58	123.00	120.00	81.75	84.64	204.75	204.64	5.86	4.80	Straight	Galena
160	3	75.9	30.2	22.8	12.78	19.87	133.42	110.77	81.05	85.72	214.47	196.49	9.96	21	Straight	Galena
175	3	81.7	32.7	21.2	11.9	19.8	120.00	121.00	80.30	78.08	199.73	198.12	11.4	27	Straight	Galena
181	3	71.60	40.76	17.25	14.13	19.98	97.52	93.35	73.80	76.28	171.32	169.63	11.22	26.00	Barbed	Galena
195	3	43.18	29.44	14.66	8.36	17.83	116.82	108.52	63.74	66.52	180.56	175.04	9.32	7.00	Straight	Galena
220	3	91.72	32.37	17.04	16.99	25.35	141.60	166.10	77.58	70.95	219.18	237.05	7.87	26.00	Slope	Galena
231	3	87.9	34.7	26	24.96	9	109.93	109.30	70.73	72.93	180.66	182.23	7.59	20	Straight	Galena
234	3	46.55	24.23	14.02	17.16	11.14	140.00	132.00	71.37	70.00	211.37	202.00	9.79	8.00	Slope	Galena
163	3	89.6	30.20	19.55	11.8	19.3	93.03	96.62	76.80	76.62	169.83	173.24	12.1	23	Barbed	Maquoketa
174	3	60.91	30.09	13.9	9.7	16.9	126.75	111.57	72.00	77.17	198.75	188.74	11.5	15	Straight	Maquoketa
198	3	65.04	27.70	14.67	13.06	19.85	125.77	135.33	73.88	68.18	199.65	203.51	8.71	16.00	Straight	Maquoketa
247	3	79.66	29.41	19.05	21.02	14.79	112.12	106.70	84.17	77.17	196.29	183.87	8.85	21	Straight	Moline
217	3	69.36	26.53	19.31	12.03	20.62	155.38	124.48	77.47	74.38	232.85	198.86	8.70	17.00	Straight	Moline Chert
165	3	N/A	36.15	15.07	14.14	22.1	128.50	135.97	67.57	57.07	196.07	193.04	13.86	21	Straight	Orthoquartzite
82	3	47.08	21.60	16.69	13.75	12.19	90.00	147.00	80.38	82.67	170.38	229.67	10.77	7.50	Barbed	Prairie du Chien

84	3	33.98	19.82	9.20	13.37	9.37	158.62	129.68	58.92	76.58	217.54	206.26	9.56	5.10	Straight	Prairie du Chien
87	3	33.73	24.31	9.80	14.15	8.60	131.62	135.42	80.00	75.55	211.62	210.97	8.36	5.80	Straight	Prairie du Chien
164	3	79.6	N/A	14.09	14.1	18.27	83.27	N/A	86.40	N/A	169.67	N/A	11.1	25	Barbed	Prairie du Chien
166	3	63.6	30.5	14.8	12.66	19.1	120.58	110.55	74.45	73.32	195.03	183.87	12.11	19	Straight	Prairie du Chien
193	3	78.85	31.10	20.55	12.19	22.00	91.67	154.30	71.00	77.00	162.67	231.30	9.41	20.00	Barbed	Prairie du Chien
200	3	62.45	27.87	15.59	13.97	18.97	131.88	124.73	76.00	83.13	207.88	207.86	10.83	17.00	Slope	Prairie du Chien
205	3	44.44	21.75	13.49	14.86	21.98	141.88	157.03	69.07	71.07	210.95	228.10	9.87	10.00	Slope	Prairie du Chien
209	3	N/A	25.24	N/A	N/A	16.36	99.60	106.27	73.15	72.70	172.75	178.97	8.44	11.00	Barbed	Prairie du Chien
210	3	73.46	28.04	20.17	10.41	20.62	105.27	109.90	72.33	79.55	177.60	189.45	10.57	18.00	Straight	Prairie du Chien
211	3	48.25	26.64	13.04	14.72	18.20	127.12	141.68	74.38	75.17	201.50	216.85	7.28	9.00	Slope	Prairie du Chien
226	3	73.86	26.58	17.91	19.31	11.95	141.05	153.15	73.92	72.13	214.97	225.28	11.89	18	Slope	Prairie du Chien
229	3	81.36	29.13	18.43	20.86	9.90	106.47	136.65	74.00	73.28	180.47	209.93	10.72	18.00	Straight	Prairie du Chien
235	3	62.70	29.21	11.53	20.64	12.82	126.38	147.00	65.00	64.00	191.38	211.00	10.42	21.00	Straight	Prairie du Chien
238	3	52.34	23.18	14.13	16.59	12.44	134.23	157.57	81.00	79.60	215.23	237.17	10.23	10.00	Straight	Prairie du Chien
240	3	49.02	21.41	13.03	15.81	8.60	180.00	180.00	69.00	77.00	249.00	257.00	9.19	8.00	Slope	Prairie du Chien
241	3	51.9	26.36	19.81	26.37	10.36	180.00	180.00	73.00	73.00	253.00	253.00	10.32	12	Slope	Prairie du Chien
244	3	58.09	24.64	17.79	19.34	8.79	123.33	149.95	73.50	79.80	196.83	229.75	10.15	12	Slope	Prairie du Chien
246	3	60.91	24.16	16.64	16.9	8.26	119.68	125.73	81.07	82.43	200.75	208.16	8.9	12	Slope	Prairie du Chien
251	3	55.03	28.79	16.72	15.68	7.27	98.72	126.27	81.71	90.80	180.43	217.07	11.30	12.00	Straight	Prairie du Chien
255	3	46.19	25.32	10.98	14.35	8.99	130.80	132.52	62.82	71.07	193.62	203.59	9.62	9	Slope	Prairie du Chien
203	3	69.53	38.15	14.34	14.61	22.16	98.68	119.18	80.98	60.80	179.66	179.98	8.63	20.00	Straight	Silicified Sandstone
157	3	92.73	27.6	16.09	13.34	19.78	121.98	112.07	77.60	73.95	199.58	186.02	12.8	32	Straight	Unknown

177	3	93.8	35.3	20.6	14.4	24.1	109.45	107.00	71.18	78.45	180.63	185.45	10.4	32	Straight	Unknown
182	3	73.30	35.99	12.03	7.41	14.63	93.97	111.33	65.95	70.67	159.92	182.00	12.54	21.00	Barbed	Unknown
212	3	52.23	27.75	12.61	10.76	18.62	103.60	109.20	77.15	68.78	180.75	177.98	10.67	12.00	Straight	Unknown
225	3	57.50	23.00	15.44	16.50	13.99	140.52	157.12	89.15	80.35	229.67	237.47	9.25	10.00	Slope	Unknown
232	3	58.65	26.11	17.59	16.91	9.26	138.37	145.23	70.62	73.42	208.99	218.65	8.41	11	Slope	Unknown
233	3	56.00	27.79	17.74	20.33	7.70	158.00	143.38	61.00	72.83	219.00	216.21	10.90	16.00	Straight	Unknown
239	3	62.50	26.62	15.58	13.38	6.84	118.32	125.52	63.92	73.78	182.24	199.30	10.38	14.00	Barbed	Unknown
252	3	55.93	25.23	13.72	13.95	12.45	130.70	133.42	77.50	84.30	208.20	217.72	9.06	10.00	Straight	Unknown