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Pottery Analysis of The Nonnast Site (39ML0009), Marshall County, South Dakota

by

Megan Ernst

A Thesis

Submitted to the School of Graduate Faculty of

St. Cloud State University

in Partial Fulfillment of the Requirements

for the Degree of

Master of Science in

Cultural Resource Management Archaeology

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Thesis Committee:
Mark Muñiz, Chairperson
Rob Mann
Michael Fosha

Abstract

The Nonnast site (39ML0009) is a Plains Village site located in the Prairie Pothole region of Marshal County, South Dakota. The site was initially identified by a surface scatter of pottery that contained both Great Oasis and Mill Creek ceramic types. The Nonnast site is located outside the normal distribution for these two cultures which are concentrated in southeast South Dakota and northwest Iowa. The site was formally tested in 2015 then again in 2017. The resulting thesis is an analysis of the ceramic and other culturally diagnostic material recovered from the excavations. The goal of the research is to firmly establish who occupied the Nonnast site and when. With the use of AMS dates, chi-square statistical analysis and ceramic typologies it was determined that the Nonnast site contains one component that most closely resembles the Over focus of the eastern division of the Initial Middle Missouri.

Acknowledgments

First and foremost I would like to thank Michael Fosha of the South Dakota Historical Society Archaeological Research Center, not only for serving as an advisor on my committee, but for being a great mentor to me throughout my career. You have pushed me to become a better archaeologist. I would also like to thank my other two committee members, Dr. Rob Mann and Dr. Mark Muñiz of St. Cloud State University for their guidance throughout my graduate school endeavor.

Thank you to the South Dakota Game, Fish, and Parks Department who permitted the excavation at the Nonnast site. The excavation and resulting data could not have been obtained without the many volunteers of the South Dakota Archaeological Society: Terry Yun, Doyle Crume, Darrell Dehne, Ardith Sand, Rose Fosha and the Cumins Family. Thank you for your time and willingness to dig during the hot summer. Additionally, we could not have accessed the site without permission of adjacent landowners Joy and Joe Pitzl, thank you.

I would like to kindly thank the North Dakota Historical Society, University of Iowa Office of the State Archaeologist and the Iowa Archeological Society for the use of multiple images throughout this thesis. I also want to be sure to thank Dale Henning and Carl Falk for your opinions and willingness to discuss my research with me.

I am very grateful to the Archaeological Research Center and Katie Lamie for helping catalogue and sort through the excavated materials.

Lastly, I want to give a very special thank you to my husband, William Ernst. You have been extremely patient with me throughout this process. You have given me support, constructive criticism and encouragement when I needed it most. You are the best!

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Chapter 1: Introduction and Research Goals

Overview

The Nonnast site, 39ML0009, is located in northeastern South Dakota. This site is situated in the Prairie-Woodland ecotone, an area of geographic transition between the Great Plains prairie of North and South Dakota and the Eastern Woodlands of Minnesota (Gregg et al. 1996). This portion of South Dakota has not been extensively surveyed or studied, leading to a lack of archaeological data and knowledge about the past cultures that inhabited this part of the state and region. Site 39ML0009 is currently recorded as a prehistoric artifact scatter containing both Great Oasis and Mill Creek components (Haug 1977a).

The site was recently surveyed in 2015 using the Light Detection and Ranging (LiDAR) remote sensing technique. The results from the LiDAR survey discovered that the Nonnast site may contain multiple potential mound features and a previously unidentified fortified village (Maki 2015). This new data prompted exploratory excavations conducted by the Archaeological Research Center (ARC) and the South Dakota Archaeological Society (SDAS) in 2015 and 2017. These excavations were the first subsurface tests conducted at the Nonnast site since it was originally recorded in 1973 (Haug 1977a).

The research presented here will focus on the analysis of the pottery and other culturally diagnostic materials recovered during 2015 and 2017 excavations. The first goal of this research is to confirm or reject the original Great Oasis and Mill Creek site designations. This will be accomplished by conducting analysis of the pottery and other diagnostic material collected. If the original designations are incorrect, what cultural components are represented at site 39ML0009? If both Mill Creek and Great Oasis components are observed, are these two components separate

or congruent? The information gathered via excavation, coupled with radiometric and stratigraphic data, will be utilized to understand the cultural chronology and occupations of site 39ML0009. The overall results of this research will help to further our understanding and interpretation of people that inhabited the Northeastern Plains subarea and the Prairie Lakes Resource region (Gregg et al. 1996; Toom 2004).

Chapter 2: Literature Review and Culture History

Geography

The Nonnast site, 39ML0009 is located in the northeast part of South Dakota on lands owned and managed by the South Dakota Game, Fish, and Parks Department (SDGFP). This portion of the state is located within a natural resource region called the Prairie Lakes Region (PLR). The PLR is a characterized by tall prairie grasses, and numerous shallow lakes, and wetlands (Anfinson 1997). The PLR encompasses southwestern Minnesota, eastern South Dakota, and central Iowa.

The Nonnast site is located on a unique topographic feature within the PLR called the Coteau des Prairie. The Coteau des Prairie (or Prairie Coteau) is a plateau that was formed during the Wisconsin glaciation period by the James and Des Moines lobes (Anfinson 1997:9). The hummocky topography of the Prairie Coteau was created by stagnant melting chunks of glacial ice that deposited rock and formed small undrained lakes, commonly referred to as prairie potholes or kettle lakes (Anfinson 1982; Figure 1). The Prairie Coteau stretches from Northwest North Dakota down through eastern South Dakota, and over into southwestern Minnesota. The Coteau raises some 500-800 feet above the surrounding prairie making it one of the more impressive topographic features of the eastern Plains (Gibbon 2012).

Although located on a unique topographic landform, archaeological information of the PLR and the Prairie Coteau is generally lacking. This lack of information has led to a poor understanding of the cultural chronology in this region.

39ML0009 Site History

The Nonnast site was first visited by John S. Sigstad in 1973 (Haug 1977a). During this time, Sigstad made a small collection of surface artifacts. He also received a "coffee can full of pot sherds" from Don Allen, a SDGFP employee, but the exact location of where he collected the artifacts is unknown (Sigstad and Allen 1973). The site was visited again by Jim Haug of the South Dakota State Historical Society, Archaeological Research Center (ARC) in 1977. Haug

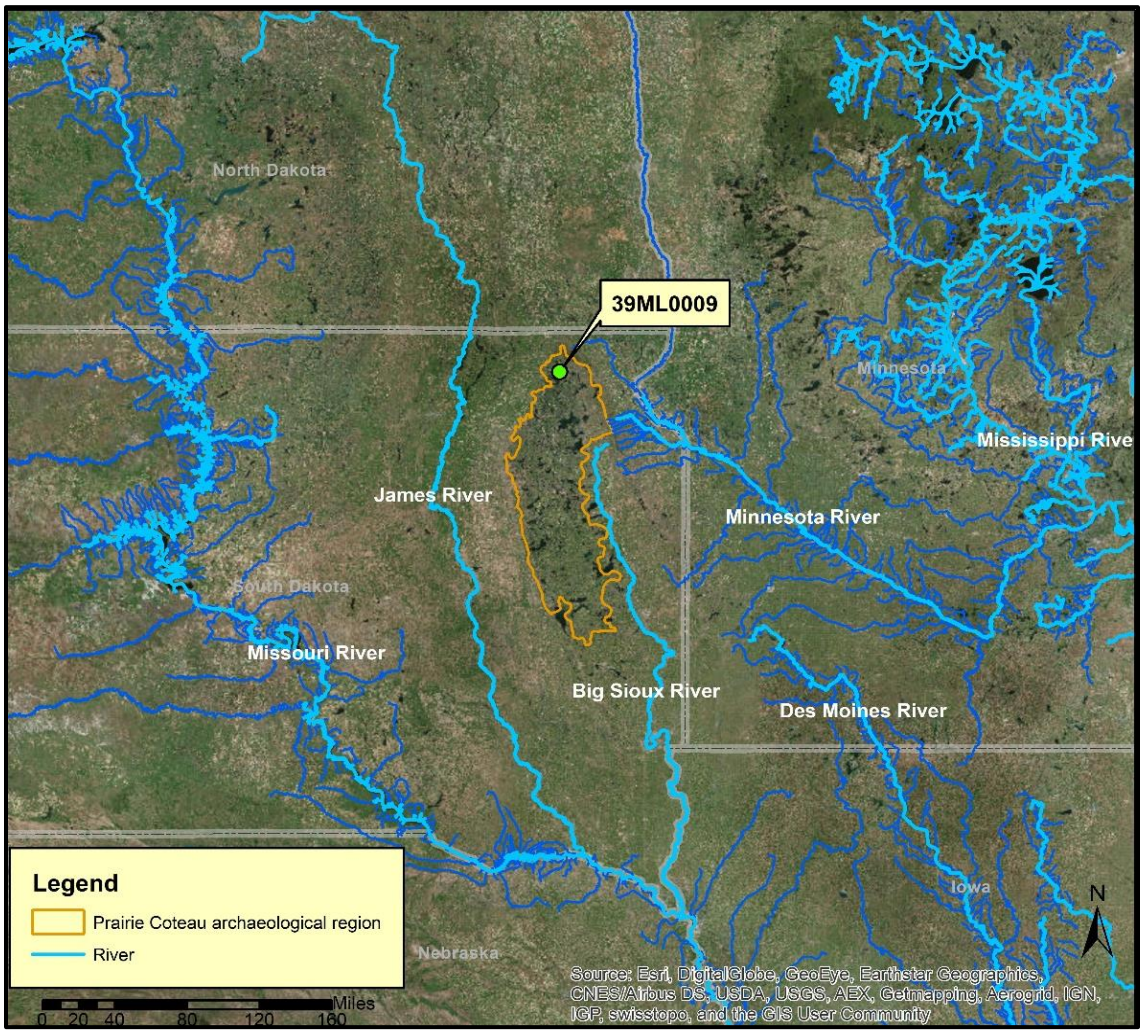


Figure 1. General Location of 39ML0009 (The Nonnast site) in Marshal County, South Dakota, relative to nearby rivers and lakes.

conducted another surface collection of the site. During this time, he also examined an assemblage consisting of pottery collected by a local collector who had been collecting pottery from the site for “several years” (Haug 1977a). Haug was given permission to study the private collection of pottery and to borrow a representative sample of ceramics. This assemblage, combined with the surface collections done by Haug and Sigstad, provided a large enough sample to allow Haug to make the determination that the combined ceramic assemblage consisted of rim sherds that contained both Great Oasis (AD 900-1250) and Mill Creek (AD 1100-1250) characteristics (Haug 1977a). As such, he identified 39ML0009 as containing both

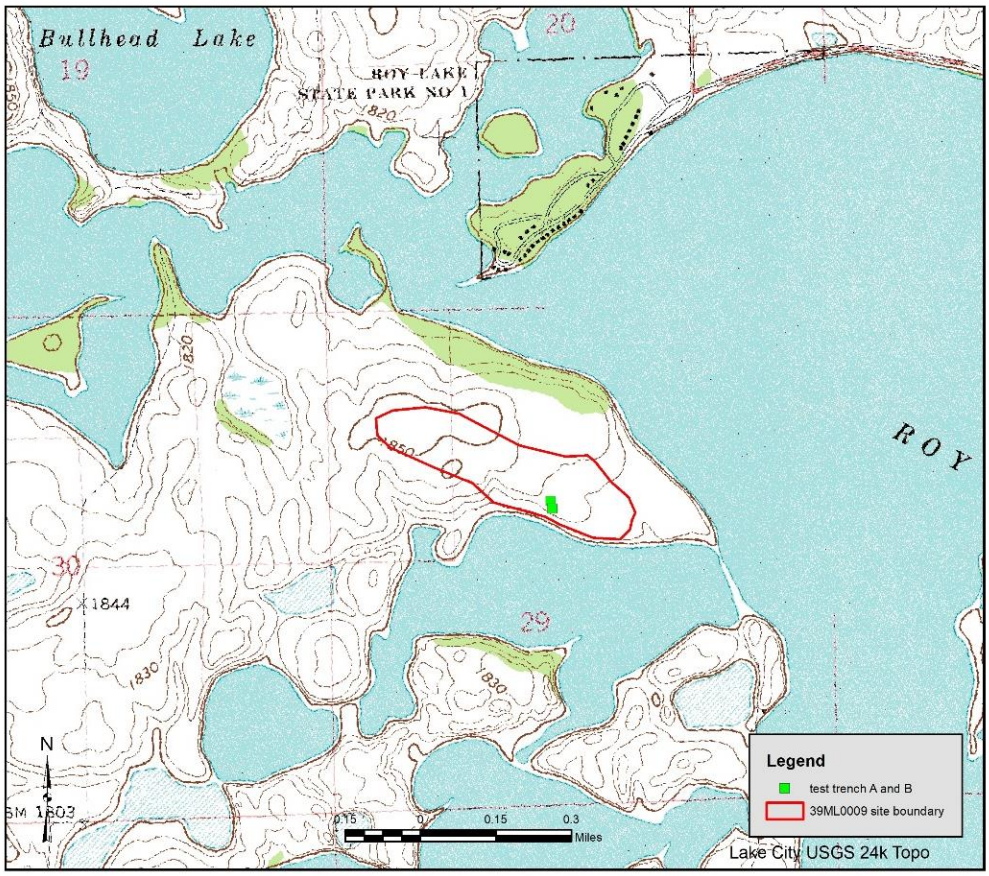


Figure 2. Lake City USGS 24k topo map. Current 39ML0009 site boundary.

components even though the site lies outside the typical geographic distribution of both Mill Creek and Great Oasis sites (Figure 4). The only other diagnostic material collected from the surface was one projectile point that was identified as a side-notched Besant point (Haug 1977a). Besant projectile points on the Northeastern Plains date to the Middle Woodland period, 100 BC-600 AD (Gregg et al. 2008). Haug recommended that further studies be conducted and that excavations take place. However, the site was not visited again until 2015.

The South Dakota State Historical Society ARC conducted a mortuary survey of Marshal County in 2015. Archeo-Physics LLC, was contracted to conduct Light Detection and Ranging (LiDAR) remote sensing. The results from the LiDAR survey discovered that the Nonnast site contained multiple potential mound features and what appeared to be a previously unidentified fortified village (Figure 3; Maki et al. 2015).

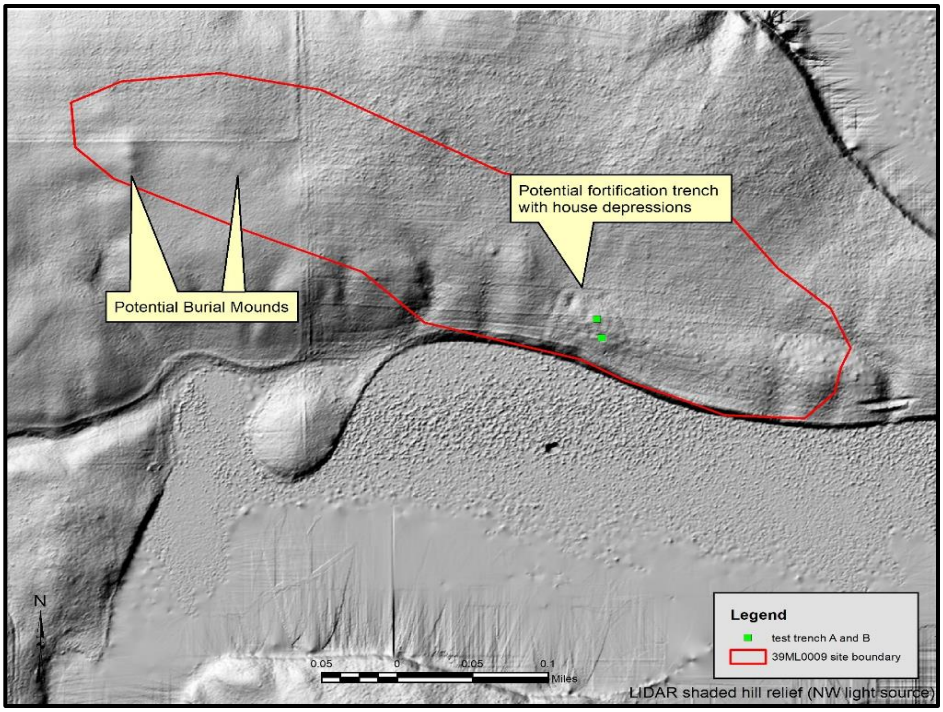


Figure 3. 39ML0009 Site boundaries with LiDAR features.

During the summer of 2015, volunteers from the South Dakota Archaeological Society (SDAS), in cooperation with the ARC, under the direction of Michael Fosha, excavated one test unit (1x2m) within the possible village to verify the remote sensing data. The unit was placed in a potential house depression. Standard archaeological excavation techniques were utilized including screening all material through a 1/4" hardware mesh screen. The unit was dug to a depth of 25cm below surface (cmbs). It was noted that the soils were starting to change color at this depth. Since the crew was short on time it was decided to stop at 25cmbs since there would be no time to excavate any potential features. The excavation unit was positive for a range of cultural material including: Mill Creek and Great Oasis pottery rims and body sherds, *Leptoxis* shell beads, and a large variety of animal bone which predominately consisted of fish species. There was such an abundance of bone material it was thought that this unit might contain a possible feature. A sample of mammal bone was collected between 10-20cmbs for radiocarbon dating. The excavation unit was then lined with geotechnical fabric and backfilled. Geotechnical fabric was used to clearly identify between what had and had not been excavated for future research.

The sample of mammal bone collected during the 2015 was dated radiometrically through Accelerated Mass Spectrometry (AMS). The results of the AMS dated this particular sample to 310 +/- 30BP and calibrated (2σ) to AD 1485 to 1650 (Beta – 43200; Bone collagen; δ^{13} C= -17.3‰). This calibrated date is beyond the accepted terminal dates for both Mill Creek and Great Oasis. To understand the importance of this site and the significance of the AMS date in relation to both Great Oasis and Mill Creek components, a firm understanding of the time frames and cultural chronology is important.

Cultural Chronology: Woodland and Plains Village Periods

The general time periods relevant to 39ML0009 and the components assigned to the site are roughly the transition between the Woodland (200 BC-AD 900) and Plains Village (AD 900-1650) of the Late Prehistoric Period (Anfinson 1997:86). The end of the Woodland period is often referred to as the Terminal Woodland (Tiffany and Alex 2001; Winham and Calabrese 1998; Wood 2001). Whereas, the Plains Village period originates with the Initial Middle Missouri Variant (IMMV) (Henning and Henning 1978; Lehmer 1954; Tiffany 1983).

Throughout this paper I will repeatedly use the words tradition, variant, phase, and focus. These are taxonomic words used to describe the degree of similarity between archaeological assemblages while taking into account the temporal and geographic distributions of those assemblages (Lehmer and Caldwell 1966; Tiffany 1983; Willey and Phillips 1962). A tradition is defined as a set of distinctive characteristics marked by technological or ecological adaptations that have a considerable duration through time, with a fairly limited geographic extent (Lehmer and Caldwell 1966:512; Tiffany 1983; Willey and Phillips 1962). A variant is defined as a, "unique and reasonably uniform expression of a cultural tradition which has a greater order of magnitude than a phase, and which is distinguished from other variants of the same tradition by its geographic distribution, age and/or cultural content" (Lehmer 1971: 32). A phase is a space and time unit possessing unique traits that distinguish it from all other archaeological units (Willey and Phillips 1962: 22). A phase is very limited in time and space. A focus is the approximate equivalent to a phase; however, a phase has more defined temporal connotations (Phillips and Willey 1953).

The Woodland and Plains Village time periods can also be referred to as traditions as well because both contain a distinctive way of life that is reflected in the technology and cultures that occupy these time periods (Lehmer and Caldwell 1966). The Woodland tradition within the Prairie Lakes Region is characterized by the use of pottery. The ceramics utilized were often globular in shape, decorated on the rim, tempered with crushed rock, and textured and impressed with cords marks (Anfinson 1997; Tiffany 2003). The bow and arrow had replaced the atlatl and dart so the projectiles were often small and notched (Gregg et al. 1996). The hunter-gatherer lifestyle was the predominate means of subsistence; however, this lifestyle was supplemented by horticulture or trade of horticultural products (Frison et al. 1996; Henning 1996; Tiffany 2005). Hamlets were small and houses were oval (Johnson 2001). These hamlets were occupied seasonally and were located on the floodplain of lacustrine and riverine environments. These locales were chosen because they provided a natural defense against wildfire and outside groups while providing access to aquatic resources and timber (Anfinson 1997:45). Overall, the subsistence patterns of the Woodland period show an increase in sedentism.

Where the terminal Woodland was composed of small seasonal hamlets, the IMMV of the Plains Village Tradition is characterized by large semi-permanent villages which were often fortified (Frison et al 1996; Wood 2001). Village houses were rectangular, semi-subterranean structures with numerous interior hearths, storage pits and midden accumulations (Morrow and Reed 2005:5). Village locations focused on riparian areas rather than lacustrine environs of the previous Woodland Period (Anfinson 1997).

One of the hallmark differences between the Woodland and the IMMV is the reliance on agriculture, especially maize. This reliance is indicated by numerous storage pits and the remains

of domesticated plant species found at IMMV sites (Tiffany 2007). Pottery of the IMMV also differs from the Woodland as it tends to be decorated with trailed lines, cross-hatching, and twisted cord in geometric motifs (Tiffany 2007:5). Vessels were smoothed and featured an S-shaped rim (Gibbon 2012, Anfinson 1997). Pottery also included the use of handles. IMMV people also relied heavily on bison procurement as indicated by the extensive bone tool technology and middens recovered from IMMV sites (Tiffany 1983).

The unique identifying characteristics between Woodland and IMMV are outlined above. In some geographical locations outside of the PLR, mostly to the east and south, this cultural change from Woodland to IMMV was abrupt (Lensink and Tiffany 2005; Tiffany and Alex 2001). However, the semisedentary and agricultural-based lifestyle of the IMMV did not immediately replace those practicing a Woodland subsistence within the PLR (Anfinson 1997). The change was often gradual and a mix of both Woodland and IMMV characteristics were adopted by different groups during the transition.

Great Oasis (AD 900-1,250)

Henning and Henning (1978:14) proposed to divide the IMMV up into eastern and western divisions. Great Oasis was grouped as belonging to the eastern division of the Initial Middle Missouri Variant (Johnson 2007; Henning and Henning 1978; Tiffany 1983). Most recently Tiffany (1982, 1983) proposed to drop the term variant from the Initial Middle Missouri. There have been no serious challenges to Tiffany's taxonomic change (Johnson 2007:98). Therefore, the eastern division of the Initial Middle Missouri (IMMe) will be utilized throughout the rest of this thesis.

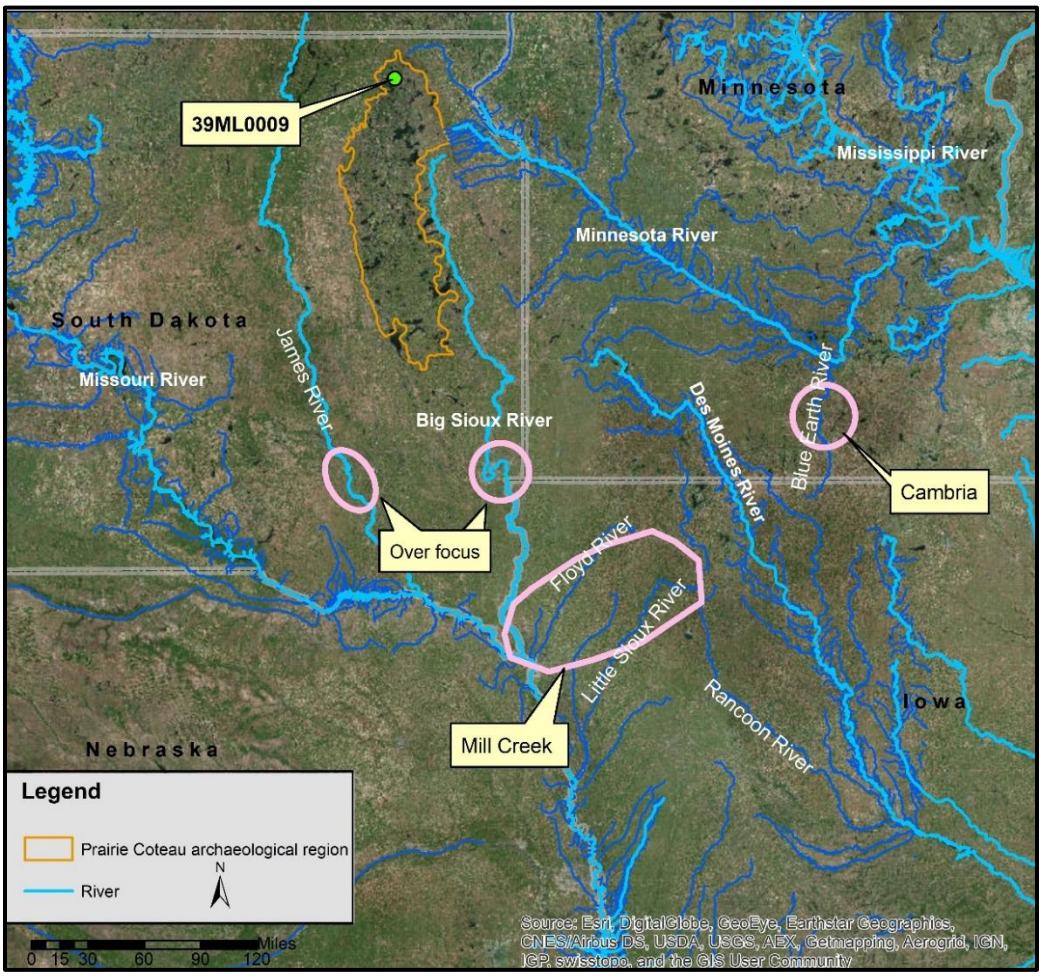


Figure 4. IMMe phases, not including Great Oasis (see Figure 5 for Great Oasis). Map based on Henning 2001.

Nevertheless, not all archaeologists agree on what phases should be included in the IMMe. Many archaeologists believe that Great Oasis is part of and contemporaneous with the IMMe (Anfinson 1997; Gibbon 1993; Henning 2001; Johnson 2007). According to these archaeologists there are there are at least six phases that make up the IMMe: Big Sioux, Little Sioux, Brandon, Lower James, Cambria, and Great Oasis (Henning and Henning 1978; Tiffany 1983; Winham and Calabrese 1998). The Big Sioux and Little Sioux phases make up the Mill Creek Culture (Henning and Toom 2003). The Brandon locality and James River phase make up

the Over focus (Henning 1996; Winham and Calabrese 1998). Henning (2001:224) sees Great Oasis as fundamental to the Initial Middle Missouri tradition because Great Oasis sites contain a Plains Village pattern of development while retaining some Woodland characteristics. However, Tiffany and Alex (2001:88) suggest that Great Oasis should be considered a part of the Terminal Woodland tradition. The hamlets are small and unfortified as they are in the Woodland tradition. According to Tiffany (2007) Great Oasis dates are generally earlier than any other IMM phases. Tiffany (2007) believes that Great Oasis has closer affiliations to Woodland than IMM. Tiffany and Lensink (2005) state that the confusion between Great Oasis and Mill Creek comes from the seeming contemporaneity of the two. According to the accepted radiocarbon dates, Great Oasis ranges from AD 900-1250 (Johnson 2007). However, Lensink and Tiffany (2005:128) argue that "the majority of overlap corresponds to a period of increased and erratic ^{14}C production from AD 1029-1156." They go onto hypothesize that since this is the case radiocarbon dates from this time period cannot be solely relied upon to differentiate between Great Oasis as IMM or Woodland (Lensink and TIffany 2005:128). With this being the case, they propose an end date of Great Oasis as AD 1100. Henning (1971), on the other hand, regards Great Oasis as antecedent and contemporaneous with the IMM. Regardless of these taxonomic issues, there is general agreement that Great Oasis is derived out of a Terminal Woodland base (Tiffany 2005; Henning 2001). The resolution to this taxonomic disagreement is outside the scope of this thesis. However, since the majority of archaeologists include Great Oasis as part of the IMMe, I will follow suit and include Great Oasis as part of IMMe until further evidence is obtained to determine that Great Oasis is Terminal Woodland (Anfinson 1997; Henning 2001; Johnson 2007; Winham and Calabrese 1993).

The Great Oasis culture is widely distributed; however, it is concentrated just outside of the PLR to the south, in northwestern Iowa, southeastern South Dakota and the southwestern portion of Minnesota (Figure 5). Evidence of the Great Oasis culture within the Prairie Lakes Region is poor. Only about 10 Great Oasis sites have been identified including the Great Oasis type site within the PLR (Anfinson 1997:92; Henning and Toom 2003).

There are a number of localities and phases suggested for Great Oasis. Tiffany and Alex (2001) have proposed a Lower Raccoon phase and a Central Des Moines phase. Lower Raccoon localities are concentrated near the Raccoon River, IA. The Des Moines phase consist of sites concentrated near the city of Des Moines, IA (Tiffany and Alex 2001). Lensink and Tiffany (2005:127) expanded upon this to include eight other localities in South Dakota, Iowa and Minnesota: Big Bend, Fort Randall, Gavins Point, Upper Big Sioux, Lower Big Sioux, Crocker, Prairie Lakes, and Mills (Figure 5). Henning (1996) has proposed a joined Great Oasis and Mill Creek phase called Perry Creek located near Sioux City, IA within the Lower Big Sioux locality. However, Tiffany and Alex (2001:86) believe that the Perry Creek phase needs to be redefined due to the apparent concurrent occupation of the Larson site (13PM0061) by both Mill Creek and Great Oasis occupations (Henning 1996).

The Great Oasis culture appears during the Neo-Atlantic climatic episode, also known as the Medieval Warming period. The Neo-Atlantic was a period of comparatively warm and moist climatic conditions on the western Prairie Peninsula (Gregg 1994:79). This warm moist climate allowed for the spread of maize agriculture. The change from hunter-gatherer, Woodland, to agricultural subsistence, IMM, coincided with the Neo-Atlantic period circa AD 1000-1250 (Toom 1996). The Great Oasis culture falls within this transitional time period.

Great Oasis habitation sites consist of rectangular semi-subterranean structures that often contain storage pits which indicate a more permanent occupation (Henning 2001). This type of permanent structure is not observed in the Woodland Tradition of the PLR. However, unlike many Middle Missouri Tradition sites, Great Oasis habitation sites are unfortified and located in naturally defensive positions such as peninsulas and lakes (Anfinson 1997:95). The subsistence focused on hunting and gathering while supplementing their diet with horticultural practices. Excavations at Great Oasis sites show evidence of Chenopodium, squash and some maize. The low frequency of maize at Great Oasis sites have led archaeologists to believe that Great Oasis people may not have cultivated corn extensively, rather just traded for it with cultures to the east and south (Henning 1978; Lensink and Tiffany 2005:7). However, excavations at the Cowan site (AD 1015-1043), a Great Oasis site in northwestern Iowa, have produced storage pits with large amounts of charred corn kernels (Lensink and Tiffany 2005:7). This suggests that at least some Great Oasis peoples cultivated maize on a more intensive scale. However, there is little evidence that Great Oasis cultures within the PLR practiced maize agriculture (Anfinson 1982; Gibbon 2012:163). The paucity of evidence for maize agriculture in the northern PLR could also be due to the lack of fine recovery excavation techniques and the lack of site investigation and excavation.

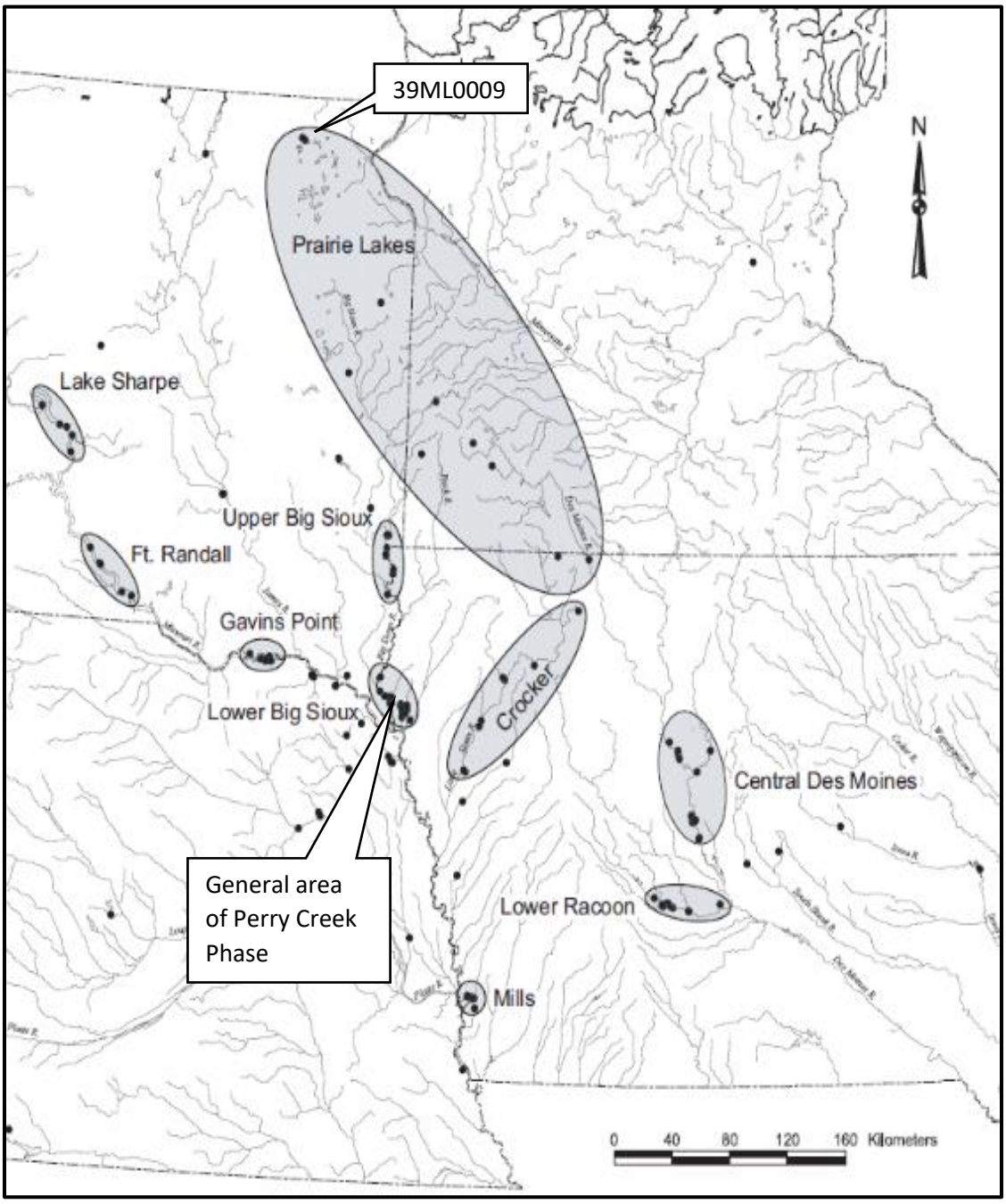


Figure 5. Distribution of Great Oasis or Great Oasis-related sites. Great Oasis localities, shaded areas, proposed by Lensink and Tiffany (2005). Including the general area of Henning's Perry Creek phase. Image used with permission from the University of Iowa Office of the State Archaeologist.

There appears to be mixed evidence for the use of burial mounds at Great Oasis sites. Burials have been uncovered in cache pits, house floors, and burial mounds (Henning and Toom 2003; Schermer 2003). The mounds, when used, are conical in shape and have included the use of natural hilltops and culturally built mounds (Tiffany and Alex 2001). Burial mounds were commonly used during the Woodland period. The continued use of burial mounds at some Great Oasis sites is an indication of a developmental relationships between Woodland and Great Oasis cultures.

Great Oasis Ceramics

Great Oasis pottery is composed of two wares: 1) Great Oasis High Rim and 2) Great Oasis Wedge Lip. Tiffany and Alex (2001:86) have proposed to rename Great Oasis wares Hitchell and Williams ware. However, these renamed wares have not been used by the wider archaeological community (Fishel 2005). Therefore, the traditional Great Oasis ware names will be used throughout this thesis.

Great Oasis vessels are generally globular shaped with rounded bottoms and tempered with grit. Although some Great Oasis rims found have also been tempered with grog and sand as well (Fishel 2005; Henning and Henning 1978). The Great Oasis High Rim ware has a straight yet, outflaring rim with a very flat lip (Figure 7; Figure 8; Henning 1996). Decorative elements are confined to the rim. Common motifs of High Rim ware include: triangles, diamond, trapezoid, cross-hatching and oblique lines. These motifs are sometimes superimposed on horizontal incised lines (Johnson 1969).

Figure 6. Profile examples of Great Oasis High Rim (a) and Great Oasis Lip (b); (Henning 1996). Image used with permission from the University of Iowa Office of the State Archaeologist.

The Great Oasis Wedge Lip has a low out curving rim with an outwardly beveled lip that appears extra thick (Figure 7 and Figure 8; Henning 1996). The lip is usually undecorated (Tiffany 2005). The rim, below the lip, is also usually undecorated (Henning 2001). Decorative motifs used on Great Oasis High Rim closely resemble those used in the Terminal Woodland (Henning and Henning 1978). However, the ceramic tradition of Great Oasis appears to be split from the Terminal Woodland Tradition of cord impressed wares. One of the defining elements of

Figure 7. Great Oasis High Rim decoration (a; b; Henning 1996) and Great Oasis Wedge Lip (c; Fishel 2005). Image used with permission from the University of Iowa Office of the State Archaeologist.

Great Oasis pottery is the precise incised decoration (Johnson 2007:102). There is a potential third ware grouping of Great Oasis ceramics. It was once thought that Great Oasis sites lacked S-shaped rims (Tiffany 1983: 97). While uncommon, S-shaped rims have been found at Great Oasis sites in MN, SD and IA (Anderson 1981, Henning 1996, Tiffany and Lensink 2005 and Johnston 1967). When S-shaped sherds have been found in Great Oasis contexts, they have frequently been categorized as Mill Creek Foreman rims or designated under some sort of

"miscellaneous" category (Lensink and Tiffany 2005:41). Doershuck and Lenskink (1996) were the first to recognize an S-shaped rim type during the excavation of the Maxwell site, a Great Oasis site in central Iowa.

Tiffany and Alex (2001:86) have proposed to designate S-shaped rims found within Great Oasis contexts, St. John ware (Figure 7). Tiffany and Alex (2001:85) report that this S-shaped form is evidence of the developmental relationship from a Woodland Great Oasis culture to the IMMe Mill Creek culture. The lips of St. John ware are rounded. Decoration is varied, but rims are generally decorated with incised horizontal lines with an overlaying motif of triangles or chevrons (Lensink and Tiffany 2005:41). However, due to the lack of complete vessels and relatively small sample size St. John ware cannot, yet, be formally classified as a Great Oasis ware (Fishel 2005:41).

Figure 8. Example of S-shaped rims from the Cowan site, potential St. John ware (Fishel 2005). Image used with permission from the University of Iowa Office of the State Archaeologist.

Mill Creek (AD 1,000-1,300)

Unlike Great Oasis, archaeologists seem to agree that Mill Creek is part of the IMMe (Anderson 1981; Henning 1971; Johnson 2007; Tiffany 1982). Technically, Mill Creek culture is

restricted to the Big Sioux and Little Sioux phases located along the Big Sioux and Little Sioux Rivers in Northwestern Iowa. localities (Henning 2001).

Like other IMMe sites, Mill Creek sites consist of fortified villages composed of semi-subterranean rectangular houses (Emerson et al. 1991). Generally, there is a central hearth and numerous storage pits. One of the defining characteristics of Mill Creek is the accumulation of deep midden mounds that contain pottery, charcoal, and bone (Henning 2001). The excavation of storage pits has recovered an abundance of maize and beans which suggests that there was a heavy reliance on these cultigens (Henning and Toom 2003).

The Big and Little Sioux phases of Mill Creek did not inter their dead within burial mounds (Henning and Toom 2003:204). Most Mill Creek burials consist of natural hill-top burials and ossuaries. Although Mill Creek shares many characteristics with many other IMMe components, it is quite unique due to its influence of Mississippian culture (Tiffany 2003). Evidence of this type of influence is seen in direct trade items such as ear spools, iconography reflected in the long nose shell masks, and by the occurrence of locally made copies of Mississippian ceramic vessels. These local copies of Mississippian vessels include forms such as water bottles and bowls, and decorative motifs such as the Ramey scroll design (Tiffany 2003). These types of Mississippian artifacts are not found on Great Oasis sites.

Mill Creek Ceramics

Mill Creek pottery is composed of four ware groupings that are further comprised of many types (Figure 8). The first ware of Mill Creek is Chamberlain high rim. This ware grouping is very closely related to Great Oasis High Rim wares in terms of form and decoration. The second ware group is Sanford ware, which Henning (1996:17) categorized as part of the more

principal, wedge lip grouping. Both Chamberlain ware and Sanford ware closely resemble Great Oasis High Rim and Wedge Lip wares in form and decoration. Some archaeologists see this similarity as evidence of a direct relationship from Great Oasis to Mill Creek (Henning and Henning 1978; Ives 1962). The third ware is the S-shaped Foreman ware which is found throughout the Initial Middle Missouri tradition, and the fourth ware is Mill Creek ware.

The pottery designated as Mill Creek ware appears to be highly influenced by Mississippian traditions (Figure 9; Tiffany 2003). This is evident by the elaborate ceramic forms including bowls, seed jars, miniatures, red-slipped vessels and handled effigy forms (Tiffany 2003). Mill Creek ware is often used as a catchall category composed of ceramics that seem to be more directly oriented towards the Middle Mississippian tradition rather than the Plains Tradition (Ives 1962). However, the degree of Mississippian influence in Mill Creek culture is debated. Lensink and Tiffany (2005:129) believe that Great Oasis people made initial contact with Mississippians. The Great Oasis people that interacted with Mississippians then rapidly transformed into Mill Creek and other IMMe cultures by AD 1100 due to this Mississippian interaction (Lensink and Tiffany 2005:129). Henning (1996: 93) also believes that Great Oasis peoples began initial trade relationships with Mississippian peoples even though Great Oasis does not exhibit any overt expression of a Mississippian pattern, such as discoidals (Henning 1967:191). Whereas, Mill Creek was highly influenced by Mississippian peoples and enhanced the trade network developed by Great Oasis peoples (Henning 1997, 2001). The fact that Mississippian ideology and culture had some sort of influence on Mill Creek is undeniable. Nevertheless, Mill Creek is believed to have developed out of a Great Oasis base due to the shared characteristics of their respective ceramic assemblages (Henning 1996; Tiffany 1982:94).

Mill Creek ceramics, in general, are shaped much like Great Oasis; they are globular with rounded bottoms. However, Mill Creek ceramics include handles and Mississippian influenced pottery wares; whereas Great Oasis does not. The temper used in both ceramic traditions is similar. Mill Creek and Great Oasis used grit or sand mixture. However, Mill Creek can also be tempered with limestone, shell or grog (Henning 1996; Henning and Toom 2003).

Sanford ware rims are short and thickened (Figure 9). A large portion of the lips are beveled but not to the extent that they are a wedge shape (Anderson 1981: 16). The decorative motifs used in Sanford ware vary from trailed lines to punctates. The lips may have crosshatching or incised parallel lines applied (Anderson 1981:17).

Chamberlain ware has a high straight rim with a distinct angle at the neck (Figure 9; Anderson 1981). The rim profile is often D-shaped with a rounded lip (Fishel 2005:52). With so many common characteristics many archaeologists believe that Chamberlain high rim ware has a direct relationship with Great Oasis High Rim ware (Anderson 1981:43; Tiffany 2007:12, Tiffany 1982)

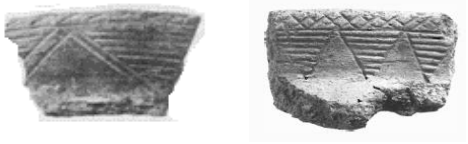
Foreman ware rims are collared with and S-shaped profile (Figure 9). The decorative motifs range from incised triangle to crosshatching on the rim. Many of these rims also include punctates along the lower edge of the collar (Anderson 1981). The last pottery designation for Mill Creek is, Mill Creek Ware. Described by Henning (1996:29) as, “an unsatisfactory catchall category for non-traditional rim sherds.” The forms, seed jars, miniatures, and effigy bows, in this ware group are more directly related to the Middle Mississippian tradition than the other Mill Creek wares (Henning 1996: 29). This ware includes types that are often decorated with

curvilinear Ramey scroll-like designs (Tiffany 2003). This curvilinear motif on Mill Creek pottery is Mississippian influenced and is not part of the Great Oasis repertoire.

Sanford ware rim profiles

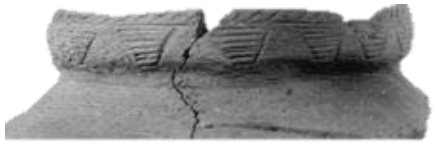
Sanford ware, sample of surface decorative treatment; Mitchell Modified lip type

Chamberlain ware rim profiles



Chamberlain ware, samples of surface decorative treatment; Incised Triangle

Foreman ware rim profiles



Foreman ware, sample of surface decorative treatment; Incised Triangle

Mill Creek Ware rim Profiles

Mill Creek Ware, sample of decorative treatment; Ramey incised.

Figure 9. Mill Creek Ware groupings. Examples of rim sherd profiles and surface decoration (Henning 1996; Fishel 2005). Images used with permission from the University of Iowa Office of the State Archaeologist and the Iowa Archeological Society.

In summary, according to Henning and Henning (1978: 16) there are four slight differences between Great Oasis and Mill Creek wares: 1) the profile of the Chamberlain ware is tapered rather than parallel-sided as in Great Oasis; 2) the lip form in Chamberlain is rounded and not flat as in Great Oasis; 3) the height of the rim in Chamberlain ware is shorter than Great Oasis; and 4) the application of decoration is not as precise in Mill Creek wares as it is in Great Oasis. However, Fishel argues (2005:53) that these criteria are subjective and hard to quantify. These close similarities can lead to misidentification.

Over Focus (AD 1,000- 1,250)

The James River phase and the Brandon locality along the Big Sioux River in South Dakota make up the Over focus (Figure 4; Henning and Toom 2003). There has been some disagreement whether to include the Over focus within the Mill Creek designation (Anderson 1969; Henning and Toom 2003; Hurt 1954; Tiffany 1982). The Over focus was first identified on the basis of three sites: Mitchell site (39DV0002), Twelve-mile Creek (39HT0001), and Brandon site (39MH0001; Alex 1981). The similarities between Over focus and Mill Creek were recognized by W.H. Over so he combined them into the Mill Creek aspect (Alex 1981). The Over focus was then removed from the Mill Creek aspect by Hurt (1951) in the early 1950s. Some archaeologists have tried to rectify this situation by combining them (Gibbon 2012; Henning 2001; Henning and Toom 2003; Winham and Calabrese 1998).

Over focus sites are very similar to Mill Creek. There are only two discernable differences between Mill Creek and the Over focus. One is the use of burial mounds. It appears as though peoples belonging to the James River phase of the Over focus interred their dead in burial mounds whereas those of the Mill Creek culture did not (Henning and Toom 2003:204).

The second difference is the use of cord impressed ceramic decoration. Over focus sites contain a higher frequency of cord impressed decorated rim sherds than Mill Creek sites do (Tiffany 1982:2). Cord impressed pottery at Mill Creek sites is a fairly rare occurrence (Tiffany 1982:2). In this thesis I will not combine Mill Creek and Over focus because I want to further explore the viability of the Over focus as a potential occupation at the Nonnast site.

The Over focus is contemporaneous with both the Great Oasis and Mill Creek cultures. The Over focus contains rectangular semi-subterranean houses that contains storage pits (Alex 1981). Two of the three recorded Over focus sites contain fortification trenches, 39DV0002 and 39MH0001 (Alex 1981). In addition, some Over focus sites contain evidence of Mississippian influence or interaction. Excavations at the Mitchell site (39DV0001), located along the James River, have uncovered ceramics with Mississippian motifs (Alex 1981). In addition, the Twelve-mile Creek site contains red slipped pottery sherds (Alex 1981).

Over Focus Ceramics

Over focus ceramics utilize the same ware and types as Mill Creek. However, there appears to be some patterns that can be discerned from Mill Creek to Over focus sites. Alex (1981) conducted a study of Lower James River valley sites and compared them to Mill Creek villages in Iowa and initial Middle Missouri villages along the Missouri River in South Dakota. Alex found that the rim height of Sanford ware ceramics increases from Mill Creek sites in Iowa to IMMe sites located along the Missouri River trench (Alex 1981:19). In addition, cord roughening increases from east to west. Alex (1981) concluded that James River sites contain ceramics that are intermediate between Mill Creek of northwest Iowa and Initial Middle Missouri sites along the river in South Dakota. However, the sites along the James River appear

to have a greater affinity towards Mill Creek of Iowa due to the presence of some Mississippian items (Alex 1981:19).

Northeastern Plains Village Complex (AD 1,200- 1,800)

The NEPVC is important to discuss because the Nonnast site it falls within the geographic range of the Northeastern Plains Village Complex (NEPVC). In addition, bone sample collected from the 2015 excavations resulted in a calibrated AMS date of AD 1485 to 1650. This date falls within the NEPVC time period. Therefore, it is necessary to consider the NEPVC a viable influence at the Nonnast site.

The NEPVC is made up of a number of sites located in eastern North Dakota mostly located near Devils Lake, James River and Sheyenne Rivers (Figure 10; Gregg et al. 2008). However, comprehensive survey throughout the area is lacking. The NEPVC is divided up into three subperiods: Early (AD 1200-1300), Middle (AD 1300-1600), and Late (AD 1600-1800; Toom 2004). It should be noted here that Toom (2004) and Henning and Toom (2003:216) have removed Cambria for the IMMe and re-assigned it to the NEPVC. Toom (2004:281) believes that the NEPVC is an extension of Cambria. Cambria and NEPVC contain similar ceramics, fortified villages, and subsistence patterns (Toom 2004). However, like other archaeological taxonomic debates not all archaeologists agree (Johnson 2007).

The settlements of NEPVC includes small fortified semi-sedentary villages and open-air encampments (Toom 2004). NEPVC peoples hunted, gathered and did some gardening, but their gardening is not as intensive as that of the Middle Missouri (Gregg et al. 2008). NEPVC sites are characterized by high frequencies of Knife River Flint (KRF), catlinite artifacts, and earthen mound mortuary features (Gregg et al. 2008).

NEPVC Ceramics

In general, ceramics of the NEPVC are thin, well-made globular jars, with distinct shoulders. Decoration consists of trailed lines in combination with tool impressions. Exterior surface treatment is typically smooth above the shoulder and either smooth or cord roughened

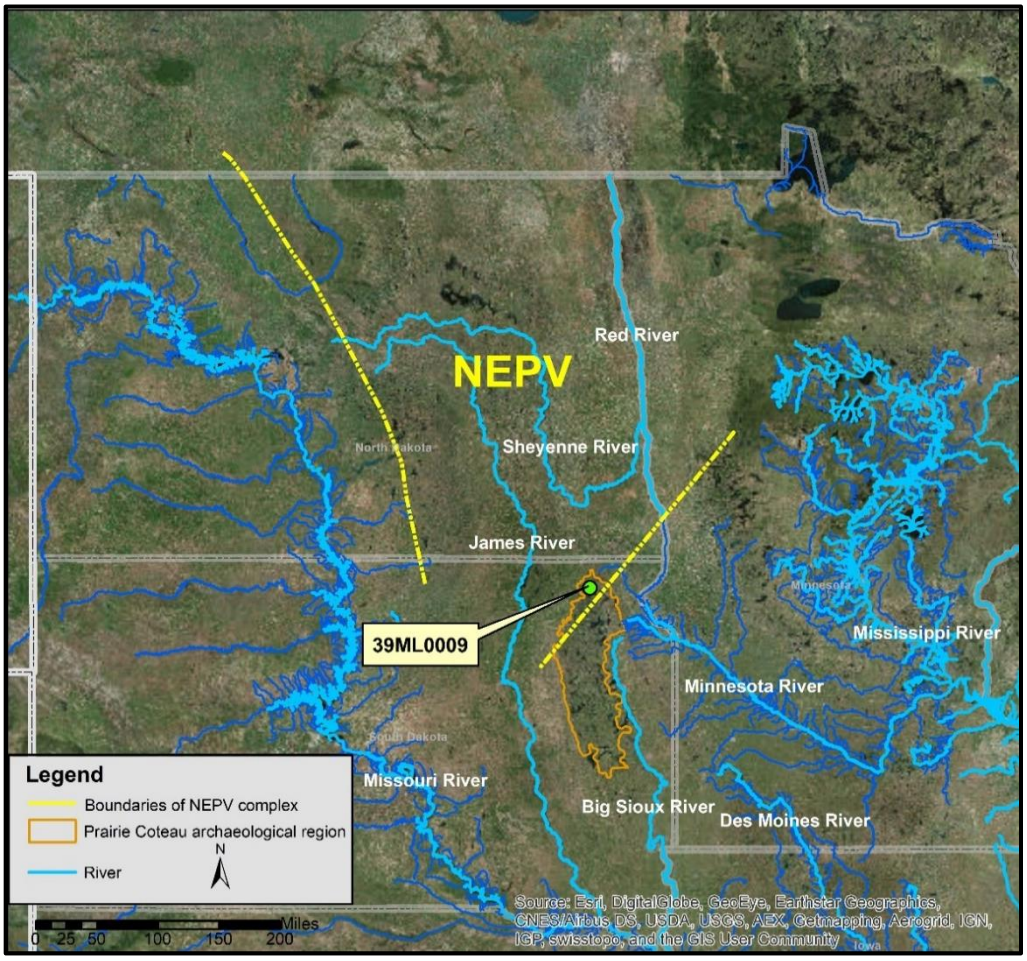


Figure 10. Map outlining the distribution of NEPV complex.

below the shoulder. Lips can be rounded or flat, scalloped, T-shaped or L-shaped. Temper is usually grit but sometimes shell (Gregg et al. 2008). Michlovic and Swenson (1998) have proposed a ceramic typology for the NEPVC (Figure 12). This new typology consists of the

Northeastern Plains Village ware group. This group is made up of three wares: Lisbon Flared Rim, Buchanan Flared Rim and Owego Flared Rim (Figure 11).

Lisbon Flared Rim has a straight to out-curving rim and is composed of three types. The lip can be flat, L or T-shaped. The surface treatment is smoothed over, cord roughening (Michlovic and Swenson 1998). Owego Flared Rim is composed of two types. Owego has a straight to out-curving rim with a flat lip. The surface treatment is smothered over or check stamped (Michlovic and Swenson 1998). The last ware is Buchanan Flared Rim which is composed of five types. The Buchanan Flared Rim has a straight to out-curving rim. The lip can be rounded, flat beveled, L-shaped, T-shaped and rolled.

Decorative elements of the Northeastern Plains Village ware group contain tool impressions on the top of the lip or along either the interior or exterior lip/rim juncture (Michlovic and Swenson 1998). Trailed lines and tool impressions are also used on the exterior rim and/or shoulder. The tool impressions used do not include cord wrapped impressions or marks. Cord wrapped marks are more indicative of Woodland ceramics (Michlovic and Swenson 1998:21). The most frequent patterns used on the Northeastern Plains Village ware group are parallel trailed lines, diagonal lines, chevrons and other complex geometric designs. This ware also includes curvilinear lines, thunderbirds and arrows (Michlovic and Swenson 1998). These curvilinear designs and thunderbird motifs are very similar to ceramics found in Cambria and Oneota cultures. The rolled lip types found in Lisbon Flared Rim ware and Buchanan Flared Rim ware resemble Mississippian pottery (Michlovic and Swenson 1998:22). The Late NEPVC sites can contain mixed of pottery assemblages (Michlovic and Swenson 1998:22). These ceramic

assemblages include Oneota, Cambria, Late Woodland Sandy Lake ceramics, and Middle Missouri ceramics including S-shaped rims in small numbers (Michlovic and Swenson 1998:22).

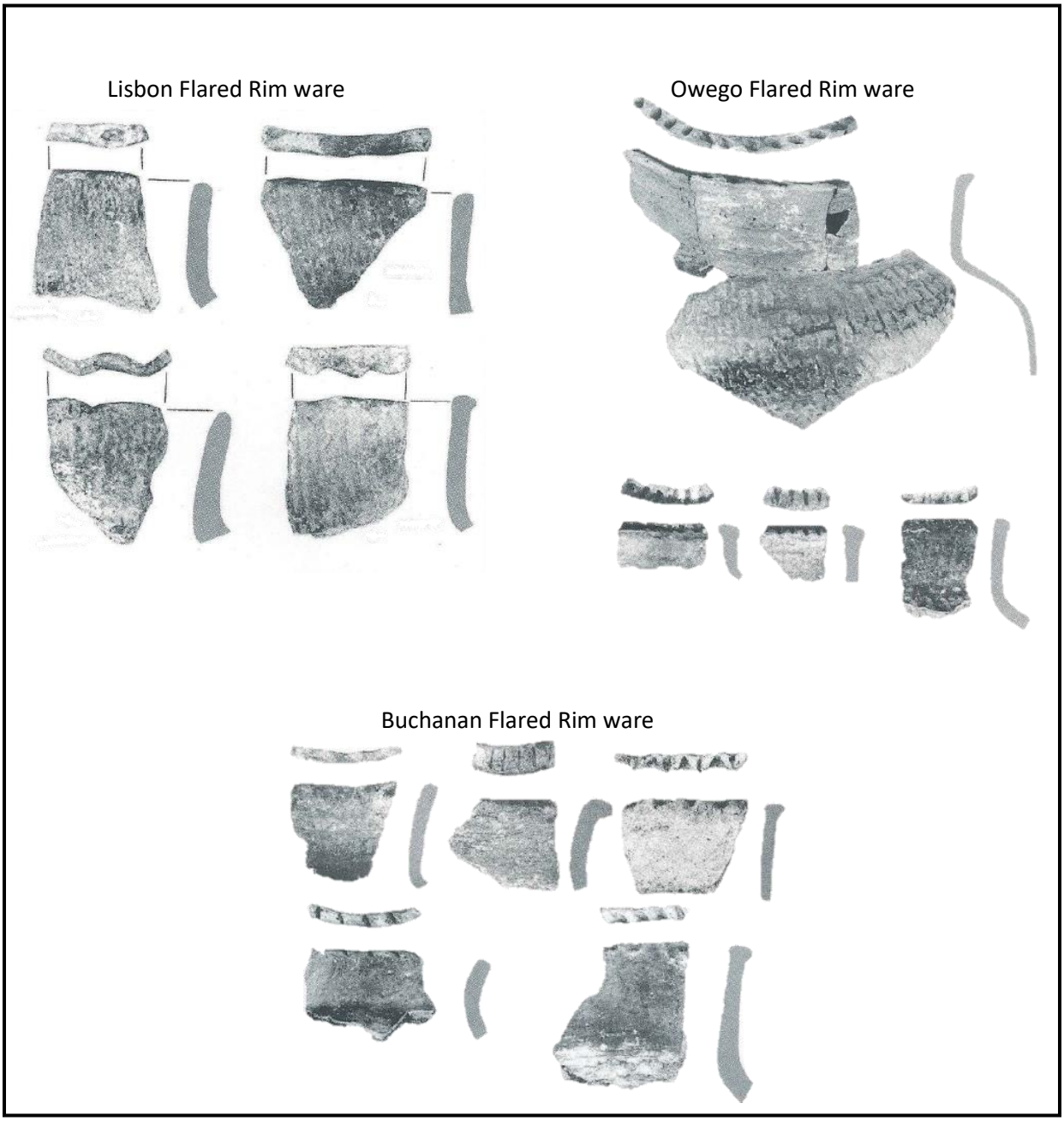


Figure 11. NEPVC ceramic ware examples (Michlovic and Swenson 1998). Images used with permission from State Historical Society of North Dakota.

The Nonnast site is situated in a time of transition from Woodland to Plains Village traditions. In addition, it is geographically located in an area that could have been accessed by peoples from the Great Oasis, Mill Creek, Over focus and NEPV cultures. The chapter that follows is a discussion of how cultural materials from the Nonnast site were obtained and how they were analyzed.

Chapter 3: Methodology

During excavation, standard archaeological methods were practiced in accordance with the excavation permit obtained from the State of South Dakota (SDCL 1-20). All excavated material was screened through a 1/4" hardware mesh. Since this site had been previously plowed, the first 10cm were excavated using the shovel skimming technique. All other levels were dug with a trowel using traditional archaeological recovery methods. The second 10cm (10-20cmbs) were taken down as one level. Below 20cm the excavation units were excavated in 5cm arbitrary levels. At the end of each 5cm level the unit floors were swept, photographs were taken, and level completion paperwork was done. For the sake of consistency all paperwork was completed by Megan Ernst. Field notes were written by both Megan Ernst and the principal investigator (PI), Michael Fosha.

Laboratory Methods

All of the materials recovered during the excavations at 39ML0009 were processed at the Archaeological Research Center (ARC). Laboratory processing of the materials followed standards and procedures outlined by the South Dakota State Historical Society (SDSHS). The initial step entailed dry brushing the loose dirt from the artifacts. This did not include any carbonized materials that might have been on any of the pottery sherds. Next, the items were sorted into broad material classes (e.g., pottery, chipped stone, bone). Then, each broad category was further refined (e.g., pottery–rim sherd vs. body sherd; chipped stone - tools vs debitage). Each refined category was assigned a unique catalog number. The artifacts were then counted or weighed if they could not be easily counted such as the fire cracked rock (FCR). An artifact tag labeled with its assigned catalog number was placed in with the artifacts within a plastic bag. All

rim sherds and other diagnostic material was separated to be further analyzed by the current analyst for the purpose of this thesis.

Analytical Methods

As previously stated, all diagnostic materials from the 2015 and 2017 excavations at 39ML0009 were analyzed. These diagnostic items mainly consisted of rim sherds. However, other potentially diagnostic material or items of special note will also be discussed. This will include a brief discussion of the *leptoxis* modified shells that were found and the projectile points.

All ceramics were divided into rims and body sherds. All of the rims were counted and separated by level and unit. The body sherds were also separated by level and unit; however, the body sherds are represented by a total weight per level and not by count. Both count and weight are acceptable means of measurement and quantification. However, sherd count cannot be reliably used to compare assemblages due to the range of ceramic fabric and how easily some sherds breaks over another (Orton and Hughes 2013: 207). This fact will not affect the Nonnast site ceramic analysis because only intra-site comparisons will be used.

Rim sherds were defined as any ceramic sherd that contains any part of the lip. Any rim sherd smaller than 1.5cm square was excluded from further analysis. This is because such a small rim does not allow for an accurate depiction of form or design motifs. The rims profiles and plan views were then scanned using a digital scanner at 600 dots per inch (DPI). All images were scanned to scale then saved as a Tiff file. The images were then reduced and saved as jpg files for use within this thesis.

Multiple types of descriptive and metric information were recorded for each rim sherd. The provenience, depth and catalog number were first recorded. Since Great Oasis and Mill Creek are comprised of the same broad ware shapes: wedge, high rim and S-shaped, the sherd was placed in one of these three broad categories (Anderson 1981; Henning and Henning 1978; Ives 1962). A ware, as defined by Lehmer (1954:41), is a group of types which share a majority of basic characteristics including: fabric, paste, temper, firing, hardness and color. Wares are also based on distinctive features, such as rim and body form (Ives 1962:2). If there was not enough information to reliably classify a rim sherd or if it did not fit into any of my defined broad ware categories, it was classified as aberrant.

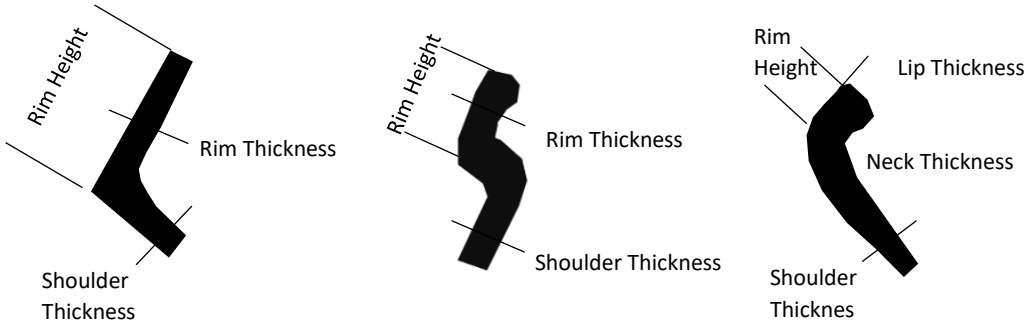


Figure 12. Metric attributes recorded on high rim, S-shaped and wedge Lip wares.

After the broad ware category was decided for each rim, metric attributes were collected and recorded. For all rims classified as High Rim ware, the rim height, rim thickness, and shoulder thickness was recorded if present. For all broad ware wedge rim sherds the: rim height, lip thickness, shoulder thickness and neck thickness were recorded. For all broad ware S-shaped rims the: rim height, rim thickness and shoulder thickness was recorded, if present. The metrics taken followed Henning (1996), Ives (1962) and Fishel (2005; Figure 12).

The fourth broad ware category was aberrant. The rim height, lip thickness, rim thickness and shoulder thickness were recorded if present. Aberrant rims were classified as such when the rims did not fit within wither Great Oasis or Mill Creek ceramic typologies, there was a mix of Great Oasis and Mill Creek characteristics or the sherd was broken and there was not enough data present to make an informed decision as to which type of board ware category was applicable due to form or shape.

Digital calipers were utilized to obtain all metric attributes. Each measurement was taken three times, and the average of the three measurements was recorded as the final number. As Henning points out (1996:35), "replication of measurement methods for comparative research is essential. This is especially true in dealing with Mill Creek and Great Oasis cultural remains where a large body of previous research remains unpublished…"

After the metric data were recorded, the temper of each sherd was examined and noted. Temper as used in the context of this thesis means any deliberate inclusions which were added to the pottery (Orton and Hughes 2013). Types of temper can vary between Great Oasis and Mill Creek Pottery. Mill Creek pottery can contain sand, shell, crushed granite/grit, grog, and limestone as temper (Henning 1996). Whereas, Great Oasis temper mostly consist of crushed granite and sand (Tiffany 2005). However, the Cowan Great Oasis site did produce a number of Great Oasis rims that contained a combination of grit and grog (Tiffany 2005). Temper for each rim sherd will be recorded to try and define any pattern of temper use that was used at the Nonnast site.

Once the temper was recorded, the lip shape and rim profile were noted. The lip shape and profile can be indicative of a more specific pottery ware than the general wares described

above and unique pottery type. According to Henning (1996:25) the lip on Great Oasis High Rim ware is flat with a parallel rim profile. Whereas, Mill Creek Chamberlain wares have a rounded lip with a rim that tapers from the neck to the rim, often creating a D-shape in profile (Tiffany 2005). Tiffany (2005:53) claims that lip shape is not always indicative and is subjective. The Cowan site is a Great Oasis site that produced Great Oasis High Rim ware sherds with lip forms that are rounded, flat and beveled; however, the lips on a large majority of High Rim wares recovered from Cowan were flat (Tiffany 2005:36). The difference between Great Oasis and Mill Creek broad ware wedge rims is that Mill Creek wedge rims are short and thickened but not to the extent that they are wedge in shape (Anderson 1981:16). Therefore, many of the wedge wares have a lip form that is considered angular (Anderson 1981).

The basic ware characteristics are very similar between Mill Creek and Great Oasis. For example, they share the same in terms of paste, hardness and color. Ives (1962) describes a "typical Mill Creek paste" this definition and phrase is used repeatedly to describe both Mill Creek and Great Oasis pottery (Anderson 1981:14; Henning 1996:18; Tiffany and Alex 2001:26). With this being the case, I did not record the paste, hardness, or color. However, some Mill Creek wares do utilize a red slip. So the use of slips was noted.

A key component to pottery types and ceramic seriation is decoration. A ceramic type is defined by Ives (1962:9) as, "a segment of a given ware which exhibits a distinctive method of design application or design form which has special and temporal significance." Therefore, the decoration on all rim sherds within the Nonnast site assemblage were recorded. If no decoration was present that was also noted.

Mill Creek ceramics have many formal type designations under each ware category (Ives 1962 and Anderson 1981). Anderson's definition of Mill Creek wares is more exclusive than Ives which includes more varieties of decoration (Table 1).

Table 1: Ives (1962) and Anderson (1981) Mill Creek Type designations.

<table>
<tr><th></th><th>Sanford Ware Types</th><th>Chamberlain Ware types</th><th>Foreman ware types</th><th>Mill Creek Ware types</th></tr>
<tr><td rowspan="5">Anderson (1981)</td><td>Mitchell Modified lip</td><td>Chamberlain Incised</td><td>Foreman Incised</td><td>High Rim (same as Ives Vertical Neck type)</td></tr>
<tr><td>Kimball Modified lip</td><td>Chamberlain Incised Triangle</td><td>Foreman Incised Triangle</td><td>Bowl</td></tr>
<tr><td rowspan="2">Sanford Plain</td><td rowspan="2">Chamberlain Crosshatched</td><td>Foreman Crosshatched</td><td>Seed Jar</td></tr>
<tr><td>Foreman Plain</td><td>Miniature (Ives does not include this type)</td></tr>
<tr><td rowspan="3">Ives (1962)
* includes all of Anderson's designations plus these listed</td><td rowspan="3">Sanford Incised Shoulder</td><td>Chamberlain cord Impressed</td><td>Foreman Cord Impressed</td><td rowspan="3">Red Film</td></tr>
<tr><td>Chamberlain cord Impressed Triangle</td><td rowspan="2">Foreman Cord Impressed Triangle</td></tr>
<tr><td>Chamberlain Plain</td></tr>
</table>

Ives (1962) includes cord impressed pottery within his Mill Creek ceramic typology which is based on various sites mostly in the Middle Missouri subarea. However, he notes "cord impressed decoration is rare or absent" in Mill Creek assemblages (Ives 1962: 11). Ives goes on to state that "cord impressing is not a part of Mill Creek ceramic tradition" (Ives 1962: 18) In fact, Ives claims that those cord impressed ceramics that are found on Mill Creek sites are trade items (Ives 1962:18). This is no longer the prevailing thought. Cord impressions are rare on Mill Creek sites in Iowa but are more commonly found at Mill Creek and Over focus sites in South

Dakota (Hurt 1954, Tiffany 1982:2). Alex has observed that the Brandon locality of the Over focus produced the highest percentage of cord impressed pottery sherds when compared to Mill Creek and Over focus sites along the James River (Alex 1981: 156). The nature of the Brandon Site near Sioux Falls presents an intermediary between the high frequency of cord impressed rims, like there is along the Missouri River, with the decorative elements of Mill Creek (Alex 1981:185).

Over focus ceramics use the same typology as Mill Creek. Therefore, the analysis of the Nonnast site rim sherds will be divided into Great Oasis and Mill Creek wares. However, decoration will be recorded. The recordation of decoration for the Nonnast site assemblage will closely follow the methods outlined in the Cowan Report (Fishel 2005). Following Fishel's methods will allow for easy comparison between both Mill Creek and Great Oasis ceramic assemblages. This will also help any future researchers that want to conduct further analyses on Great Oasis and/or Mill Creek ceramics.

According to Fishel (2005:33) high rim decoration can occur in two to three bands along the rim. The upper band is designated as the first 0.5-1cm from the vessel's lip (Fishel 2005:33). The middle band, if present, is located between the high and low bands. The lower band is the area of the rim below the upper band, or middle band, extending down to the shoulder juncture of the vessel (Fishel 2005:33).

In Fishel's (2005) ceramic analysis of the Cowan site, each decoration within the upper and middle bands correspond to six lettered elements (Table 2). The decorations of the lower band contain a defined field element and geometric motif. Each field element has a specific letter

designation. Each motif has a specific letter and number combination (Table 2). The number of lines within each motif are also recorded with a corresponding letter (Figure 13).

Table 2. High rim, S-shaped and aberrant decorative attributes and associated codes (Fishel 2005).

Lower Band (X = band absent)
Field Element A Plain B Horizontal Lines C Diagonal lines, right D Diagonal lines, left E Crosshatched lines
Geometric Motif A1 Triangle, plain A2 Triangle, horizontal lines A3 Triangle, diagonal lines right A4 Triangle, diagonal lines left B1 Pendant triangle, plain B2 Pendant triangle, horizontal lines B3 Pendant triangle, diagonal lines, right B4 Pendant triangle, diagonal lines, left C Continuous oblique lines, right D Continuous oblique lines, left E Space oblique lines, right F Space oblique lines, left G Trapezoid H Pendant trapezoid I Diamond J Running deer K Turkey track L Inverted turkey track M Panel N Arrow
Number of lines outlining motif A One line B Two lines C Three lines D Four lines E Five lines F Six lines
Upper and Middle Bands (X = Band absent)

Element	
A	Plain
B	Horizontal lines
C	Diagonal lines, right
D	Diagonal lines, left
E	Crosshatches lines
F	Punctates
G	Vertical lines

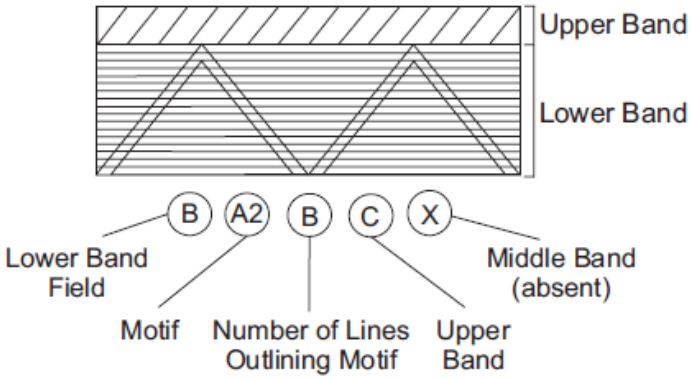


Figure 13. An example of the recorded decorative components recorded on each High Rim, S-shaped and aberrant rim sherd (Fishel 2005). Image used with permission from the University of Iowa Office of the State Archaeologist

Fishel's methodology for recording decoration will be used for all High Rim wares, S-shaped and aberrant wares at the Nonnast site (Appendix D). This methodology will not be used for wedge shaped wares for both Mill Creek and Great Oasis, since the decoration on wedge shaped wares is confined to the lip-rim exterior and/or to the flatted lip surface (Henning and Henning 1978). In addition, decoration on wedge ware is not as detailed as it is in High Rim and S-Shaped wares. Nevertheless, all decoration present on wedge shaped wares was recorded.

Another characteristic of decoration recorded for each rim sherd is the *precision of application*. According to Henning and Henning (1978: 16) the precise application of decoration is a fundamental difference between Great Oasis High Rim and Mill Creek Chamberlain wares

(Johnson 2007:102). However, Fishel argues (2005:53) that these criteria are subjective and hard to quantify. Some characteristics of a precise application that were utilized in this ceramic analysis are: straight lines, lines that do not overlap (when not purposefully superimposed on one another), and lines that are evenly spaced. Henning (1996:24) refers to the precision of decoration application as the "neatness factor." He goes on to explain that the "neatness factor" is almost "impossible to quantify" but is important when separating Mill Creek and Great Oasis (Henning 1996:24). Fishel (2005:53), on the other hand, argues that the neatness factor cannot be relied upon as a defining characteristic. The neatness may be a reflection of individual artistic ability or may be related to the manufacturing process (Fishel 2005:53). Regardless, the precision of decoration application was noted during analysis so any patterns involving the "neatness factor" could be discerned.

Tool shape was also noted as part of the ceramic recordation. Most Great Oasis and Mill Creek ceramic sherds are incised unlike earlier Woodland ceramics that are cord-impressed (Henning and Henning 1978, Johnson 2007). However, cord impressed pottery does appear in very small percentages on Mill Creek sites (Tiffany 1982:2). Alex (1981) concluded that Over focus sites contained more cord roughen and decorated pottery then other Mill Creek sites in Iowa and along the Missouri River. Trailed Ramey incised pottery is also found on Mill Creek sites. The incised decorations on Ramey Mississippian vessels are much broader than in Mill Creek or Great Oasis wares. Therefore, tool shape was noted in the Nonnast site assemblage to try and find any patterns of decoration application.

After information for provenience, broad ware category, temper, lip form, rim profile, decoration and all metrics were taken for each rim, they were categorized as a specific ware and

type. Meaning they were split into either Great Oasis or Mill Creek categories. Since the Nonnast site was originally designated as having both Great Oasis and Mill Creek occupations a strict adherence to the defining characteristics of Great Oasis and Mill Creek pottery was followed when assigning specific ware categories. For example, a flat lip is Great Oasis High Rim ware; whereas, a curved lip is a Chamberlain high rim ware (Fishel 2005; Henning 1996:25). I strictly adhered to Henning and Henning's (1978) definition of Great Oasis wares. On the other hand, Ives (1962) and Anderson (1981) were strictly adhered to in the definition of Mill Creek wares. Therefore, if a rim sherd contained a mix of traits such as a flat lip, like Great Oasis but was D-shaped in profile, like Chamberlain high rim, the rim was considered aberrant. In addition, if a rim did not neatly fit into a defined specific ware category it was also considered aberrant for example, an L-Shaped rim does not fit within the Great Oasis or Mill Creek ware categories. Decoration was also taken into consideration when defining the specific wares since this is a defining characteristic of Great Oasis. Therefore, lip form, rim profile, precision and decoration were utilized in that order of importance to define the ware and type, except for any cord impressed pottery which was categorized as Mill Creek because no Great Oasis cord impressed pottery is noted in any of the previous research. However, the main focus of this thesis is not to define types but to define wares because ware categories will answer the research question of who occupied the Nonnast site.

Once all of the metric and descriptive information was collected, chi square tests were conducted on a range of information collected to determine if any discernable statistical differences can be observed by depth and throughout the site by trench. If a significant statistical

difference is observed, it could be an indication that two cultural components are present at the Nonnast site.

Chapter 4: Current Investigations 39ML0009

To recap, the Nonnast site was first tested through excavation in 2015 by SDAS and ARC after LiDAR indicated a possible fortified village. One, 1x2m test unit was excavated to a depth of 25cmbs within a possible house depression as indicated by the LiDAR (Maki et al. 2015). Artifacts recovered during the 2015 excavation includes: pottery, *Leptoxis* shell beads, and a large variety of animal bone, especially fish species. A sample of mammal bone was collected between 10-20cmbs and radiometrically dated through AMS. The sample dated to 310 +/- 30BP (Beta – 43200; Bone collagen; δ^{13} C= -17.3‰). This date was calibrated (2σ) to AD 1485 to 1650 (95% probability).

The calibrated results from mammal bone sample was not only beyond the accepted dates for the assigned components of 39ML0009, Great Oasis and Mill Creek; it was also beyond the Initial Middle Missouri Variant, which dates from approximately AD 900/1000 to AD 1300 (Henning 2001, Johnson 1996). It was concluded that more information should be obtained from the site to try and understand who occupied the Nonnast site and when. As a result, more excavations were conducted during the summer of 2017.

2017 Field Techniques

The 2017 field work was conducted on August 6 through August 11 with the help of members of SDAS and employees of the South Dakota Game Fish and Parks Department. All work was co-directed by Michael Fosha, principal investigator with the ARC, and the current analyst. The goal of the 2017 excavations was to expand upon the information obtained by the

1x2 meter test unit that was dug at the site in 2015. As previously mentioned, the 2015 excavation produced an abundance of bone. Therefore, it was decided to expand the 2015 test unit into a trench composed of five additional 1x1 meter test units. This trench, referred to as Trench A, would allow for the identification of any possible features that were anticipated during the 2015 excavation. An advantage of conducting testing via trench is to provide a good cross section of a portion of the site allowing for a good subsurface view of site stratigraphy and soil development. In this case, the expansion of test unit 1 into a trench would provide a cross-section of any possible house features located within the possibly fortified village.

The 2015 test unit (TU 1) was relocated using a metal detector. The pins marking the unit corners were left in place after the 2015 excavation which allowed for easier relocation. Three out of the four pins were relocated using a metal detector. A datum (N500 W500) was then placed three meters east of TU 1. All excavation units were oriented from this datum point (Table 3, Figure 13).

Table 3. Trench A unit designations.

Unit number designation	Unit Provenience	Finishing depth (cmbs)
1 (1x2m; 2015 excavation 25cmbs)	N 500 W 504 and 505	N500 W504 = 50 N500 W 505 = 40
4 (1x1m)	N 500 W 503	30
5 (1x1m)	N 500 W 506	30
6 (1x1m)	N 500 W 507	35
7 (1x1m)	N 500 W 508	30
8 (1x1m)	N 500 W 509	10

While the crew was working on the excavation of Trench A it was decided to explore other areas within the village feature. Three shovel tests (ST) were conducted (Figure 14). Two

shovel tests, measuring approximately 50cm round by 25cm deep, were conducted. The first shovel test (ST 1) was excavated to a depth of approximately 20cmbs. Very few artifacts were obtained, and soils seemed very mixed. The second shovel test (ST 2) was located to the northwest of Trench A in a depression. This shovel test produced some pottery and lithic flakes. Dark soils were encountered down to approximately 45cmbs which were much different than the soils encountered in Trench A. The third shovel test (ST 3) was located on a rise north of Trench A. At approximately 25cmbs a slight soil change appeared as it did in TU 1 during the 2015 excavations. Shovel test 3 was dug to a depth of approximately 30cmbs. This shovel test produced fire cracked rock (FCR), bone, and pottery. One body sherd collected from this ST was decorated with a unique motif (Henning personal communication 2017, Hall and Hall 2004). It was decided to add another small trench in this location due to the abundance of material recovered in the ST 3 and the unique pottery sherd that was found. This trench is referred to as Trench B (Table 4, Figure 15). Trench B is composed of two test units and is located 22 meters north and perpendicular to Trench A (Figure 15). Trench B consisted of one 1x 2meter test unit and a 1x1m test unit. At this point in time, the fortification trench was not tested due to time constraints and limited access to the LiDAR data.

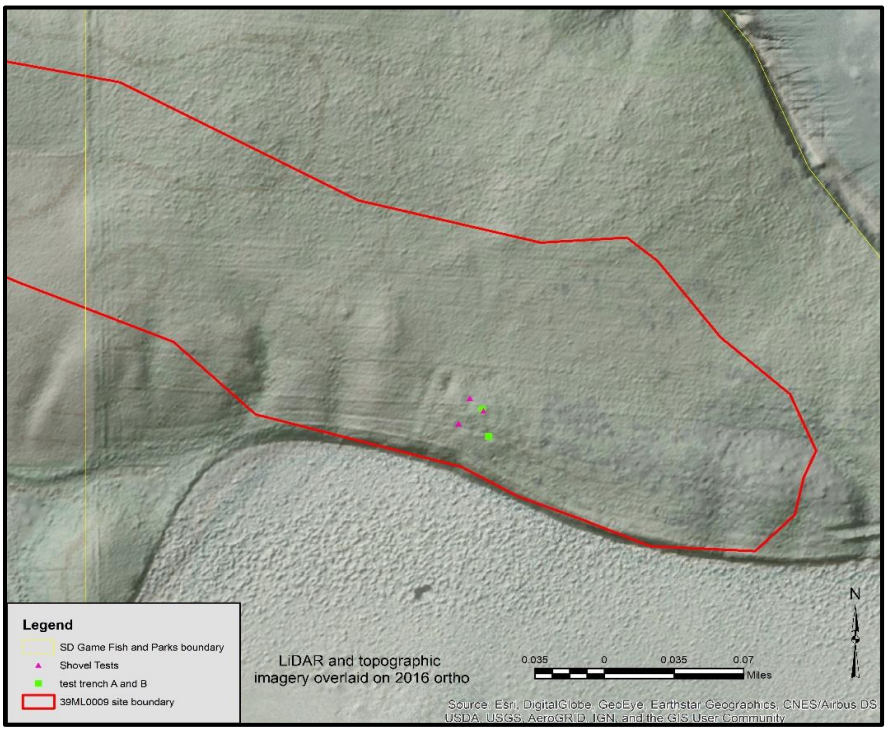


Figure 14. 2015 LiDAR imagery overlaid with USGS topo and 2016 aerial imagery, showing location of Test trenches and shovel tests.

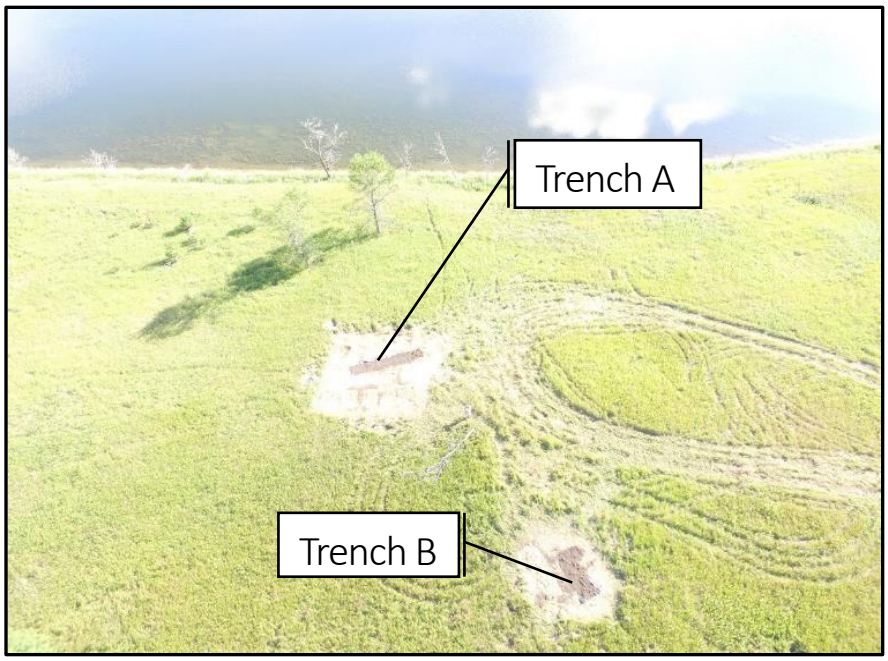


Figure 15. 39ML0009; 2017 excavation overview trench A and trench B; Photo facing south.

Table 4. Trench B unit designations.

Unit number designation	Unit Provenience	Finishing depth (cmbs)
2 (1x2m)	N 523 and 524 W510	30
3 (1x1m)	N 522 W 510	30

2017 Excavation Results

Site Stratigraphy: Test units 1 and 4 were profiled from Trench A. These units were representative of the stratigraphy over the remainder of Trench A (Figure 16). The Ap, or plow zone, extends from ground surface to approximately 18-22cmbs. The plow zone is composed of silt that is friable and weak in structure. The Ap zone includes the sod layer and is thick with roots. The remaining soil stratigraphy (20-50 cmbs) is fairly uniform in color but lighter than the plow zone. The remaining soil was a silt loam that was weak and friable with evidence of rodent burrowing activities, specifically pocket gophers (Appendix F). There was a slight increase in structure and carbonates forming at approximately 40cmbs. At this same level light soil inclusions began to appear. These lighter inclusions became more mottled around 45cmbs. A soil core was taken at the unit (TU 1; N 500 W 504) finishing depth that went to a depth of 75cmbs. A soil change from silt loam to a lighter compact aeolian silt with heavy carbonates started approximately 66cmbs. It was concluded that the mottled surface found at 40-45 cmbs was due to major rodent activity. The rodents were bringing this lighter material up from below and depositing it above.

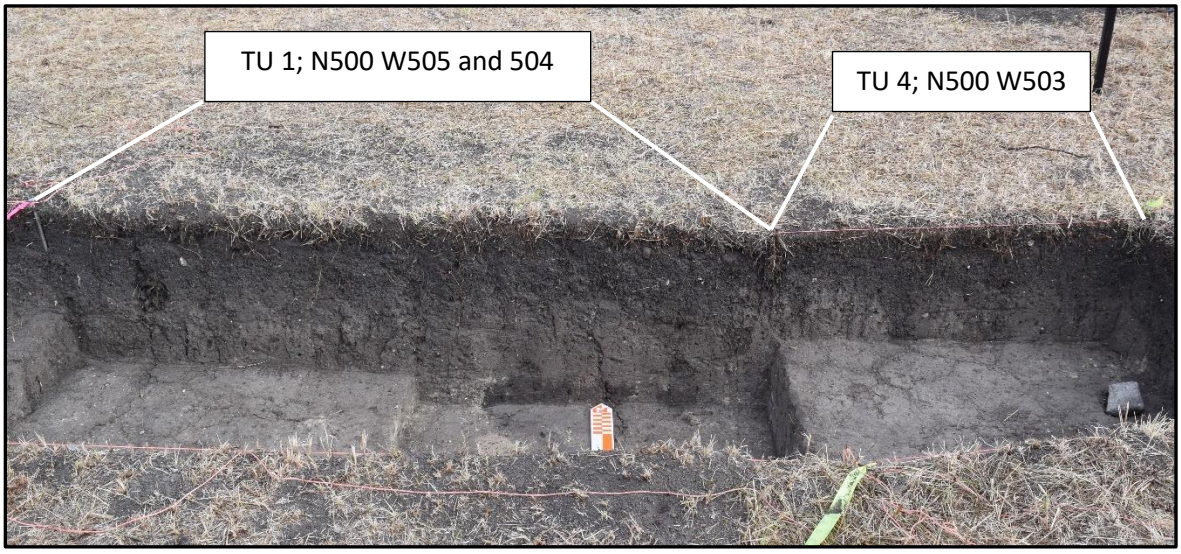


Figure 16. Trench A; profile TU 1 and 4.

As previously stated, Trench B was located on a small raise 22m north of Trench A. The soils in Trench B were very comparable to Trench A. An Ap zone was identified starting at the ground surface to approximately 20cmbs. The plow zone in Trench B is the same composition as Trench A. The remaining soil excavated from Trench B was composed of silt loams which were structurally weak and friable. Rodent disturbance in this trench did not seem as predominant as it was in Trench A. Although this trench was not excavated to the depth that Trench A was. With this being the case, the rodent disturbance might not have become apparent with the amount of excavation that was conducted in trench B.

According to the United States Department of Agriculture, Natural Resources Conservation Service (NRCS), web soil survey, this portion of the site is composed of Poinsett-Forman complex. Poinsett soils are described as a silt loam to a silt loam clay that is well drained (NRCS 2017). Forman soils are described well drained clay loam (NRCS 2017). The parent material of Poinsett-Forman is silty drift over loamy till (NRCS 2017).

Features: During excavations two features were observed. The first was a post mold and the second was a living floor. The post most was identified in the eastern wall of TU 4, N500 W 503. The adjacent test unit N 500 W 502 was not excavated. The post mold was observed and noted at 30cmbs, the finishing depth of unit 4 (Figure 17). However, the post mold first appears in the unit profile at approximately 22cmbs. The post mold was excavated below 30cmbs to find the extent of the feature. The post mold measures 7cm in diameter and measures 16cm in length and extends to a depth of 38cmbs. With the major amount of rodent disturbances, it was decided that this was a feature and not a rodent burrow because it was vertical for over 10cm in length. Rodent burrows usually turn or curve within 10cm.

Figure 17. TU 4 east wall; Feature 1, post mold 30cmbs.

The second feature was a living surface which was identified in Trench B starting at 25cm and extending to the finishing depth of the unit which was 30cmbs (Figure 18). A plan view of the feature within Trench B was mapped at 30cmbs. It was decided that this was a living

surface feature due to the horizontal in situ arrangement of the artifacts. The feature was composed of a circular ground stone tool, a large mammal bone, pottery sherd, and manuport stones that were all arranged in a horizontal in situ fashion. Therefore, they seemed to be previously undisturbed by plowing or rodent activities.

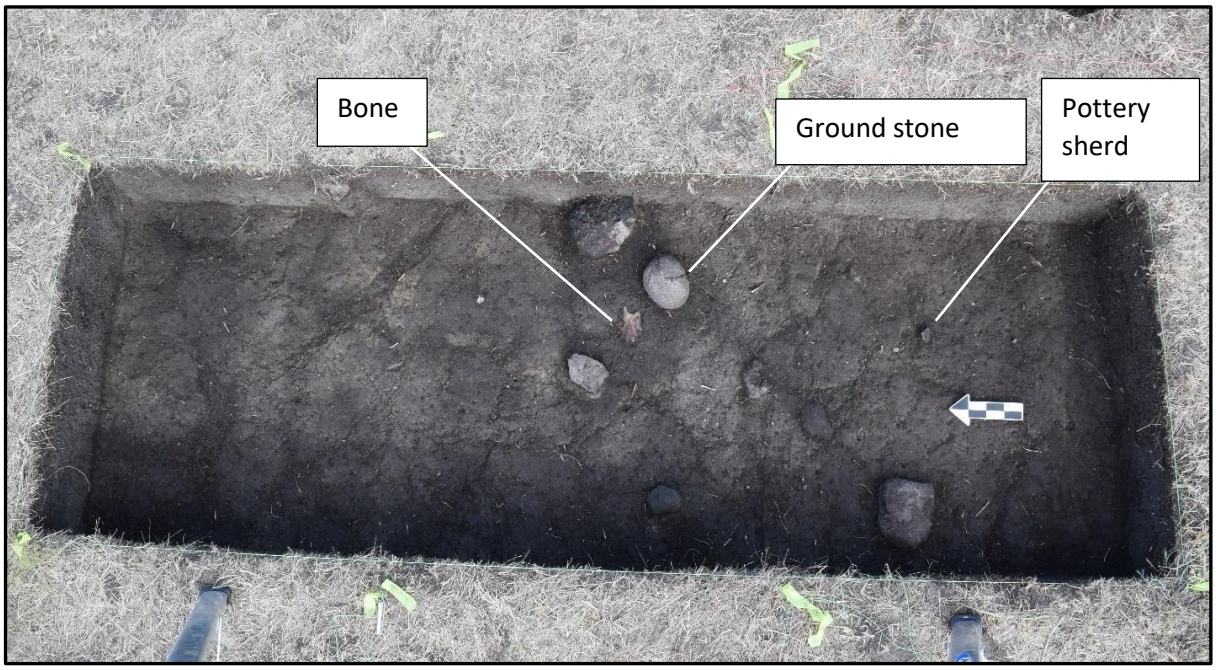


Figure 18. Trench B; Feature 2, Living surface

The ground stone tool is granite and is ground to a smooth flat surface on the ventral side of the tool. The dorsal and lateral sides of the tool show no grinding. The bone from feature 2 was mammal; it weighed 51 grams and measured 6 cm in width by 11 cm in length. This bone was utilized as a radiocarbon dating sample to try and accurately date the feature. The radiocarbon dating is discussed in further detail below (see "AMS dates" section). The piece of pottery found is a body sherd that is cord roughened and tempered with grit. Feature 2 also contained cobble sized manuports (Figure 17).

As previously stated, the 2015 excavation of unit 1 was thought to contain a potential bone midden feature due to the amount and range of species recovered within the first 25 cm. The 2017 excavation revealed no indication of a bone middle in the remainder of TU 1 or within the adjacent units.

Diagnostic artifacts: Three projectile points were found during the 2017 excavations, but none were found during the 2015 excavation (Table 5). All of the projectile points are side notched and measure at most, 3cm in length (Figure 19).

The first projectile point found from 10-20cmbs is a Plains Side-notched point (Figure 19, A). This is a small projectile point which exhibits random flaking with a square, straight base. The notches are fairly deep and narrow which is a characteristic of the Plains Side-notched point (Kehoe 1966). The other two projectile points found are Prairie Side-notched points which were found between the depths of 35-40cmbs (Figure 19, B, and C). These points contain wide rounded notches. The base is straight with rounded corners. These projectile points exhibit random flaking with a lack symmetry which is characteristic in the Prairie Side-notched typology (Kehoe 1966).

The Prairie side-notched type is found in the northern Plains and Woodlands (Kehoe 1966). The Prairie Side-notched point appears to have developed from the Besant tradition circa AD 650 and lasting until AD 1250 (Peck and Ives 2001). Plains side-notched date from AD 1300 to the Historic Period and generally date later than the Prairie-Side notched points (Kehoe 1966, Peck and Ives 2001)

Table 5. Projectile point information.

Provenience/Trench	Material	Depth	Typology	Catalog number
TU3; N522 W 510; Trench B	quartzite	10-20 cmbs	Plains side-notched	03-010
TU 1; N 500.80 W 503.74; Trench A	chert	39cmbs	Prairie side-notched	01-032A
TU 1; N 500 W 504 and 505; Trench A	chert	35-40cmbs	Prairie side-notched	01-032B

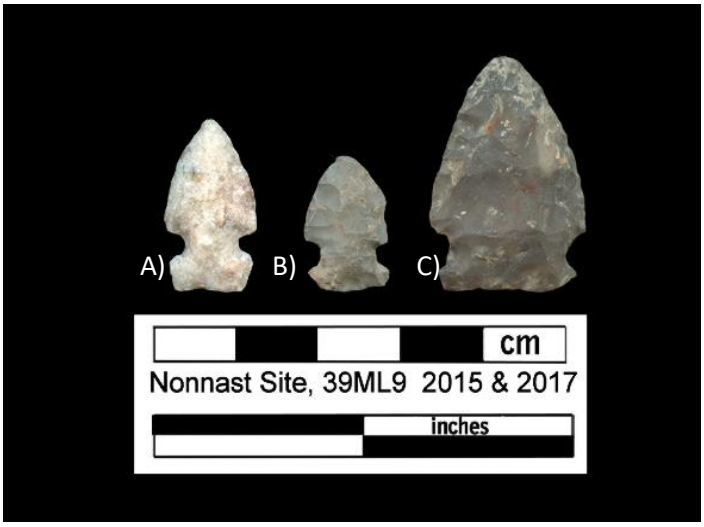


Figure 19. Projectile points recovered during 2015 and 2017 excavations. A) TU; 3 10-20cmbs, B) TU 1; 39cmbs C) TU 1; 35-40 cmbs.

One bone tool was found; it was the tip of a highly polished bone awl. This was found in TU 2 (N523 and 524 W 510) approximately 10-20 cmbs. The only other potentially diagnostic material, besides the pottery, were three *Leptoxis* shell beads.

Leptoxis sp. is a genus of freshwater gastropod found in the Ohio River valley and the Ozark highlands of Missouri. However, the historical distribution of this snail could have been much greater (Henning 2005). *Leptoxis* shell beads were made by grinding and smoothing down the whorl of the shell adjacent to the aperture (Henning 2005). Three of these beads were found during the 2015 and 2017 excavations at the Nonnast site (Table 6; Figure 20). *Leptoxis* has been

Figure 20. *Leptoxis* shell beads; anterior view on left; posterior view on right; a) TU 1, 20-30cmbs, cat# 01-021; b) TU 3, 10-20cmbs, cat# 03-015; c) TU 4, 0-10cmbs, cat# 04-008

used by to make beads by many cultures of past. *Leptoxis* shell beads have been found at sites from multiple states including: Alabama, Arkansas, Illinois, Iowa, Kentucky, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Tennessee and Wisconsin (Henning 2005). *Leptoxis* shell has been in use on the northern plains since the Woodland period. The height of use appears to range from AD 600 to AD 1100 (Henning 2005). *Leptoxis* is found at both Great Oasis and Mill Creek sites and is often found in burial contexts (Henning 2005; Tiffany and Alex 2001).

Table 6. *Leptoxis* shell bead information from 30ML0009.

Test Unit; Provenience; Trench	Depth	Catalog number
TU 1; N 500 W 504 and 505 Trench A	20-30 cmbs	01-021
TU 3; N 522 W 510; Trench B	10-20 cmbs	03-015
TU4; N 500 W 506; Trench A	0-10 cmbs	04-008

Henning (1991) has interpreted the presence of *Leptoxis* shell beads at Great Oasis sites as an indication of Mississippian contact and/or trade. Tiffany and Alex (2001) see the presence of *Leptoxis* beads at Great Oasis sites as an indication that a mutual source was shared by multiple cultures. However, Tiffany and Alex (2002) also interpret the presence of Leptoxis beads in Mill Creek contexts as an indication of Mississippian contact sites due to the prevalence of Mississippian-like artifacts often found in Mill Creek contexts. Nevertheless, *Leptoxis* beads found at the Nonnast site are non-local and are an indication of trade.

AMS dates: As previously stated, a bone sample was recovered for AMS dating from the 2015 excavations. This bone sample (39ml9 XU1- 8-15) was excavated from TU 1 at a depth of 10-20cmbs.

Two additional mammal bone collagen samples were excavated during the 2017 excavation and dated radiometrically through AMS analysis by Beta Analytic. The second bone sample (01-040), was obtained from Test unit 1 (N 500 W 504 and 505), Trench A. This sample was recovered from approximately 40-45cmbs. This sample was identified as a medium to large mammal, artiodactyl (Falk unpublished results). The third bone sample (02-032) was obtained from Feature 2, the living surface, TU2 (N 523 W510). The bone was found approximately 30 cmbs, the finishing depth of Trench B.

Table 7. 2015 and 2017 AMS dating results from 39ML0009. (In chronological order).

Sample Number	**Provenience**	**Depth (cmbs)**	**Conventional Radiocarbon Age (BP)**	**Calendar Calibrated results**	**Probability ranges and dates (cal AD)**	**D13C Value (δ^{13} C)**
39ml9 XU1- 8-15	TU 1, N 500 W 504 and 505	10-20	310 +/-30	AD 1485 - 1650	(95%) 1485-1650	-17.3‰
02-032	TU 2, N 523 and 524 W510,	30	860 +/- 30	AD 1150-1256	(83.5%) 1150-1256 (9.9%) 1059-1084 (2.0%) 1124-1136	-17.9‰
01-040	TU 1, N 500 W 504 and 505,	40-50	910 +/- 30	AD 1033-1190	(94.0%) 1033-1190 (1.4%) 1198-1204	-15.3‰

The AMS results from the second sample, 02-032, dated to 860 +/- 30BP (Beta – 494077). This date was calibrated to AD 1150-1256. The AMS results from the third sample, 01-040, dated to 910+/- 30BP (Beta–494078). This date was calibrated to AD 1033-1190. The other diagnostic materials found at the Nonnast site are the projectile points and pottery. The table below shows the results from all AMS radiometric dating (Table 7). In addition, the Beta Analytic lab results are included in Appendix E. The radiometric dates show intact stratigraphic order remains at the Nonnast site and are consistent with the general date estimates based off of the projectile points.

These AMS dates coupled with ceramic analysis will help to define the cultural component(s) that occupied the Nonnsat site. The chapter that follows is a discussion and analysis of the pottery recovered from the 2015 and 2017 excavations.

Chapter 5: Ceramic Analysis Results

All of the pottery collected during the 2015 and 2017 excavations was analyzed following the procedures outlined in Chapter 3. A total of 73 rim sherds were analyzed. During the analysis a few broad patterns were observed. One being that all of the pottery collected during excavation is composed of the "typical Mill Creek paste" as described in Chapter 3. Another is that no Ramey Incised pottery was observed. In addition, none of the pottery sherds contained any slips. As previously explained, the presence of red slips and/or Ramey Incised pottery is an indication of trade or contact with Mississippian influenced cultures or can be an indication of locally made Mississippian reproductions (Henning 1996; Tiffany 2003). It was obvious that the ceramic assemblage from 39ML009 did not contain any NEPVC ceramics including Cambria because it contained no Mississippian influences. Another broad pattern observed was that no ceramic handles were present within the ceramic assemblage recovered during the 2015 and 2017 excavations. Ceramic vessels that have handles are a characteristic of Mill Creek, NEPV, and Cambria. What follows is a discussion of the pottery observed during the excavations at the Nonnast site

Temper

The majority of rims at the Nonnast site (total rims n = 73) were grit tempered (n = 43). Crushed granite was the preferred grit used. The second preferred method of temper was sand (n = 28). Sand naturally occurs in clay, but in the sand tempered rim sherds no other inclusions were represented. Therefore, sand was considered the temper. The two remaining rims were grog tempered (n = 2). All of the listed tempers are part of the "Mill Creek typical paste" as described by Ives (1962:11), Henning and Henning (1978), and Tiffany (1982).

Body Sherds

The total weight for all body sherds was 6689.5 grams. The focus of this thesis is on the rim sherds; therefore, treatment for each body sherd was not recorded. However, a small sample of body sherds was examined from each level. The body sherd treatment ranged from plain to cord marked and smoothed-over cord marking. Some sherds contained horizontal incised lines. These incised sherds were small in overall size when compared to the other cord marked or smoothed over body sherds. This could mean that they were part of a decorated shoulder of even from the neck of the ceramic vessel. No refits for the body sherds or rim sherds were attempted. Since the surface treatment and temper of each body sherd was not recorded no analysis other than distribution ratios was conducted.

When comparing the first 30 centimeters of body sherds excavated from Trench A to Trench B, the overall average is significantly higher in Trench B than it is in Trench A. The first 30cm are compared because 30cm is the final depth of Trench B. Trench B produced an average of 431.43g of body sherds; whereas, Trench A produced an average 183.74 of body sherds in the first 30 cm of excavation. This is probably due to the feature observed in Trench B. Unfortunately, excavation had to cease and expansion of trench B, horizontally or vertically, during the 2017 excavation was not possible.

The majority of body sherds were consistent in paste and treatment. However, there were two body sherds that stood out due to their unique decoration. They both contained a unique motif similar to an inverted turkey track (Figure 21).

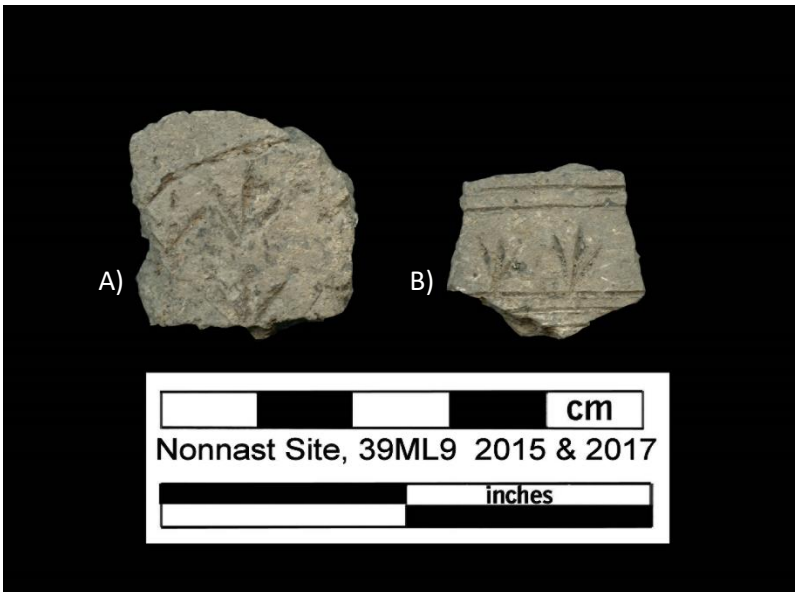


Figure 21. Bluestem motif pottery recovered during the 2017 excavations. Sherd A) Shovel test 3, adjacent to Trench B, depth unknown; B) N 500 W 504 B) and 505, Trench A, depth 30-35cmbs.

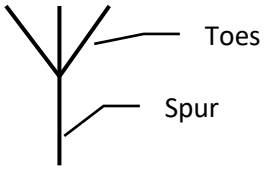


Figure 22. Traditional inverted turkey track motif.

Henning (1978:22) describes an inverted turkey track as a single vertical trailed line with two opposing, obliquely trailed lines intersecting it from the opposite sides to form the toes of the turkey. The toes of the inverted turkey track are pointed towards the lip of the vessel. The central vertical line extends past the toes to form a spur (Figure 22). The turkey track is similar to the maize motif which only contains two oblique lines and a central vertical line, forming a Y-shape (Hal and Hal 2001). Hal and Hal (2001:112) have proposed to combine the turkey track, inverted turkey track and maize motifs, under a broader "bluestem" motif. This is due to the predominance of big bluestem grass on the prairie which is characterized by a long stem topped

with two or three seed heads. Dale Henning (personal communication 2017) has noted that the inverted turkey track body sherds from the Nonnast site do not have a "spur." The central vertical line stops where the two oblique lines intersect with the vertical line. This has lead Henning (personal communication 2017) to believe this particular motif is more reminiscent of a plant, such as bluestem, rather than a turkey track. This author tends to agree. Therefore, this unique motif found at the Nonnast site could be considered part of the broader bluestem motif proposed by Hall and Hal (2004) until further evidence is obtained.

The first sherd (Figure 21, A) that contained the bluestem motif was found within ST 3 at an unknown depth. This shovel test was the deciding factor of the location of test Trench B due to the abundance of cultural material recovered in the first 30cm of the shovel test. Shovel test 3 is located directly adjacent to unit N 524 W 510, TU 2. This unique sherd contains two side by side bluestem motifs with paralleling incised lines above and below the motifs. The second pottery sherd found containing the bluestem motif was identified in the laboratory during sorting (Figure 21, B). This sherd originated from test trench A, TU 1 (N 500 W 504 and 505) at a depth of 30-35cmbs. This sherd contains three bluestem motifs in a pyramid form, 2 motifs forming the base with one motif on top of the other two. A curved incised line is apparent and appears to be encircling the motifs.

Both the turkey track and the inverted turkey track is found in Great Oasis, Over focus and Mill Creek ceramic assemblages (Alex 1981; Hal and Hal 2001; Henning 1978; Tiffany 1983). However, it appears most often in Mill Creek (Dale Henning, personal communication 2017). As for the Over focus, the turkey track is found most often along the Big Sioux and James River drainages (Alex 1981). It is almost absent along the Missouri River drainage (Alex

1981:19). Most of the reports found that reference the turkey track or inverted turkey track motif display the center vertical line extending past the two diagonal oblique lines making the "spur" as noted above. None of the materials referenced discussed or pictured a motif that does not contain the "spur" as the Nonnast site pottery sherds do. Therefore, as previously stated the Nonnast site motifs are not a true turkey track. This motif could be a unique cultural identifier within the Prairie Lakes Region.

Rim Sherds

Out of all the rim sherds collected, 73 were larger than 1.5cm squared. A variety of rim sherd wares, Great Oasis and Mill Creek, were observed within the Nonnast site ceramic assemblage. As described above, the rims were first sorted into a general broad ware category as described by Henning (1996). The rims were then further divided into specific ware groupings. Since Over focus uses the same typology as Mill Creek, only Great Oasis and Mill Creek ware groupings were used. All decoration was recorded and analyzed. Below is a discussion of the different attributes of rim sherds that were analyzed along with the resulting statistical analysis of each category. The rim sherd attributes analyzed are: broad ware, lip form, rim profile shape, and ware decoration.

For each attribute two types of analysis were conducted: time and space. If a discernable difference is observed in the distribution of rim attribute by level (i.e., through time), it may be an indication that different components exist at the Nonnast site. If a discernable difference in rim attribute is observed over the trenches (i.e., across space), it may be an indication that the rim sherds were distributed in different ways, horizontally, over the site. To establish if a statistical difference occurs, a chi-square significance test was conducted in order to confirm or reject the

null hypothesis. The null hypothesis postulates that the observed difference between two samples is a consequence of the vagaries of sampling. (Drennen 2010:157). In other words, the null hypothesis assumes equal random distribution. The chi-square significance test results in a *p* value. If the *p* value is greater than the significance level of .05 or 5% then one has "failed to reject" the null hypothesis. (Drennen 2010:158) When that is the case, no significant statistical relationship exists between the two variables. In this thesis both the *p* value and chi-square (χ^2) values will be reported. The Fisher's exact test will be reported If the expected values are less than one and more than 20% of the expected values are less than five (Drennen 2010:192). All chi-square tests were conducted using PAST 3.22 software which can be used in scientific data analysis including plotting, univariate, and multivariate statistics.

Broad ware sherds: Of the 73 rim sherds analyzed, 8 were S-shaped (11%), 10 were wedge shaped (14%), 50 were high rim (68%) and 5 were aberrant (7%). A chi-square test was conducted to find whether there is a statistically significant difference between the broad ware categories and the depths at which they were found. If any meaningful pattern can be discerned by level it may indicate different occupations over time. The majority of S-shaped rims, an indication of Mill Creek, should be located in shallower depths. If this is the case, clear components may be defined at the site. Chi-square tests were also used to find any statistical difference in broad ware categories throughout the site by trench. Since Feature 2, a living surface, was located in Trench B it was also advantageous to look at intrasite pottery distributions by comparing trench A and B. If any discernable statistical patterns exist, then this could be an indication of special use areas. The chi-square test was not utilized for broad ware analyses over the individual units because the numbers did not meet the standard rules for

conducting a chi-square test and the grouping of the individual units into two trenches altered the need.

Broad ware statistical results. Chi-square tests for broad ware categories by depth yielded a Fishers exact *p* value of .37 ($\chi^2 = 8.91$, $p > .05$). Therefore, it is very likely that the differences in distribution of broad ware rims by level is the result of random chance (Table 8). It should be noted that depth 40-50cmbs was deleted from analysis because of the small sample size; only one aberrant rim sherd was found at this depth. The chi-square test results for broad ware categories by trench yielded a Fisher's exact *p* value of .59 ($\chi^2 = 1.86$, $p > .05$). As with the chi-square by level, the differences observed in broad ware categories by trench is very likely to be the result of the vagaries of sampling (Table 9).

Table 8. Observed broad ware categories by depth.

	cmbs	S-shaped	Wedge	High Rim	Aberrant	Grand Total
Depth	0-10	3	3	19	0	25
	10-20	4	2	14	3	23
	20-30	0	4	13	1	18
	30-40	1	1	4	0	6
	Grand total	8	10	50	4	72

Table 9. Observed broad ware categories by trench.

	S-Shaped	Wedge	High Rim	Aberrant	Grand Total
Trench A	4	4	31	3	42
Trench B	4	6	19	2	31
Grand Total	8	10	50	5	73

Lip form: Of the 73 rim sherds examined 34 had flat lips (47%), 29 were rounded (40%) and 9 were angled/wedge (12%). As previously described, Great Oasis and Mill Creek ceramic assemblages share close similarities. Therefore, the Nonnast site pottery was closely analyzed. Henning (1996:25) has stated that Great Oasis High Rims always have a flat lip. If Henning is

correct, and if Great Oasis precedes Mill Creek, which is the current consensus, then the ceramic assemblage at the Nonnast site should have a greater number of flat lips within the deeper levels indicating an older Great Oasis component. Whereas, rims with rounded lips should be found in shallower depths indication a later Mill Creek component. This was the case at the Brewster site (13CK0015) where flat rims were more prevalent during the start of the occupation (Anderson 1981:43). These rims were found at deeper levels of the site. Rounded rims then gained popularity by the occupations end (Fishel 2005:53).

Lip form statistical results. The results of the chi-square tests on lip form by depth yielded Fishers exact a *p* value of .78 ($\chi^2 = 3.54$, $p > .05$). The results indicate that it is extremely likely that the differences in lip form by level is the result of the vagaries of sampling (Table 10). Level 40-50 was deleted from analysis because of the small sample size; only one rim sherd was found at this depth. Similarly, the chi-square results of lip form by trench yielded a *p* value of .64 ($\chi^2 = .89$, $p > .05$). Therefore, the differences observed in lip form by trench are very likely to be the result of the vagaries of sampling (Table 11).

Table 10. Number of observed lip forms by depth.

	cmbs	**Flat**	**Round**	**Angle/Wedge**	**Grand Totals**
Depth	0-10	11	11	3	25
	10-20	13	8	2	23
	20-30	8	8	2	18
	30-40	2	2	2	6
	Grand Total	34	29	9	72

Table 11. Number of observed lip forms by trench.

	Flat	Round	Angle/Wedge	Grand Total
Trench A	21	17	4	42
Trench B	13	13	5	31
Grand Total	34	30	9	73

Rim profile. Rim profile can be another useful marker when distinguishing between Great Oasis rim sherds and Mill Creek. Great Oasis High Him sherds are generally parallel; whereas, the Mill Creek Chamberlain ware is often tapered, D-shaped in profile (Ives 1962; Henning and Henning 1978: 16; Fishel 2005:52). Besides mixed assemblages, parallel rim profiles should be more frequent in the lower levels at the Nonnast site indicating that Great Oasis is a component at 39ML0009. The horizontal spatial distribution of rim profiles was also examined. If a concentration of a specific rim profile is observed in one area of the site then this could be an indication that different areas of the site were occupied at different times use areas. Out of the 73 rim sherds examined, 37 were parallel (51%), 16 were tapered (22%), 8 were wedge shaped (11%), 8 were S-shaped (11%) and 4 (5%) needed more data (NED) to determine the profile. Most of the rims in the NED category were split in half vertically so they were missing the outside or inside portion of the vessel; therefore, an accurate rim profile could not be distinguished (Appendix A, B and C).

Rim profile statistical results. The results of the chi-square tests on rim profiles by depth yielded a Fisher's exact *p* value of .10 ($\chi^2 = 15.71$, $p > .05$). Therefore, it is likely that the differences in rim profile by depth is the result of the vagaries of sampling (Table 12). The .05 significance level is exceeded by the *p* value of .10 thereby failing to reject the null hypothesis. Again, level 40-50 was deleted from analysis because of the small sample size; only one rim

sherd was found at this depth. The chi-square results of lip form by trench yielded a *p* a Fisher's exact *p* value of .20 ($\chi^2 = 6.17$, $p > .05$). With this being the case, the differences of rim profiles by trench is fairly likely to be the result of the vagaries of sampling (Table 13).

Table 12. Number of observed rim profiles by depth.

	cmbs	Parallel	Tapered	Wedge	S-shaped	NED	Grand Totals
Depth	0-10	10	11	3	1	0	25
	10-20	13	5	1	2	2	23
	20-30	12	1	3	0	2	18
	30-40	3	1	1	1	0	6
	Grand Total	38	18	8	4	4	72

Table 13. Number of rim profiles by trench.

	Parallel	Tapered	Wedge	S-shaped	NED	Grand Totals
Trench A	20	13	4	1	4	42
Trench B	18	6	4	3	0	31
Grand Total	38	19	8	4	4	73

Pottery w**are.** Ware distribution by depth and by trench should be the best indication of what component(s) make up the Nonnast site. Of the 73 rim sherds analyzed 47 (64%) were Mill Creek rim sherds: 31 were Chamberlain high rim ware (42%), 9 were Foreman ware (12%), and 7 were Sanford ware (10%). All Mill Creek Ware was digitized and are included in Appendix A. A total of 11 (15%) rim sherds were Great Oasis: 9 were Great Oasis High Rim ware (12%) and 2 rim sherds were Great Oasis wedge lip ware (3%). All Great Oasis ware was digitized and are included in Appendix B. Fifteen (21%) rim sherds were considered aberrant meaning they either: 1) did not fit into Mill Creek or Great Oasis typologies; 2) they had a mix of traits from both Mill Creek and Great Oasis pottery typologies; or 3) an accurate ware could not be distinguished

with the amount of available data. All aberrant rim sherds were digitized and are included in Appendix C.

Table 14. Number of observed pottery wares by depth.

	cmbs	Chamberlain	Foreman	Sanford	Great Oasis High Rim	Great Oasis wedge	Aberrant	Grand Total
Depth	0-10	12	4	2	1	0	6	25
	10-20	9	4	2	4	0	4	23
	20-30	8	0	2	3	2	3	18
	30-40	2	1	1	1	0	1	6
	Grand Total	31	9	7	9	2	15	72

Tale 15. Number of observed pottery wares by trench.

	Chamberlain	Foreman	Sanford	Great Oasis high rim	Great Oasis wedge	Aberrant	Grand Total
Trench A	20	4	2	6	1	9	42
Trench B	11	5	5	3	1	6	31
Grand Total	31	9	7	9	2	15	73

Pottery ware statistical results. The results of the chi-square tests on pottery wares by depth yielded a Fisher's exact *p* value of .51 ($\chi^2 = 13.70$, $p > .05$). Therefore, it is very likely that the differences in pottery wares by depth is the result of the vagaries of sampling (Table 14). Level 40-50 was deleted from analysis because of the small sample size; only one rim sherd was found at this depth. In addition, chi-square tests of pottery wares were also run by trench. The *p* value of the chi-square by trench

yielded a Fisher's exact *p* value of .44 ($\chi^2 = 4.65$, $p > .05$). Therefore, it is very likely that the distribution of pottery wares by trench is due to random chance and the vagaries of sampling (Table 15).

Ware decoration. All decoration, if present, on the rim sherds was recorded using methods outlined by Fishel (2005). Decoration is important when designating pottery types, as the designs and types of application can have temporal significance (Ives 1962:9). Although the focus of this paper is not to define types, the letter and number designation for each high rim, S-shaped and aberrant rim is included in Appendix D.

At the Nonnast site, pottery decoration can be an important indicator for cultural components. Great Oasis and Mill Creek both contain incised pottery. However, Mill Creek, as well as Over focus, can contain cord impressed pottery in small quantities. Therefore, a chi-square test was conducted for the type of decoration used by depth and by trench. Any cord impressed pottery should be found closer to the surface as an indication of a later Mill Creek occupation. Any moderate amount of cord-impressed pottery could also be an indication of Over focus occupation which contains a greater amount of Cord impressed pottery than Mill Creek sites (Alex 1981). Out of the 73 rim sherds, 41 (56%) were incised, 15 were cord impressed (20.5%), 2 (3%) rim sherds had both incised and cord impressed designs and 15 (20.5%) rim sherds had no decoration.

Ware decoration statistical results. Below is a table of those rim sherds decoration by depth (Table 16). It appears that cord impressed pottery is more frequent towards the surface which would confirm a later Mill Creek occupation. When a chi-square test is conducted, disregarding 2 rims that contain both types of decoration and one sherd from the 40-50cmbs level because they are outliers. The results yielded a Fisher's exact *p* value is .29 ($\chi^2 = 7.60$, $p > .05$). Therefore, it is fairly likely that the type of decoration utilized on the rim sherds by depth is due to random chance and the vagaries of sampling. A chi-square test was also

conducted for the application of decoration by trench. The two pottery sherds that contained both incised and cord-impressed decorations were not part of this analysis since they were outliers. The chi-square test by trench yielded a *p* value of .33 ($\chi^2 = 2.24$, $p > .05$). Therefore, it is fairly likely that the type of decoration utilized on the rim sherds by trench is the result of random chance and the vagaries of sampling (Table 17).

Table 16. Types of pottery decoration observed by depth.

	cmbs	None	Incised	Cord Impressed	Grand Total
Depth	0-10	6	11	7	24
	10-20	2	16	4	22
	20-30	4	10	4	18
	30-40	3	3	0	6
	Grand Total	15	40	15	70

Table 17. Type of pottery decoration observed by trench.

	None	Incised	Cord-Impressed	Grand Total
Trench A	9	21	11	41
Trench B	6	20	4	30
Grand Total	15	41	15	71

Precision of decoration application. Referred to by Henning (1996:24) as the "neatness factor," the precision of how the decoration was applied was recorded on all rim sherds that contained decoration. As previously stated, Henning and Henning (1978) explained that precisely applied decoration is a characteristic of Great Oasis pottery.

The current analysis was conducted on the decoration present on high rim, S-shaped, and aberrant rims. Although decoration was noted on wedge shaped rims, the decoration on these wares is confined to the lip and not applicable to an in-depth analysis. Therefore, out of the 73 rim sherds collected 58 contained decoration, 38 (65.5 %) had neatly applied decoration;

whereas, 20 (34.5%) had decoration that was haphazardly applied, or sloppy. Neat decoration was defined as straight lines, lines that do not overlap (not including superimposed lines), and evenly spaced lines. A chi-square test was conducted for the precision of application by depth and by trench. Although cultural components cannot be based on the neatness factors alone, any spatial patterns that are present are worth exploring.

Precision of decoration application statistical results. The results of the chi-square test regarding the neatness factor by depth yielded a *p* value of .48 ($\chi^2 = 2.50$, $p > .05$). The results indicate that it is very likely that the differences in the neatness factor by level is the result of the vagaries of sampling (Table 18). Level 40-50 was deleted from analysis because of the small sample size; only one rim sherd was found at this depth. The chi-square test results of the neatness factor by trench yielded a *p* value of .010 ($\chi^2 = 6.64$ $p < .05$). With this being the case, the null hypothesis is rejected. Therefore, a statistical relationship exists between the neatness of the applied decoration and the horizontal distribution by trench (Table 19).

Table 18. Precision of decoration application observed by depth.

	cmbs	Neat	Sloppy	Grand Total
Depth	0-10	12	7	19
	10-20	14	7	21
	20-30	11	3	14
	30-40	1	2	3
	Grand Total	38	19	57

Table 19. Precision of decoration application observed by trench.

	Neat	Sloppy	Grand Total
Trench A	17	16	33
Trench B	21	4	25
Grand Total	38	20	58

Discussion of Ceramic Analysis

The research that has been conducted on the body sherds thus far give no clear indication as to whether the site was occupied by Great Oasis, Mill Creek, Over focus or some sort of combination of the three listed cultures. The temper noted in each rim sherd was consistent with the typical Mill Creek Paste. Two rim sherds observed at the Nonnast site were tempered with grog. Grog was identified as reddish or orange-colored ceramic inclusions (Fishel 2005). Grog temper was utilized in small percentages at the Cowan, Great Oasis site (Fishel 2005). It was observed in higher percentages at the Larson site, which is part of Henning's (1996) Perry Creek phase, a mixture of both Great Oasis and Mill Creek Components. Therefore, temper alone cannot be utilized as cultural identifier at the Nonnast site.

The body sherds at the Nonnast site were composed of plain, cord-roughened and smoothed-over cord roughened sherds. All of these pottery treatments are found on Mill Creek, Over focus, and Great Oasis sites assemblages (Alex 1981; Fishel 2005; Henning 1996; Tiffany 1982). The distribution of body sherds was significantly higher in Trench B which is due to the presence of Feature 2, the living surface, within this same trench. Although there was more pottery present, Feature 2 contained no clear cultural signifiers. To reiterate, the minor observations made of the body sherds are inconclusive as to what culture(s) inhabited the Nonnast site. However, a more intensive analysis of the body sherds would be worthwhile as they might hold some information as to how and who was making pottery at the Nonnast site, especially if refits are attempted. Refitting pottery sherds can give unique insights into the distribution and spatial relationships of artifacts across the site (Morrow and Reed 2005).

Furthermore, if the body sherds are examined in detail, attributes such as temper may be a cultural signifier if inordinate amount of limestone, shell, or grog are present.

The bluestem motif body sherds found are unique and could be a cultural indicator. Both body sherds were found within the first 35 cm of the surface which correlates to the radiocarbon dates of AD 1150 – AD 1650 which falls within the range of Great Oasis, Mill Creek and Over focus. Both bluestem body sherds have the same motif, to the degree that they do not contain a spur as a true turkey track motif would (Henning personal communication 2017). If only one of these unique motifs was recovered during excavations it could be due to happenstance; however, since both sherds have the same motif, it is not coincidence. Nevertheless, the turkey track and inverted turkey track is found in both Great Oasis and Mill Creek contexts. (Ives 1962, Henning and Henning 1978, Tiffany 1982, Henning 1996). Alex (1981: 154) has noted that, the turkey track motif is found on pottery from Great Oasis and Over villages located along the James River, Big Sioux and Little Sioux rivers. However, the turkey track motif is rare to non-existent on sites along the Missouri River; connecting Over focus sites more to Mill Creek rather than the Initial Middle Missouri sites to the west (Alex 1981:155). Since this particular motif has not been noted in any other literature, no firm cultural affiliation can be attributed to the group making this particular design. This design could be unique to the Prairie Lakes Region making it a regional cultural indicator.

A majority of the statistics run on the pottery rim sherds show no significant patterning of pottery distribution throughout the trenches or by depth. The only chi-square test that produced a significant number was the neatness factor by trench. Trench A contained almost an even split of neat (17 rims) to haphazardly (16 rims) applied decoration. Whereas, Trench B contained 21

rims that had neat decoration compared to 4 rims that had haphazardly applied decoration. This uneven horizontal distribution of neatly decorated pottery is probably due to the presence of Feature 2 , the living surface, in Trench B. Due to time constraints during excavation we were not able to fully explore this feature. As Henning (1996) and Fishel (2005) observed, the neatness factor is subjective and cannot be quantified. Therefore, no defining conclusions can be made in regards to why there was a greater number of neatly decorated pottery in Trench B or who made this neatly decorated pottery.

All of the other statistics run on the pottery rim sherds show significant patterning of pottery distribution throughout the site by depth of by trench. Therefore, two clear components cannot be discerned. This can be due to multiple of factors, however, bioturbation would be the most obvious reason as there is clear evidence in the stratigraphy and over the surface of the site that rodents have been causing impacts to the site. However, the radiocarbon dates obtained from different levels indicate an overall stratigraphic order is intact (Table 7). Therefore, the rodents have not caused a discernable impact to the vertical distribution to the site as a whole.

All of the Great Oasis pottery sherds were found within the first 35cmbs of excavation at the Nonnast site. If we rely on the accuracy of the radiocarbon dates, the first 35cm of the site have a conventional radiocarbon age between 310 +/-30 BP and 860 +/- 30BP or a calibrated age around AD 1150-1650. These dates overlap with the conventional calibrated radiocarbon dates of AD 900-1250 for Great Oasis (Johnson 2007, Lensink and Tiffany 2005:129). However, Lensink and Tiffany (2005: 128) propose that radiocarbon dates cannot be relied upon during the period of AD 1029-1156 due to an increase in ^{14}C production. They suggest that other horizon markers such as the presence of Ramey Incised pottery and marine shell, which does not include

freshwater *Leptoxis,* be used as an indication of the IMM and the transition to Mill Creek. According to Lensink and Tiffany (2005:128), these two horizon markers are an indication of Mississippian contact and no Great Oasis sites contain these two specific markers. Therefore, they propose an end of AD 1100 for Great Oasis (Lensink and Tiffany 2005:129). If we apply this radiocarbon theory to the Nonnast site, the radiocarbon dates obtained from the first 35cm of excavation just narrowly overlaps with the Great Oasis dates as proposed by Lensink and Tiffany (2005). The third radiocarbon date obtained from the 40-45cm depth falls more within the period of unreliable radiocarbon dates as proposed by Lensink and Tiffany (2005). Even if this third date obtained from 39ML0009 is inaccurate, it does not change the fact that only Mill Creek Rim sherds were found at the deepest levels of the excavation, between 35-50cmbs. This evidence means that the Nonnast site was first occupied by peoples making IMM pottery and not peoples making Great Oasis pottery. As Tiffany and Alex (2001:89) state, "Great Oasis groups did not make Mill Creek pottery." However, Great Oasis pottery has been reported from a number of Mill Creek sites (Anderson 1981; Henning 1996; Tiffany 1982; Tiffany and Alex 2001). Tiffany and Alex (2001:89) explain that this mixture of pottery is due, in part, from the rapid transition of Great Oasis into Mill Creek.

The Nonnast site contains a relatively high amount of cord-impressed rim sherds, just over 20% when compared to Mill Creek sites in Iowa that contain a handful of cord-impressed rim sherds out of thousands (Anderson 1981; Tiffany 1983). When comparing Mill Creek sites of Iowa to Over focus sites along the James River Valley and the Brandon locality in South Dakota, the South Dakota sites contain a much greater percentage of cord-impressed rim sherds (Alex 1981; Tiffany 1982:2). Out of the 15 rim sherds that were cord-impressed, 14 were

categorized as Chamberlain high rim ware and 1 was Foreman ware. This bares a close similarity to the Brandon locality (39MH0001). As Alex (1981:156) states, "…the Brandon Site contains a number of Chamberlain Cord Impressed rims, far more than would be expected from Mill Creek or James River sites." Therefore, the Nonnast site has the closest similarities with the Over focus, specifically the Brandon locality (39MH0001). In light of this evidence, it would be appropriate to keep the Over focus and Mill Creek cultures separate until further information is obtained to positively lump these two cultures together.

Aberrant rim sherds composed 21% of the total rim sherd assemblage. The aberrant rim sherds were found at varying depths. As previously discussed, aberrant rim sherds were defined as rims that did not fit within either Great Oasis or Mill Creek ceramic typologies, there was a mix of characteristics, or the sherd was broken and there was not enough data to reliably tell if it was Great Oasis or Mill Creek. Out of the 15 aberrant sherds, 6 rims had a mix of traits, 4 rims did not fit into either Great Oasis or Mill Creek typologies and the remaining 5 were either broken or there was not enough data to reliably type the sherd. Those aberrant rims that did not fit into either Great Oasis or Mill Creek (Appendix C, Figure 1c, sherds 119, 121, 126 and 126) could be part of the Mill Creek Ware grouping; however, these rims may also be part of a undefined Over ceramic typology so for now, these will remain aberrant and not classified into a specific typology.

There are a number of sites that have recorded ceramic assemblages with a mix of Great Oasis and Mill Creek characteristics (Ives 1962, Anderson 1981, Tiffany 1982, Fishel 2005, Henning 1996). For example, the Brewster site (13CK0015) contained rim sherds that were found to be intermediate between Great Oasis and Mill Creek Chamberlain pottery (Anderson

1981:43). Anderson (1981:44) attributes this mix of traits to the relationship between the two types. The relationship being, that Great Oasis evolved into Mill Creek (Tiffany Alex 2001, Tiffany 1982).

Tiffany and Alex (2001:79) state that Great Oasis-Mill Creek hybrid rims and mixed assemblages can be explained in five different ways: 1) trade; 2) rapid transition from Great Oasis to Mill Creek; 3) mixed components; 4) breakage of Great Oasis vessels maintained in Mill Creek households and 5) resistant or non-conforming potters still making Great Oasis pottery in early Mill Creek/IMM sites. Do these explanations apply to the Nonnast site?

The first explanation, trade, may account for the small percentage of Great Oasis pottery found at 39ML0009. However, there are not many Great Oasis sites neighboring the Nonnast site within the PLR. Nevertheless, Great Oasis pottery could have eventually made its way up from the Upper Big Sioux Great Oasis locality (Figure 5). The second explanation, rapid transition from Great Oasis to Mill Creek, does not apply to the Nonnast site. As Anfinson (1997) stated the PLR was slow to adopt change. The Nonnast site is located within the fairly remote Prairie Pothole region of SD. There are no major river ways in this geographic area. Tiffany and Alex (2001:1) hypothesize Great Oasis peoples rapidly adopted the IMMe Plains Village lifeway of as a result their location along major river systems. Therefore, this rapid transition probably did not happen in the PLR as it did along the Missouri River in Iowa. Furthermore, if this rapid transition happened at the Nonnast site one would expect to find Great Oasis and Mill Creek pottery mixed vertically throughout every level, however, this is not the case. Great Oasis pottery was only found within the top 35 cm of the site with Mill Creek ceramics being found at deeper

depths. Additionally, one would expect to find other Mill Creek/IMM traits such as pottery handles or more Mississippian trade goods. None of which are found at the Nonnast site.

The third explanation of mixed assemblages is mixed components. This does not apply to the Nonnast site. Although the site contains a mix of Great Oasis and Mill Creek pottery, it also contains cord-impressed Over focus pottery. There is not enough data to prove that the site once contained separate components that have been mixed. If that was the case, one should find an even mixture of Great Oasis/Mill Creek/Over focus pottery throughout the site. Additionally, the AMS dates obtained from bone samples confirm intact stratigraphic order (Table 7). Furthermore, the Nonnast site could not be considered part of Henning's Perry Creek Phase because there is no evidence of "extensive trade contacts" (Henning 1996:1). Although *Leptoxis* shell was observed at the site; the presence of this shell alone cannot be considered extensive trade.

The fourth explanation of mixed assemblages is breakage of Great Oasis vessels maintained in Mill Creek households. This explanation would directly correlate to the mixed assemblage explanation and the rapid transition explanation, both of which are not applicable to the Nonnast site as previously discussed. Currently, there is not enough data to prove that the Nonnast site contained Mill Creek households. The fifth and final explanation, resistant or non-conforming potters who maintained Great Oasis traditions may be the best explanation for the mixed ceramic assemblage at 39ML0009.

The Nonnast site not only has Great Oasis and Mill Creek type pottery, but it also contains a cord-impressed wares of the Over focus (Alex 1981). The Nonnast site is geographically located in an area of transition between the Great Plains prairie and the Eastern

Woodlands of Minnesota (Gregg et al. 1996). As previously discussed, this area was slow to change (Anfinson 1997). If Great Oasis is antecedent to the IMM then it is very likely that Great Oasis pottery would continue to be made after the emergence of the IMM (Alex 1981:42). Especially, in an area that is slow to adopt change. Therefore, the group first settling at the Nonnast site could have been be maintaining their traditional pottery styles which appear to have not been influenced by Mississippian styles as other IMMe cultures were.

It has been hypothesized that the Over focus sites represent a fusion of Great Oasis, Mill Creek, and Cambria cultures with influences from remnant Woodland tradition cultures (Johnson 2007:98). It would appear that this may be the case with the Nonnsat site. The Nonnast site does not appear to contain Mississippian influenced pottery like Mill Creek and other Over focus sites do, such as the Mitchell site. The Over focus and Mill Creek sites that contain Mississippian influences are found along major river ways such as the James River in South Dakota and the Little Sioux River in Iowa. This is not the case at the Nonnast site which has no rivers within the area. Nevertheless, the Nonnast site does contain a number of S-shaped rims which is a classic characteristic of IMM phases. Although the ceramic assemblage contains IMM characteristics it also contains cord-impressed pottery which is reminiscent of the Woodland tradition and the Over focus. he Nonnast site also contains pottery sherds that contain a unique style of the bluestem motif that is not found on any other IMM or Great Oasis site which could represent a new pottery type or be part of an Over focus typology. Nevertheless, the pottery of the Nonnast site contains mixed characteristics that does not allow it to fit neatly within either Great Oasis or Mill Creek typologies.

Since the Nonnast site retains intact stratigraphy and since pottery found at the deepest levels was composed of Mill Creek or aberrant wares 39ML0009 must have been first occupied by IMMe peoples who retained a traditional Woodland and Great Oasis way of making pottery, but included classic IMM forms such as S-shaped rims. The ceramic assemblage described above is typical of other ceramic assemblages found at Over focus sites. Therefore, the Nonnast site should be considered as being occupied by the Over focus.

As previously stated some archaeologists group Mill Creek and Over focus cultures together (Henning 1996; Winham and Calabrese 1998). However, the pottery at the Nonnast site provides evidence that the Over focus should remain split from Mill Creek until more information is gathered to positively grouping or split these two cultures. An alternative scenario is that the pottery found at the Nonnast site and other sites within the PLR may be part of a larger phase that has not yet been identified.

Chapter 6: Summary, Conclusions and Future Research

Summary and Conclusion

The Nonnast site was originally designated as a multicomponent site consisting of both Great Oasis and Mill Creek occupations. These designations are based on the pottery collected from the surface of the site and through the examination of private collections (Haug 1977). The excavations that took place during the 2015 and 2017 field seasons added an abundance of material to the overall assemblage from the Nonnast site. This excavated material combined with the AMS dates give a more accurate depiction of who occupied the Nonnast site and when.

Some of the diagnostic material recovered during the most recent excavations was not particularly helpful in distinguishing between Great Oasis, Mill Creek, or Over focus occupations. The side-notched points are fairly ubiquitous for this area and general time period. Side-notched points first made an appearance on the Plains with the use of the bow and arrow in the Woodland period (Gregg et al. 1996). The use and manufacture of side-notched points continued through the Contact period, circa mid-19th century. Prairie Side-notched points generally date earlier than Plains Side-notched points. The Plains Side-notched point was found from 10-20cmbs. Whereas, the Prairie Side-notched points were found from 35-40. The stratigraphic order of the projectile points found correlates with the AMS dates obtained from the site. Nevertheless, the presence of these particular Prairie and Plains Side-notched points do not give a precise enough time period to clearly define the occupation(s) of the Nonnast site.

The *Leptoxis* shell beads are diagnostics recovered during both the 2015 and 2017 excavations. These are a trade item, however, they are found within both Great Oasis and Mill Creek contexts (Henning 2005; Tiffany and Alex 2001). Although interesting, these shell beads

alone, do not give a clear indication as to whether Great Oasis, Mill Creek, Over focus cultures occupied the Nonnast site.

The bone awl tip found is an indication of bone tool technology. Diverse bone tool technology is a characteristic of the IMM. Bone tool technology is present at Over focus sites however the Brandon Locality did not produce an abundance of worked bone and when compared to other IMM sites (Over and Meleen 1941:35). In general, Great Oasis sites have not produced the amount or the extent of diverse bone tools as Mill Creek sites have (Morrow et al 2005:104; Tiffany 1983:97). However, one bone tool tip cannot be used as any type of cultural indication. The overall lack of bone tools recovered from the Nonnast site thus far is uncharacteristic of other IMM sites which contain a large range of bone tool technologies. However, this lack of bone tools is similar to the Brandon Locality of the Over focus. This may suggest that this particular site is more closely affiliated with the Brandon locality of the Over focus than to other Over focus sites along the James River.

There were two features observed during the 2017 excavation: a post mold and a living surface. Feature 1, the post mold, gives no clear indication as to the type of house constructed at the Nonnast site without further excavation. Feature 2, the living surface, also contains no clear cultural diagnostics. Even with the presence of both these features, conclusions cannot be drawn as to how the Nonnast site was inhabited. The LiDAR remote sensing conducted appeared to reveal a fortified village, however, no testing was done within the potential fortification trench due to time constraints. Therefore, the features excavated and the potential village features identified in the LiDAR give no clear indication as to who occupied the Nonnast site.

The radiocarbon dates obtained from the collected bone collagen samples suggest generally intact stratigraphy at the Nonnast site. Therefore, Great Oasis rims should be found in the lower, older, levels of the site. However, this was not the case. All of the Great Oasis rims are found within the top 35cm of the site, whereas, Mill Creek rims are found at deeper depths. The deepest bone sample collected for AMS dating was collected at the 40-50cm level. This yielded results of a calibrated calendar year of AD 1022-1190. This falls well within the accepted dates for both Mill Creek and Great Oasis cultures, but only Mill Creek pottery was found at this depth. Although there is rodent disturbance at the site, the existence of Features 1 and 2 and the stratigraphic order of the radiocarbon dates provides enough evidence to state that the vertical and horizontal disturbance of artifacts have been minimally affected at the Nonnast site.

Ceramics, rim sherds in particular, can be a relatively good cultural indicator. Although pottery does not equal people, it does represent spatial and temporal connections between groups of people and can demonstrate cultural change (Ives 1962). The diagnostic rim sherds at the Nonnast site were analyzed to try and confirm the occupations. Overall the Nonnast site contains a majority of Mill Creek Wares; 64% were categorized as Mill Creek, 15% were categorized as Great Oasis, and 21% of the ceramics rims were considered aberrant.

The only chi-square test that produced a significant statistical result was in regards to the neatness of the applied decoration by trench. As previously discussed, this “neatness factor” can be a distinguishing characteristic between Great Oasis and Mill Creek. However, this particular variable is very subjective, and one cannot fairly classify pottery based on the neatness of the decoration applied alone. In addition, there have been no studies on the neatness of Over focus pottery. This distribution pattern may be attributed to Feature 2 in Trench B. However, without

knowing more about Feature 2 there are few conclusions that can be made in regards to this particular statistical result.

All of the other chi-square tests conducted on the rim sherds show no significant patterning in the distribution of pottery types, wares or forms by level or across the site. Therefore, it cannot be positively stated that two clear and separate occupations were in existence at the Nonnast site. With this being the case, it can be concluded that the Nonnast site is a single-component site. Nonnast site had a majority of Mill Creek wares, but lacked Mississippian ceramics, slips, and ceramics with handles. These characteristics are distinctive cultural attributes of Mill Creek sites of the IMM. The Nonnast site also contained a fair amount of cord-impressed pottery, 20.5% of the analyzed ceramic assemblage, which is not regularly found in Mill Creek or Great Oasis assemblages. However, cord-impressed decorated pottery is characteristic of the Woodland Tradition, IMM pottery of the Missouri River trench and to the Over focus (Tiffany and Alex 2001:90). Another IMMe site that produced a large amount of cord-impressed pottery was the Brandon site (39MH0001) which is part of the Over focus. This suggests that the Nonnast site may be most closely affiliated to the Over focus rather than to Great Oasis or to Mill Creek. As previously discussed, some archaeologists combine the Over focus into Mill Creek (Henning 1996; Winham and Calabrese 1998). However, the evidence produced from the Nonnast excavations suggest that this split should remain in place until further evidence can be obtained.

Alex (1981:184) hypothesized that the villages along the James and Big Sioux River valleys are a cultural intermediate between Mill Creek cultures of Iowa and IMM sites along the Missouri River trench. Alex (1981:185) goes on to speculate that the eastern groups of the Initial

Middle Missouri moved north into the glacial lakes region of the eastern Dakotas. It is probable that the people of the Over focus moved north and settled at the Nonnast site and other sites in the Prairie Lakes Region. According to the earliest AMS dates obtained, the Nonnast site was occupied from AD 1033-1190 this is during the Neo-Atlantic climatic episode which ranged from AD 1000-1250 (Toom 1996). During this time maize agriculture was spreading northward due to the warmer and moister climate. This allowed for a population increase which may have caused some overcrowding which could have been an impetus for people to start moving to more remote places like the PLR. People moving into this region could have easily subsided on fish and bison that would have been found in the area. Fish was obviously a large portion of the diet of the people occupying the Nonnast site due to an abundance of fish bone recovered during excavation (Falk unpublished results).

Using the data uncovered during excavations, it can be concluded that the Nonnast site was occupied by IMMe peoples most closely related to Over focus rather than to Great Oasis. These peoples were not highly influenced by Mississippian cultural traditions as Mill Creek peoples were. Rather, the group(s) that occupied the Nonnast site continued to utilize pottery traditions that they were familiar with such as cord-impressed decoration and S-shaped pottery forms. Therefore, with the information available at this time, the Great Oasis and Mill Creek site designation should be dropped from the Nonnast site and 39ML0009 should be considered part of the Over focus an eastern division of the Initial Middle Missouri.

Since the Nonnast site should be considered part of the Over focus it may be pertinent to reclassify the Over focus as a variant or phase rather than a focus. Focus was defined by McKern (1939:308) as a, “class of culture exhibiting characteristic peculiarities in the finest analyses of

cultural detail…" Phillips and Willey (1953:620) prefer the term phase as the approximate equivalent to focus. A phase is defined by Phillips and Willey (1953:620) as , "a space-time-culture unit possessing traits sufficiently characteristic to distinguish it from other units similarly conceived, weather of the same or other cultural traditions, geographically limited to a locality or region and chronologically limited to a relatively brief span of time." If we stick to this definition it would further support the splitting of the Over and Mill Creek. The Over focus appears to be separate enough from Mill Creek in space and also appears to not have been as highly influenced by Mississippian culture as other Mill Creek sites are. Therefore, I propose that the Over focus should be reclassified as the Over phase.

The pottery and diagnostic materials collected during excavation have provided evidence that the Nonnast site is mostly closely related to the Over phase of the IMM. However, it is also worth examining the site regardless of the pottery, on the basis of general location, burial practices, village construction and subsistence.

The site is located in a lacustrine environment that is very similar to Woodland sites. There is no evidence of extensive bone tool technology at the Nonnast site which is a hallmark characteristic of the IMM. The potential burial mound features identified through the LiDAR remote sensing are also an indication of a Woodland-type burial practice. Burial mounds were not utilized at Mill Creek sites but were used in both Great Oasis and Over focus sites (Henning and Toom 2003, Schermer 2003, Tiffany and Alex 200). However, the burial mounds at the Nonnast site are located on private land, and without a preliminary pedestrian survey they cannot be positively identified as such. On the other hand, the potential fortification trench is a very strong indication of an IMM practice. There have been no single component Great Oasis sites

recorded thus far that contain a fortified village. Fortification trenches are generally believed to have been utilized as a defense in warfare (Bamforth 1994). An increase in warfare on the Great Plains has been attributed to the population increase associated with the Neo-Atlantic and the emergence of the Plains Village tradition (Bamforth 1994; Toom 1996). However, the location of the Nonnast site is in a highly defensible area, surrounded by a lake on three sides of the landform. A fortification trench seems to be excessive and redundant in this particular location. This could possibly mean that this particular anomaly found in the LiDAR remote sensing is not a fortification trench. It could also indicate that peoples familiar with constructing villages that contain fortifications inhabited the Nonnast site. These peoples could have come from the Missouri River trench who routinely constructed fortified villages, or it could be IMMe peoples from Iowa moving northwest. The reasoning as to why these people were moving could be due to overcrowding and the lack of available resources as previously discussed. However, without more research on the fortification trench, types of habitation used, and subsistence practices any theory as to why these people occupied the PLR is purely speculative.

Future Research

Much is still unknown about the cultures and sites within the Prairie Lakes Region. More research on the surrounding sites in this area would shed some light on which cultures occupied this region and where they came from. More research in the PLR would confirm if the Over focus should be grouped into Mill Creek or if they should remain separate. This research could also expand on the present knowledge of the Over focus.

Not only does the PLR need to be explored more, but more excavation at the Nonnast site would help to further define the cultural component(s). For example, one post mold (Feature 2)

was uncovered during excavation. More exploratory excavation could reveal the type of housing that was utilized. We still do not know if the Nonnast site was a permanent occupation or if it was only utilized during the summer. Determining the type of habitation utilized at the Nonnast site will help archaeologists understand how this particular site fits into the wider occupation patterns on the PLR. Additionally fine recovery techniques should also be implemented during future excavations. This will help to establish if maize agriculture was practiced at the site. This will help to define subsistence patterns for cultures occupying this region.

With the amount of pottery obtained from Trench B and the existence of Feature 2, future excavation should focus on the northern portions of the site. Expanding upon the information obtained from Feature 2 may reveal how the site was utilized. Additionally, future excavations at the Nonnast site should focus on the potential features identified through the LiDAR imagery. The potential fortification trench should be tested to confirm that they are cultural in nature and not some sort of natural or modern historic phenomena. If the trench can be confirmed as a type of fortification it strengthens the argument that this site was not occupied by Great Oasis peoples rather it was occupied by the Over focus or another type of IMMe culture.

Further testing and exploration in the PLR would also help to define the presence of Great Oasis in this area. Little is known about Great Oasis sites in South Dakota. According to Johnson (2007:91) it may be better to consider Great Oasis as a horizon marked by a distinctive way of decorating pottery rather than a culture. Great Oasis sites in Iowa have produced characteristics that are much closer to IMM than to Woodland, such as agriculture, large middens and bone tool technology (Tiffany 2005 and Tiffany and Alex 2001). This is not the norm;

characteristics are clearly different in Iowa than they are in MN or SD. Nevertheless, the taxonomic disagreement of Great Oasis is still ongoing and is an avenue for future researchers.

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Appendix A: Digitized Mill Creek Ceramic Rim Sherds; Surface Decoration and Profiles, Utilized for Analysis

Figure 1A. Mill Creek Chamberlain ware recovered during 2015 and 2017 excavations at the Nonnast site (39ML0009); Sherds: 108, 110,113, 115,118,125,127,135,138 are cord-impressed and indicate an Over focus pottery tradition. Sherd 122 contains both incised and cord-impressed decoration.

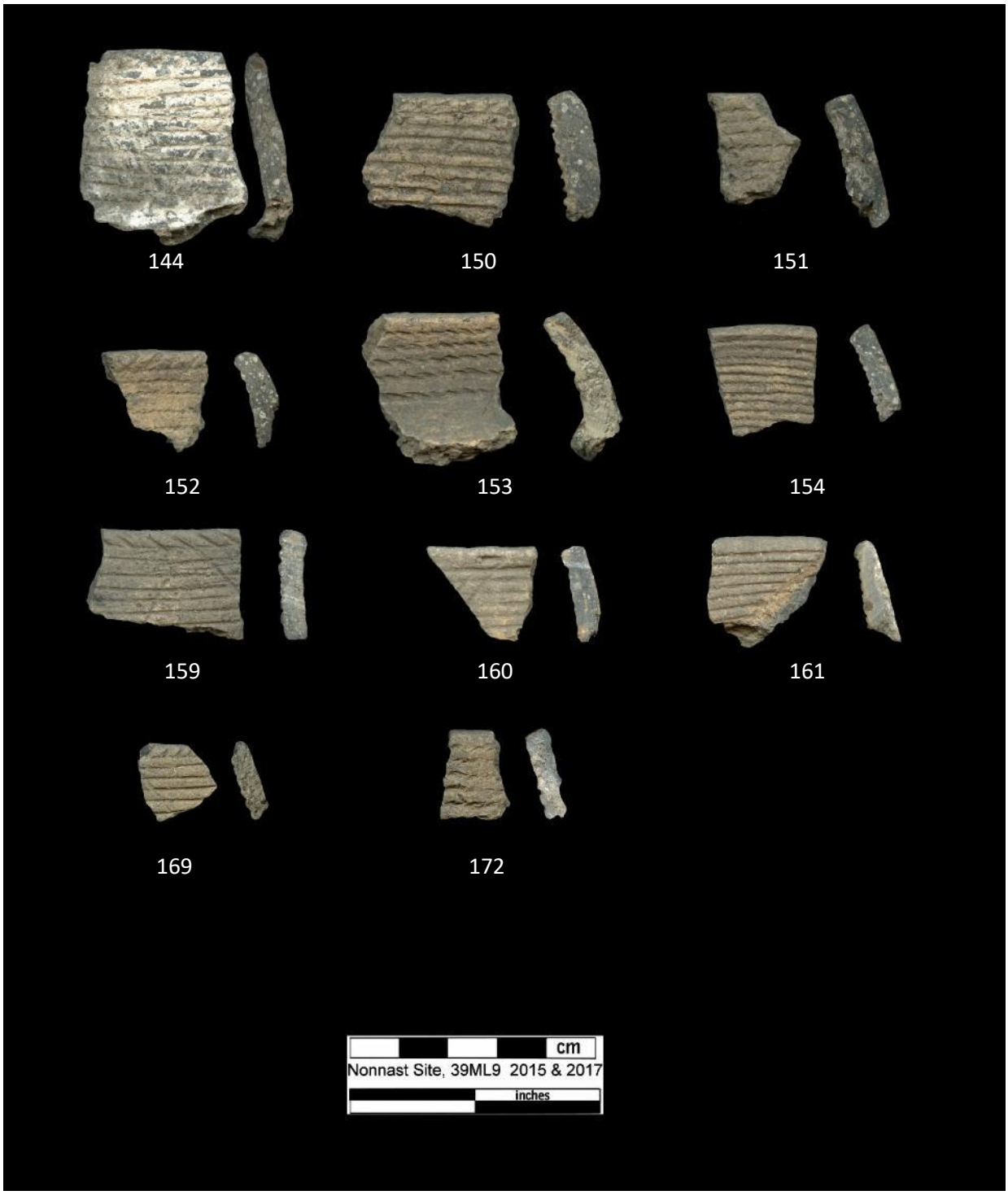


Figure 2A. Mill Creek Chamberlain ware recovered during 2015 and 2017 excavations at the Nonnast site (39ML0009); Sherds: 151, 153, 154 and 172 are cord-impressed and indicate an Over focus pottery tradition. Sherd 152 contains both incised and cord-impressed decoration.

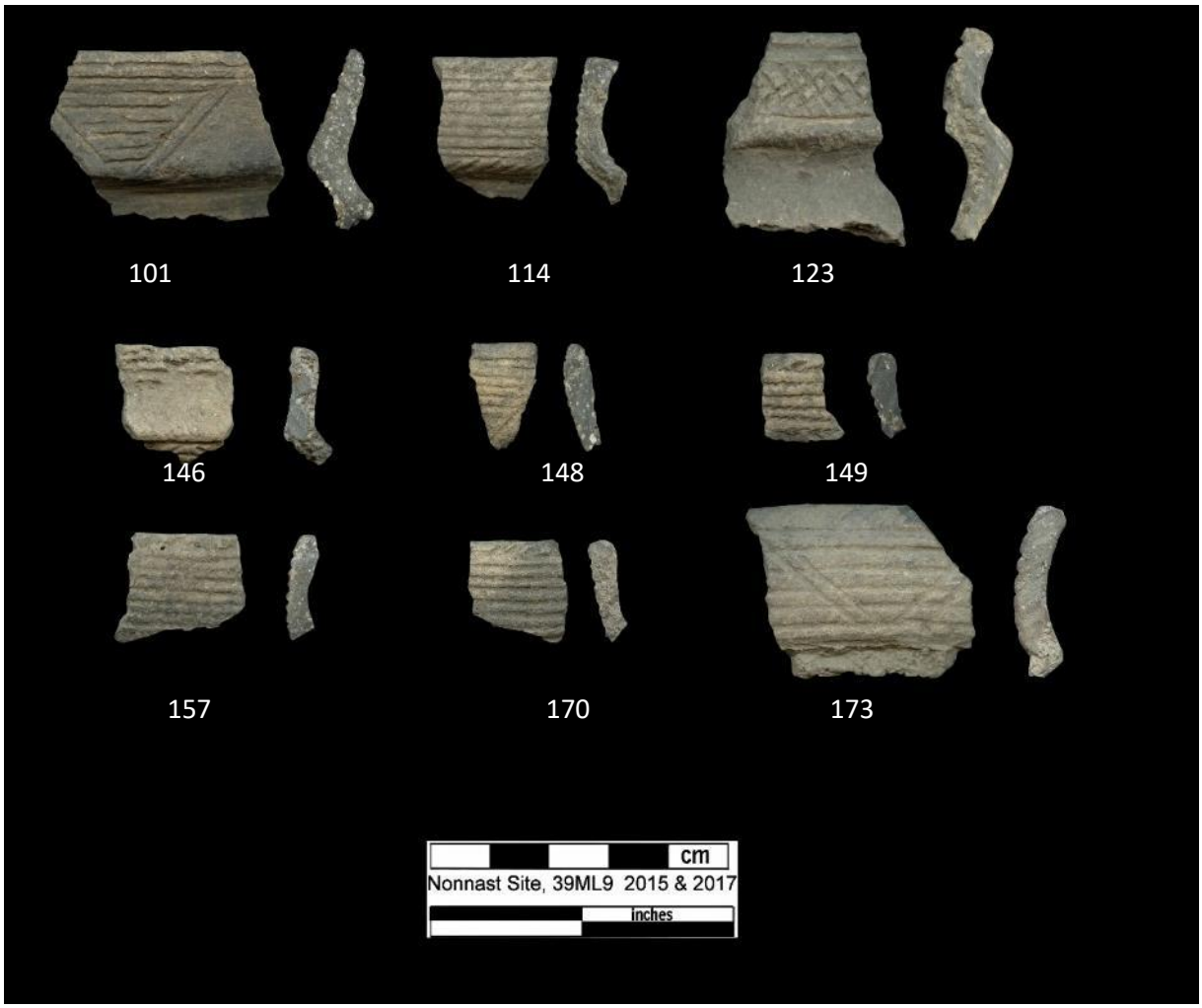


Figure 3A. Mill Creek Foreman ware recovered during 2015 and 2017 excavations at the Nonnast site (39ML0009) sherd 149 is cord impressed.

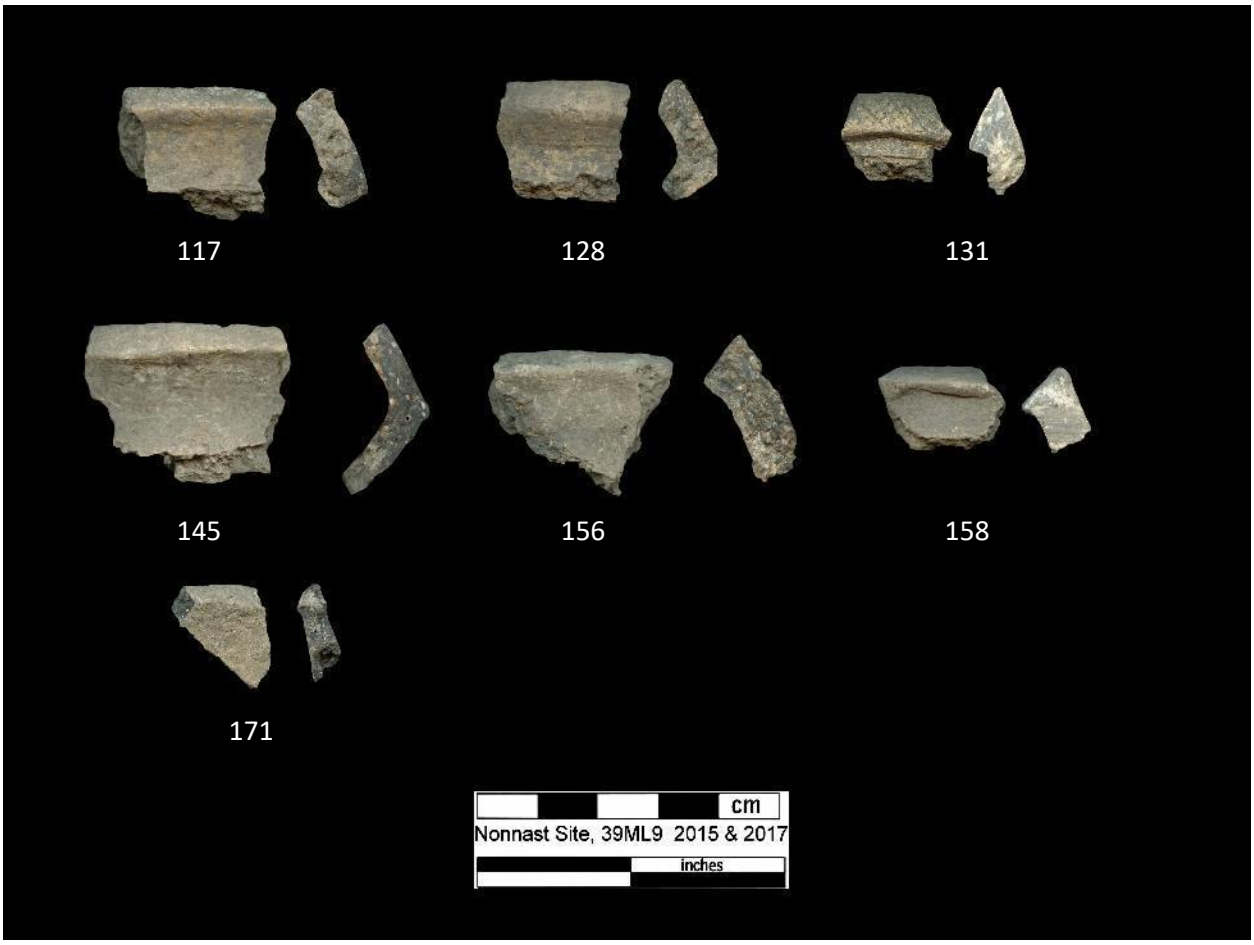


Figure 4A. Mill Creek Sanford ware recovered during 2015 and 2017 excavations at the Nonnast site (39ML0009).

Appendix B: Digitized Great Oasis Ceramic Rim Sherd Profiles and Surface Decoration, Utilized for Analysis

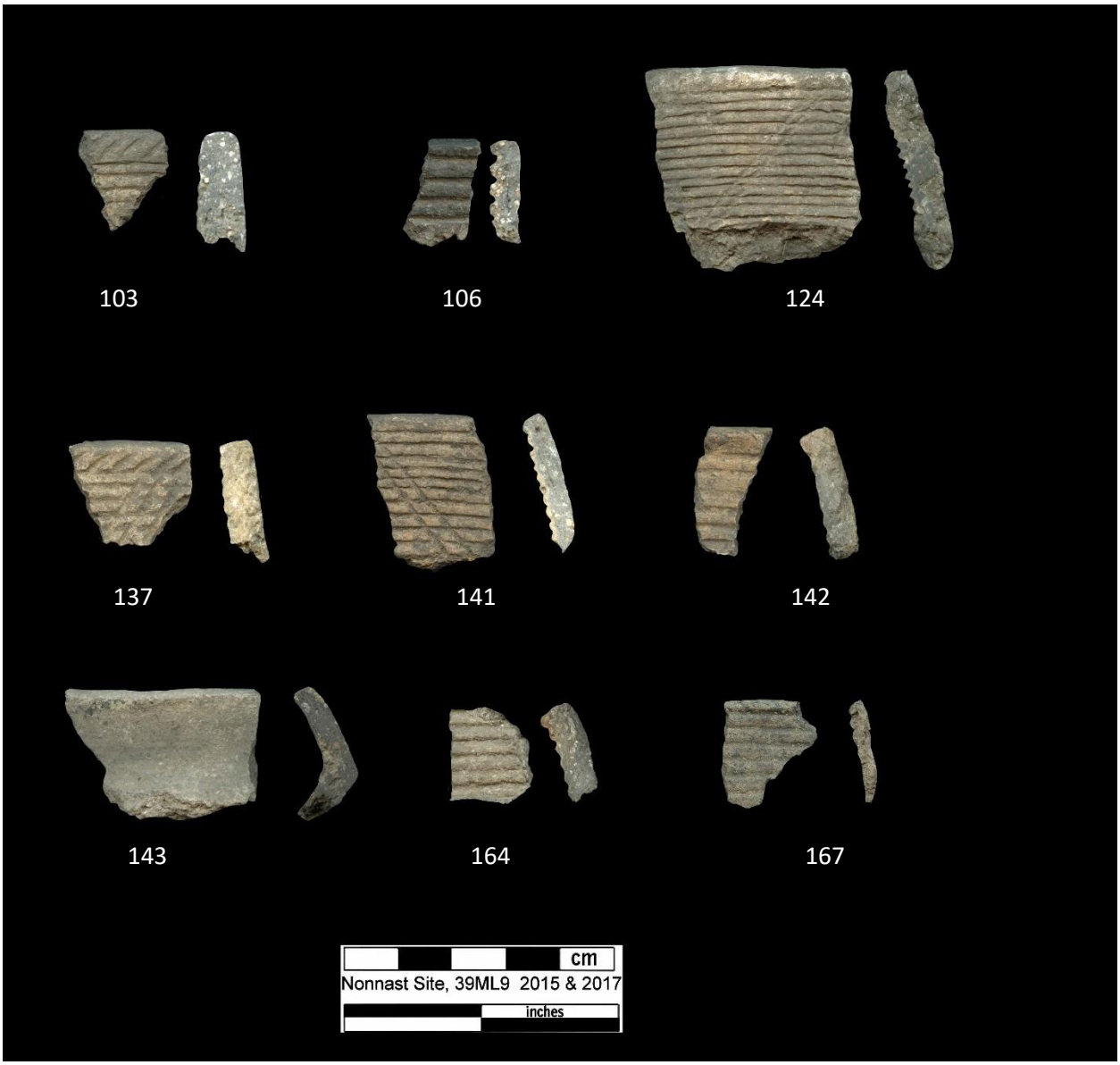


Figure 1B. Great Oasis High Rim ware recovered during 2015 and 2017 excavations at the Nonnast site.

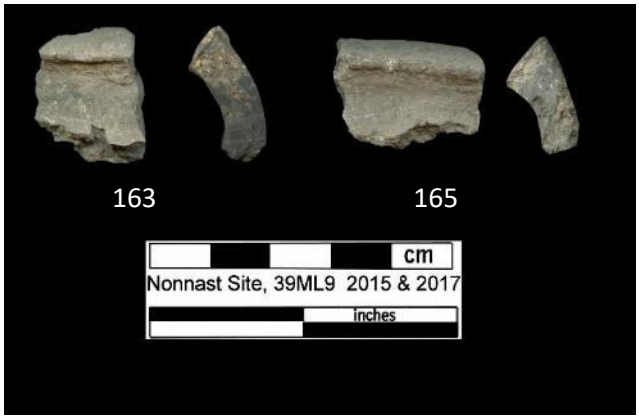


Figure 2B. Great Oasis Wedge Lip ware recovered during 2015 and 2017 excavations at the Nonnast site (39ML0009)

Appendix C: Digitized Aberrant Ceramic Rim Sherd Profiles and Surface Decoration, Utilized for Analysis

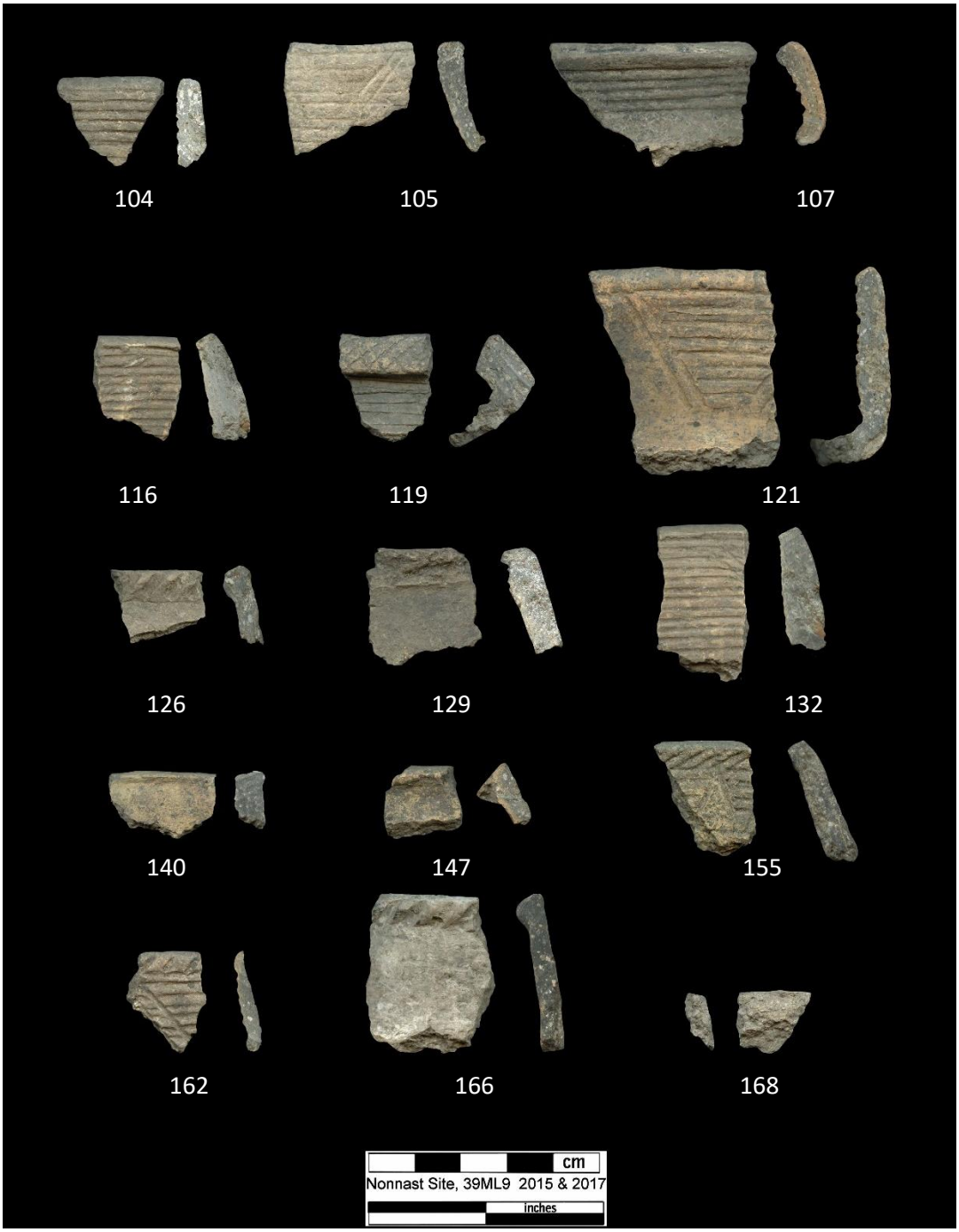


Figure 1C. Aberrant Rims recovered during 2015 2017 excavations at the Nonnast site (39ML0009).

Appendix D: Decorative Components for Each High Rim, S-shaped and Aberrant Rim Sherd Recovered During the 2015 and 2017 Excavations at the Nonnast Site (39ML0009)

Sherd	Test Unit	Provenience	Decoration
101	3	N522 W 510	B A2 B B X
102	3	N522 W 510	A B2 A C X
103	3	N522 W 510	B X X C X
104	3	N522 W 510	B X X B X
105	1	N 500 W504	B A2 B B X
106	2	N524 W 510	B X X B X
107	1	N 500 W504 and 505	B X X B X
108	1	N 500 W504 and 505	A X X C X
109	1	N 500 W504 and 505	B X X E X
110	5	N 500 W506	B A1 A B X
111	2	N 523 W510	B A1 B B X
112	1	N 500 W 504 and 505	X X X X X
113	2	N 524 W 510	B X X B X
114	2	N 524 W 510	C X X C B
115	2	N 524 W 510	X X X B X
116	2	N 524 W 510	B A2 X B X
118	2	N 524 W 510	B X X B X
119	2	N 524 W 510	B X X E X
120	2	N 524 W 510	B G C B X
121	2	N 524 W 510	B A2 A B X
122	2	N 524 W 510	B X X G X
123	2	N 524 W 510	E and B X B and A B X
124	5	N500 W 506	B A2 A B X
125	5	N500 W 506	B X X B X
126	5	N500 W 506	X X X C X
127	2	N524 W510	B X X B X
129	2	N524 W510	X X X X X
130	2	N524 W510	X X X X X
132	2	N524 W510	B X X B X
133	5	N 500 W 506	B A1 and B2 C B X
134	5	N 500 W 507	X X X X X
135	4	N500 W503	B and C X X B and C X

136	4	N500 W503	B X X F X
137	4	N500 W503	B and C X X C X
138	7	N500 W 508	X X X B X
139	7	N500 W 508	X X X B X
140	7	N500 W 508	X X X X X
141	6	N 500 W 507	B and D X B B X
142	6	N 500 W 507	X X X B X
143	1	N 500 W 504 and 505	X X X X X
144	1	N 500 W 504 and 505	B A2 X C X
146	1	N 500 W 504 and 505	B A2 X A X
147	8	N500 W 509	X X X X X
148	8	N500 W 509	B X X B X
149	8	N500 W 509	B X X C X
150	8	N500 W 509	B B X C X
151	8	N500 W 509	B X X B X
152	8	N500 W 509	B X X C X
153	4	N 500 W503	B X X B X
154	4	N 500 W 503	B X X B X
155	6	N 500 W 507	B A2 A C X
157	3	N 522 W 510	A X X C X
159	3	N 522 W 510	B A2 A D X
160	3	N 522 W 510	A and C X X F X
161	4	N 500 W 503	B X X A X
162	7	N500 W508	A and D X X C X
164	2	N 524 W 510	B X X B X
166	6	N 500 W 507	X X X C X
167	7	N 500 W 508	B X X B X
168	7	N 500 W 508	X X X X X
169	6	N 500 W 507	B and D X X C X
170	2	N 524 W 510	B X X C X
172	5	N500 W 506	B X X B X
173	7	N500 w 508	B A2 X C X

Appendix E: Beta Analytic AMS Laboratory Results

Sample 39ML9 XU-1 8-15 Beta-432005

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Michael Fosha — Report Date: 2/29/2016

State Archaeological Research Center — Material Received: 2/19/2016

Sample Data	Measured Radiocarbon Age	d13C	Conventional Radiocarbon Age(*)
Beta - 432005	180 +/- 30 BP	-17.3 o/oo d15N= +7.4 o/oo	310 +/- 30 BP

SAMPLE : 39ML9 XU-1 8-15
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (bone collagen): collagen extraction: with alkali
2 SIGMA CALIBRATION : Cal AD 1485 to 1650 (Cal BP 465 to 300)

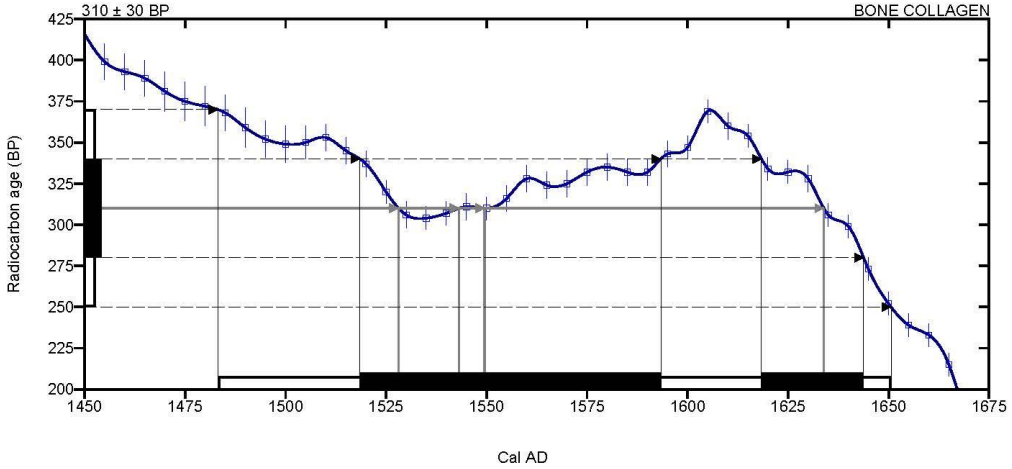
Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -17.3 o/oo : lab. mult = 1)

Laboratory number	**Beta-432005 : 39ML9 XU-1 8-15**
Conventional radiocarbon age	**310 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1485 to 1650 (Cal BP 465 to 300)**
Intercept of radiocarbon age with calibration curve	Cal AD 1530 (Cal BP 420) Cal AD 1545 (Cal BP 405) Cal AD 1550 (Cal BP 400) Cal AD 1635 (Cal BP 315)
Calibrated Result (68% Probability)	Cal AD 1520 to 1595 (Cal BP 430 to 355) Cal AD 1620 to 1645 (Cal BP 330 to 305)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory
4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

Sample 02-032 Beta-494077

Beta Analytic
RADIOCARBON DATING

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Mr. Darden Hood
President

Mr. Ronald Hatfield
Mr. Christopher Patrick
Deputy Directors

ISO/IEC 2005:17025-Accredited Testing Laboratory

REPORT OF RADIOCARBON DATING ANALYSES

Megan Maier — Report Date: May 25, 2018

St. Cloud State University — Material Received: May 10, 2018

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes Calendar Calibrated Results: 95.4 % Probability High Probability Density Range Method (HPD)	
Beta - 494077	**02-032**	**860 +/- 30 BP**	IRMS δ13C: -17.9 o/oo IRMS δ15N: +5.7 o/oo
(83.5%)	**1150 - 1256 cal AD(800 - 694 cal BP)**		
(9.9%)	**1049 - 1084 cal AD(901 - 866 cal BP)**		
(2.0%)	**1124 - 1136 cal AD(826 - 814 cal BP)**		

Submitter Material: Bone (Non-heated)
Pretreatment: (bone collagen) collagen extraction; with alkali
Analyzed Material: Bone collagen
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 89.85 +/- 0.34 pMC
Fraction Modern Carbon: 0.8985 +/- 0.0034
D14C: -101.53 +/- 3.36 o/oo
Δ14C: -108.89 +/- 3.36 o/oo(1950:2,018.00)
Measured Radiocarbon Age: (without d13C correction): 740 +/- 30 BP
Calibration: BetaCal3.21: HPD method: INTCAL13
Carbon/Nitrogen: CN : 3.4 %C: 19.75 %N: 6.83

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

BetaCal 3.21

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL13)

(Variables: d13C = -17.9 o/oo)

Laboratory number **Beta-494077**

Conventional radiocarbon age **860 ± 30 BP**

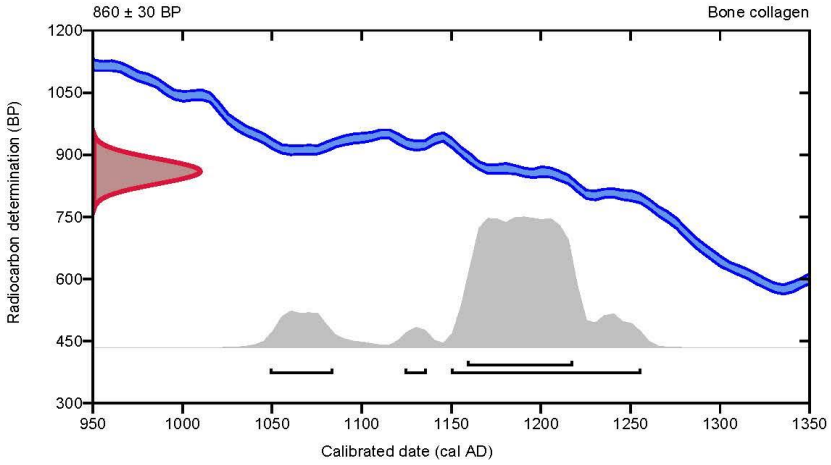
95.4% probability

(83.5%)	1150 - 1256 cal AD	(800 - 694 cal BP)
(9.9%)	1049 - 1084 cal AD	(901 - 866 cal BP)
(2%)	1124 - 1136 cal AD	(826 - 814 cal BP)

68.2% probability

(68.2%)	1159 - 1218 cal AD	(791 - 732 cal BP)

02-032



Database used

INTCAL13

References

References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337-360.

References to Database INTCAL13

Reimer, et.al., 2013, Radiocarbon55(4).

Beta Analytic Radiocarbon Dating Laboratory

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Sample 01-040 Beta-494078

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RADIOCARBON DATING

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Mr. Christopher Patrick
Deputy Directors

ISO/IEC 2005:17025-Accredited Testing Laboratory

REPORT OF RADIOCARBON DATING ANALYSES

Megan Maier — Report Date: May 18, 2018

St. Cloud State University — Material Received: May 10, 2018

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes Calendar Calibrated Results: 95.4 % Probability High Probability Density Range Method (HPD)	
Beta - 494078	**01-040**	**910 +/- 30 BP**	IRMS δ13C: -15.3 o/oo IRMS δ15N: +6.1 o/oo
(94.0%)	**1033 - 1190 cal AD(917 - 760 cal BP)**		
(1.4%)	**1198 - 1204 cal AD(752 - 746 cal BP)**		

Submitter Material: Bone (Non-heated)
Pretreatment: (bone collagen) collagen extraction; with alkali
Analyzed Material: Bone collagen
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 89.29 +/- 0.33 pMC
Fraction Modern Carbon: 0.8929 +/- 0.0033
D14C: -107.10 +/- 3.33 o/oo
Δ14C: -114.42 +/- 3.33 o/oo(1950:2,018.00)
Measured Radiocarbon Age: (without d13C correction): 750 +/- 30 BP
Calibration: BetaCal3.21: HPD method: INTCAL13
Carbon/Nitrogen: CN : 3.3 %C: 37.23 %N: 13.03

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

BetaCal 3.21

Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL13)

(Variables: d13C = -15.3 o/oo)

Laboratory number **Beta-494078**

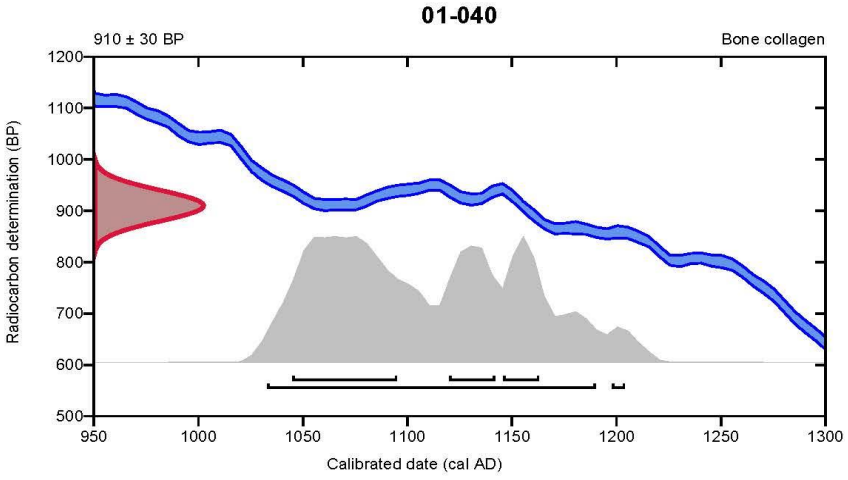
Conventional radiocarbon age **910 ± 30 BP**

95.4% probability

(94%)	1033 - 1190 cal AD	(917 - 760 cal BP)
(1.4%)	1198 - 1204 cal AD	(752 - 746 cal BP)

68.2% probability

(39.7%)	1045 - 1095 cal AD	(905 - 855 cal BP)
(16.1%)	1120 - 1142 cal AD	(830 - 808 cal BP)
(12.4%)	1146 - 1163 cal AD	(804 - 787 cal BP)



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Appendix F: Soil Profile Map of TU 1 (N 500 W 505 and 504) and TU 4 (N 500 W 503)

39ML0009 North Wall Profile