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Brick by Brick: A Comparative pXRF Analysis of Brickworks and Structures in the Belgian-American Community of the Door Peninsula

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BRICK BY BRICK: A COMPARATIVE PXRF ANALYSIS OF BRICKWORKS AND STRUCTURES IN THE BELGIAN-AMERICAN COMMUNITY OF THE DOOR PENINSULA

by

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ABSTRACT
BRICK BY BRICK: A COMPARATIVE PXRF ANALYSIS OF BRICKWORKS AND STRUCTURES IN THE BELGIAN-AMERICAN COMMUNITY OF THE DOOR PENINSULA

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Lisa Zimmerman

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Wisconsin's Door Peninsula was home to the largest Belgian immigrant population in the United States during the late 19th century. In 1871, a deadly firestorm engulfed large portions of Northeastern Wisconsin and tore through the land where these Belgian's resided. After the fire a household brickmaking industry emerged, creating the red brick that gives the Door Peninsula its architectural character today. Very few of the brickworks that created the iconic red brick are documented in the archaeological record. Vandermissen Brickworks is a late 19th and early 20th century brickworks that made handmade bricks for local structures following the Great Fire of 1871. Remains of the Vandermissen Brickworks (47DR388) along with two other historic brickworks were recovered during the Wisconsin State Highway 57 construction project. A portable X-ray fluorescence (pXRF) analyzer was used in the attempt to associate standing structures on the Door Peninsula to bricks and brick fragments recovered from Vandermissen Brickworks and two other local brickworks. The goal of this project is to determine if it is possible to use a pXRF analyzer to identify a correlation between bricks from the brickworks and bricks from structures. The data did not demonstrate similarities between

excavated bricks and bricks from the structures but it did reveal other relationships. At the Vandermissen site, the bricks from the clamps statistically differed from the rest of the brickworks. Also bricks from each of the structures statistically differed from all of the brickworks. These results serve to delimit the kinds of questions that can be answered through pXRF analysis. The results here demonstrate how pXRF analysis can be used to differentiate samples from an archaeological context and a non-archaeological context as well as differentiating bricks over fired in kilns from other bricks. The analysis of the pXRF results demonstrates how this technology can be used in future research of historic brickworks sites.

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CHAPTER 1: INTRODUCTION

Research Goals

In October of 1871, a devastating fire, known as the Peshtigo Fire, destroyed 1,000,000 acres of farms, forests, sawmills, and small towns in Wisconsin and Upper Michigan including many of the Belgian farms and small towns along the west side of the Door Peninsula of Wisconsin. The Belgians rebuilt after the fire using bricks instead of logs for construction. A household brick making industry developed to produce the bricks. Many of these distinctive red brick structures survive today and give the region its architectural character. Local brickworks would have been very common during the rebuilding period following the Peshtigo Fire. Archaeological investigations at the Vandermissen Brickworks, a late 19th and early 20th century brickworks, have recovered evidence of the steps typically associated with the process of hand-making bricks. As a pilot study, a portable X-ray fluorescence (pXRF) analyzer was used in an attempt to associate extant structures with bricks recovered from Vandermissen and two other historic brickworks. PXRF data from a sample of bricks recovered from the brickworks was compared to readings taken from a sample of red brick standing structures in the southwestern portion of the Door Peninsula.

This analysis through the use of pXRF technology and historical context looks at the relationship between bricks recovered from an archaeological context and bricks from extant structures on Wisconsin's Door Peninsula. The goal of this thesis is to determine if it is possible to use a pXRF analyzer to identify a correlation between bricks from the brickworks and bricks from structures. If it is possible this could lead to a discussion about the distribution of bricks on the landscape. PXRF data was collected from a total of

62 bricks from the different contexts. The data did not demonstrate similarities between excavated bricks and bricks from the structures. However, the data collected did demonstrate a difference between bricks from the structures and bricks found during excavations and surveys, along with a difference between bricks that were used as part of the kilns and other bricks recovered from the brickworks.

Little work has been published on brickmaking at historical sites in the United States, specifically in the Midwest region (Gurcke 1987, Kelly and Kelly 1977, Wayne 1998, and Wingfield et.al 1997). This thesis contributes to greater anthropological and historical knowledge in three ways. First, this project provides a synthesis of Belgian history and culture on the Door Peninsula. This area is the largest rural settlement of Belgian-Americans in the nation (Tishler 1989). This area includes the Namur Belgian-American Rural Historic District (Figure 1) which was added to the National Register of Historic Places (NRHP) in 1989. Based on a survey of the Belgian settlement in Brown, Door and Kewaunee Counties this district encompasses the best concentration of buildings, farmsteads, and landscape-related features (Tishler 1989). The area includes more than 3,500 acres which includes 261 buildings that were built between 1871 and 1930 (Tishler 1989). Included in the district are red brick structures which were constructed during the time Vandermissen Brickworks was in operation. The district along with assistance from local residents is able to preserve the cultural landscape that was forged by Belgian-Americans over 100 years ago.

Investigation of the Belgian population in Brown, Door and Kewaunee counties has been conducted over the last 40 years (Calkins and Laatsch 1992, Kalhert 1976,

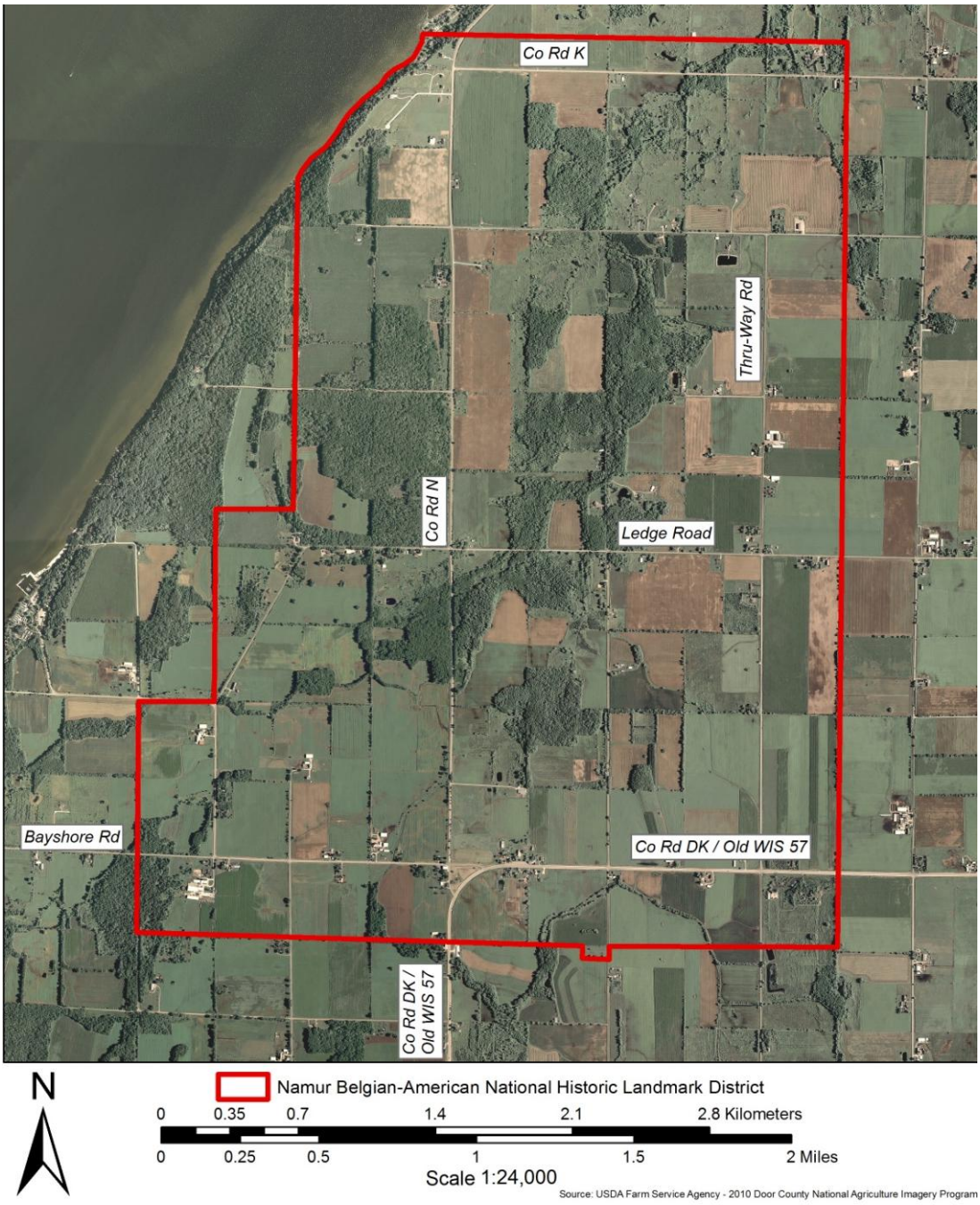


Figure 1: Namur Belgian-American Historic District

Pansaerts 1993, Rentmeester and Rentmeester 1985, Richards 2003, Tishler 1989, and Tishler and Brynildson 1986, and Tlachac 1976). The University of Wisconsin –Green Bay houses the Belgian-American Research Collection. A portion of this collection is available digitally through University of Wisconsin Digital Collections. These valuable sources provide information on the arrival of Belgians in Wisconsin, their settlement in Door County, and the effect the Great Fire had on this population. Architectural components such as roadside chapels, outdoor summer kitchens, and red brick structures are cultural icons that were influenced by Belgian heritage and can still be seen on the landscape today (Calkins and Laatsch 1992, Pansaerts 1993, Tishler 1989 and Tishler and Brynildson 1986).

Second, the comparative analysis of the pXRF results provides information about the usefulness of this technology. The initial goal was to test if the elemental composition of the bricks in the structures would correspond with the bricks and fragments collected from three local brickworks. Analysis of the pXRF results did not demonstrate this correlation but it did reveal other interesting relationships between the structures. Further comparison to other historic brickworks can provide information about variations in the brickmaking process throughout the country at the end of the 19th and beginning of the 20th century.

Sources relevant to the investigation of brickworks are discussed below. Gurcke's *Bricks and Brickmaking* (1987) provides valuable information about different kinds of sites and about the elements of the brickmaking process. McKee's *Introduction to Early American Masonry* (1973) also provides a broad background on the brickmaking process throughout American history. Research conducted at other comparative historic

sites outside of the Midwest are discussed with regard to information on the types of clay, kilns, clamps and pug mills being used at the turn of the twentieth century across the country (Kelly and Kelly 1977, Wayne 1998, and Wingfield et. al 1997).

Third, this project will provide discussion of brickmaking technology in the mid to late 19th century Midwest, to complement previous research that has been conducted on pre-twentieth century brickmaking in the Eastern United States. The use of pXRF analysis and historical context provides a platform to understand the brick production and distribution within the context of the Vandermissen Brickworks site.

Successive chapters in this thesis will provide the contextual and analytical review to explore this topic in depth. Chapter two explores methods and theories utilized in this thesis. This chapter presents a discussion of historical archaeology. The methods deployed for various parts of this project are also provided. This includes the archaeological work conducted by the University of Wisconsin-Milwaukee, the pXRF data collection, and author's engagement with the Belgian-American community in Door and Kewaunee Counties.

Chapter three presents the historical context of Belgian-American's in Northeastern Wisconsin. Discussion of the geographical setting, immigration, and life in Wisconsin in the second half of the 19th century is an imperative part of this historical context. This chapter also explores the process of making brick by hand and looks at other comparative brickworks sites. The production of bricks in the Belgian settlements of Door County differs from other areas, like New England, at the end of the 19th century. An understanding of the brickmaking process and how it influenced Belgian structural

designs and architectural choices is vital to appreciating the landscape and architecture visible today on the Door Peninsula (Hood 1996, Orser 2004 and Wayne 1998).

Chapter four provides the pXRF results of select bricks and fragments. Details of the excavations and the features at 47DR388 are discussed along with less comprehensive detail from the G. Peters Brickyard (47DR409) and Macco Brickworks (47KE55) sites. Discussion of the local community involvement and the information local members of the community provided are also discussed in this chapter. Chapter five presents the discussion and conclusions of this project along with suggestions for future work.

Site Background

The former site of the Vandermissen Brickworks (Figure 2) was excavated during the Wisconsin Department of Transportation's Wisconsin Highway 57 project. Vandermissen Brickworks is a Euroamerican site that produced handmade bricks at the end of the 19th and through the early 20th century. The Vandermissen site was identified during Phase I surveys conducted in 1997 by the University of Wisconsin-Milwaukee's Anthropology Department. In 2001 Phase II investigations were also conducted by UWM Historic Resource Management Services (HRMS) to determine if the Vandermissen Brickworks site was potentially eligible for the National Register of Historic Places (Richards 2003:1-2). At this time a systematic surface collection was conducted also, which produced over 500 individual bricks (Richards 2003:3). In 2004 Phase III investigations were conducted by HRMS to further explore features at the site.

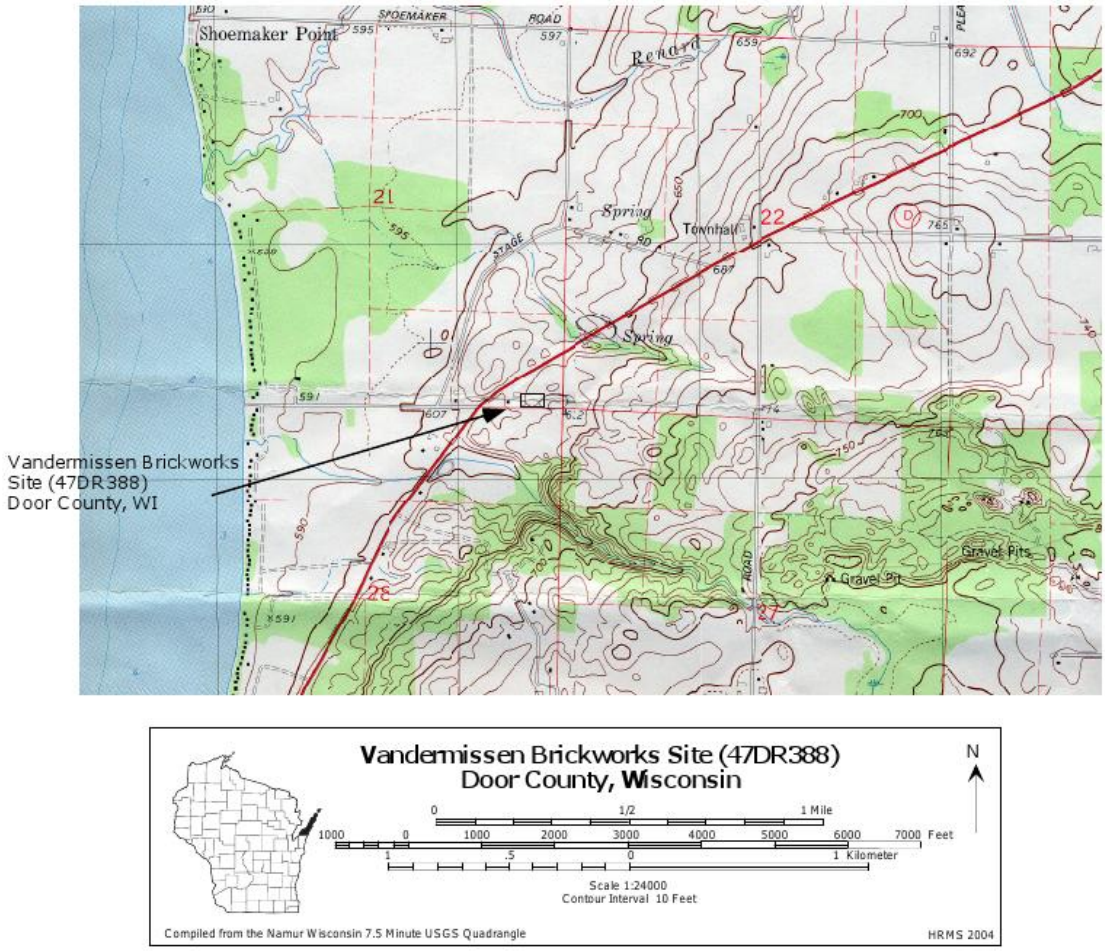


Figure 2: The Vandermissen Brickworks Site (47DR388)

Vandermissen Brickworks was chosen for this project due to its potential for investigating the small-scale cottage industry that was prospering at the end of the 19th and beginning of the 20th century. Vandermissen Brickworks produced the detailed excavated data that, along with the surface collected bricks from two other sites allowed an examination of the relationship between three known historic brickworks and the structures presumably built from bricks manufactured at these brickworks.

CHAPTER 2: METHODS AND THEORY

Historical Archaeology

In a paper presentation to the Wisconsin Archaeological Society in 1910, Dr. Carl Russell Fish, a history professor from the University of Wisconsin, stated "nearly every historian should be something of an archaeologist, and every archaeologist should be something of a historian" (Orser 2004:35). Historical archaeology attempts to utilize both fields but as a discipline has always grappled with a definition and acceptable method that all historical archaeologists could agree upon. There is a useful set of resources for theoretical approaches to historical archaeology that are implemented in this discussion including Charles Orser's *Historical Archaeology* (2004); along with other important works by Anders (1998), Cleland and Fitting (1978), and Hume (1978), Funari et. al (1999), Johnson (1999), Little (1992), and Schuyler (1978).

The origins of historic archaeology can be traced back to the mid 19th century. Early researchers like Felix Martin and James Hall took it upon themselves to excavate historic sites. In 1855 Martin excavated a site called Santa Marie 1, a Jesuit site dating to the seventeenth century in Ontario, Canada. The next year Hall excavated the home of Miles Standish, a well known Pilgrim leader, who arrived in the New World on the *Mayflower* (Orser 2004:28).

Initially, the archaeological discipline primarily viewed the excavation of historic sites as a way of doing public historical preservation (Orser 2004:30). The Historic Sites Act of 1935 placed the importance of preservation into national policy. The Act's goal was "to preserve for public use historic sites, buildings, and objects of national significance for the preservation and benefit of the people of the United States" (Orser

2004:30). This reinforced the trend at the time to excavate sites relating to famous American people. Sites such as Jamestown, Virginia associated with Pocahontas, John Smith and John Ralph, and Abraham Lincoln's two story home in Springfield, Illinois are examples of the types of sites that generated interest (Orser 2004:31).

However, some archaeologists recognized the value in excavations of sites that were not linked to a specific person but instead reflected a way of life. An example is the 1954 excavation by Alan Woolworth and Raymond Wood of Kipp's Post, a small fur trading post in North Dakota where they unearthed a range of artifacts that painted a picture of everyday life in the early American West. The excavation of the home of Lucy Foster, an African American slave in Massachusetts, conducted by Adelaide and Ripley Bullen in 1945 is another example (Orser 2004:33). Excavations of sites like these demonstrate the ability historic archaeology has to tackle basic historical problems (Orser 2004:35).

In the 1960s the question of an underlying theoretical perspective for historical archaeology began to surface. Lewis Binford published "Archaeology as Anthropology" in 1962 and this article began to shift the paradigm for archaeology as a whole while also speaking to the questions historical archaeology faced (Orser 2004:38). One idea Binford proposed was that archaeologists should not solely focus on a static collection of artifacts to understand chronological cultural histories but archaeologists should view cultures adaption to an environment through an anthropological perspective (Binford 1962:217-218).

The next year Binford was asked to serve on a panel for "The Meaning of Historic Sites Archaeology" at the Society of American Archaeology meeting. This was one of

the first steps toward a definition for the sub-discipline (Orser 2004:39). The organization of the Society for Historical Archaeology did not form until 1967 but at this time it allowed those focused on historic sites to come together and discuss the definition, methods, and future of the discipline (Orser 2004:39).

In the 1970s historical archaeologists first attempted to collectively define an approach to their work. An early method presented by Hume defined historical archaeology as the application of the archaeological method to the study of history (Hume 1978:204). This rigid position about the direction of the discipline was met with opposition by others in the field including Cleland, Fitting and Schuyler. Cleland and Fitting argued that this definition limited the potential contributions of historical archaeology (Cleland and Fitting 1978:242). Schuyler agreed, arguing that Hume's definition was inadequate and that it was essential for the field to construct a method that allowed history and archaeology to be combined in an efficient manner with the two disciplines conjoined. Schuyler believed that there was a way to connect their methods in a sophisticated approach (Schuyler 1978:28). Cleland, Fitting, and Schuyler were in agreement; historical archaeology required a theoretical approach that could use both methodologies (Cleland and Fitting 1978:242).

Over the years many professionals continued to discuss the direction of the primary focus of the field. In the 1990s historical archaeologists began to formulate which questions the discipline should be answering and from this self-examination the definition of historical archaeology became more evolved. Historical archaeology was, at this point, generally defined as the study of material remains of societies with written

records. Even though this is the general consensus of the definition currently used, there is still debate about the method historical archeologists should employ.

Historical archaeologists such as Anders, Funari, Johnson, Little, and Orser caution fellow historical archaeologists about how to utilize the written record; specifically regarding who is writing the historical record. Elements such as colonialism, capitalism, power and identity all influence the formulation and documentation of specific relationships and researchers need to be aware of a major imbalance of the histories of literate and illiterate populations (Funari et. al 1999:5-16).

Johnson agreed with this sense of fragmentation, arguing that this awareness takes research beyond traditional archaeology. Through the use of other schools of thought, historical archaeology can become more holistic but these issues needed to be addressed (Johnson 1999:25). Johnson believes that because of these concerns there cannot be one methodological approach to historical archaeology; written documents can be problematic and all written records should not be handled in the same manner (Johnson 1999:29-30).

Anders also discussed this sense of fragmentation, agreeing with the dichotomies that Johnson and Funari and co-authors refer to in their work. The literate peoples of a cultural system are often the elite class, or conquerors, who are the ones writing the historical record. This usually leads to an underrepresentation of the lower classes, which are typically illiterate populations (Anders 1998:124). Ander's discusses this as a sense of "in-betweeness" for historical archaeologists; "with the dilemma of in-betweeness as a point of departure, it is therefore important to both trace the transgressing traditions in the field of historical archaeology and suggest the broader historigraphical contexts"

(Anders1998:106-107). Understanding and training in both historical research and archaeological interpretive methods contributes to a more accurate interpretation of past societies.

Orser has also been an important recent contributor to the discussion of historical archaeological theory and methodology. He describes the discipline in his book *Historical Archaeology;*

> "Historical archaeologists can use historical records, oral interviews, and architectural information to create powerful, rich pictures of the past. These, images, constructed with material gleaned from numerous, diverse, so-called 'non archaeological' sources, add a more human, personal touch to our understanding of history" (Orser 2004:188).

But history, just as archaeology, is not only about gathering and organizing of facts. Historians also interpret their data and must understand and use historiography. There are different types of documents and historical sources that need to be approached and interpreted in different ways. Few archaeologists have been trained as historians and vice versa; which is why it is extremely helpful for the historical archaeologists to have historical training (Orser 2004:171-172).

Historical sources can either contradict or contribute to the archaeological record. Documents should not be viewed as sources that "fill in the gaps" or to look for matching records (Little 1992:4). This is part of the interpretation process and a reason why it is important to understand methodology from both historical and archaeological approaches. On the other side some historians may believe in a "cult of authority" surrounding written documents (Little 1992:5). Historians unaware of archaeological methods can overlook what the material record contributes to the understanding of past life. These ideas were taken into consideration when analyzing the historical record

pertaining to the history of the southwestern portion of the Door Peninsula and Belgian immigration to Wisconsin.

These issues also directly relate to what Orser deems the four haunts of historical archaeology; Colonialism, Eurocentrism, Capitalism, and Modernity. Orser argues that each haunt has had its impact on shaping the modern world and therefore has had an impact at each historic site including the Vandermissen Brickworks site (Orser 1996:88). These points compliment the considerations needed for interpreting the historical record as well. Historical documents must be interpreted with influences of Eurocentrism in mind.

The other haunts are also present when discussing Vandermissen Brickworks. Production and distribution of red brick throughout the southwestern portion of the Door Peninsula fits into Orser's description of the four haunts. Colonialism brought Belgian-Americans to the rural Northeastern Wisconsin. Eurocentrism, colonialism, and capitalism all directly relate to one another and are based on interactions between people (Orser 1996:71). At Vandermissen Brickworks there are several capitalistic influences at play. The market for red brick at the end of the 19th and beginning of the 20th century was strong and brick was being produced to be sold throughout the surrounding communities. Vandermissen Brickworks also competed with other local brickyards including G. Peters Brickyard and Macco Brickworks for consumers.

Not only was the Vandermissen family selling the finished product but people were also selling their labor to produce the bricks. Some of the brickyards in the area may have used family members for labor and some used a paid labor force. Through historic research it is known that in 1910 Vandermissen Brickworks utilized a labor force

outside of the immediate family (The Advocate, 27 May 1910). All of these relationships influence the distribution of brick in a capitalistic, European-American society.

Discussion of the landscape can also provide historical archaeologists another avenue of data that contributes to a more complete understanding of the past. Understanding and interpreting a site can produce questions about the landscape that can be analyzed through historical and archaeological analysis (Hood 1996, Orser 2004, and Wayne 1998). The reasons a group occupies a site or region and how they were able to modify the environment to fit their own cultural patterns are questions that can be examined through this type of approach. This examination can answer not only why people occupy a space but also the effect they have had on the surface through time (Wayne 1998:97).

Modifications of the landscape have lasting effects and are still visible today, as is the case with the Belgian influence on the southwest Door Peninsula (Figure 3). There are multiple examples from the area under consideration in this paper. For instance, while the new State Highway 57 was being designed by the Wisconsin Department of Transportation, it was required to avoid the Namur Rural Historic District and structures in order to preserve their history. This area was deemed historically important in 1989 and for various reasons had been preserved. The new Highway 57 is now a part of the landscape but was constructed around this historic district.

The lasting changes to the landscape, in evidence on the southwestern Door Peninsula today, are the structures built from these bricks including farmhouses, factories, schools, and churches. As Orser states, "historical archaeologists are as interested in what rests above the ground as they are about what lies beneath it" (Orser

2004:184). Historic materials above the ground are vital manifestations of material culture that can provide information about how people lived in the recent past (Orser 2004:184). Vandermissen Brickworks is an example of a historic site that reflects a certain way of life that can be interpreted through the archaeological record, architectural survey, historical documents and oral histories.

Figure 3: Typical Landscape including the new State Highway 57 and a red brick farmhouse

Methods

There are three parts of this thesis that contribute to the discussion of brick and brickmaking on the Door Peninsula: archaeological investigations, pXRF analysis, and community interaction. Archaeological investigations by HRMS discovered 32 features at the Vandermissen Brickworks site (47DR388). The features uncovered demonstrate

how handmade bricks were produced and represent several stages of the brickmaking process. Extraction pits, a possible pug mill or ring pit, clamps and culling piles are included in these features. Closer investigation of the brickmaking process through the features of the site will provide more information not only about how the brickmaking industry functioned in Northeastern Wisconsin but also the economic process and formation of the cultural landscape of the area.

The archaeological records also produced multiple bricks available for pXRF analysis from different contexts. At Vandermissen Brickworks bricks were recovered from feature context and surface collection. This provided soft, hard and vitrified brick for analysis. G. Peters Brickyard and Macco Brickworks also provided a small amount of bricks and fragments for pXRF analysis. These samples were recovered from surface collection at the sites.

The second part of this thesis utilizes pXRF analysis of bricks from the local brickworks from an archaeological context and bricks from extant structures. The use of pXRF has advanced in the last decade due to increased portability, accessibility, and flexibility of the technology (Shugar and Mass 2012:17). The technology is still relatively new and issues still need to be addressed in relation to its use. These issues include appropriate analysis conditions, proper calibration standards that may provide the best possible quantitative results based on the material being analyzed and field conditions in which the instrument can be used to collect dependable data (Shugar and Mass 2012:19). Little work has been conducted on historic clays such as the bricks used here and all of these issues are considerations in this work.

This pilot study attempted to associate bricks from extant structures to bricks recovered from Vandermissen Brickworks, Macco Brickworks, and G. Peter's Brickyard. PXRF analysis was completed on a total of 62 bricks, 28 brick samples from Vandermissen, 10 brick samples from G. Peters, 9 brick samples from Macco, one comparative sample (Madison Brick) and 14 bricks from the structures in Door and Kewaunee Counties. The Bruker Tracer III-v ED-XRF, a handheld pXRF device, was used for this project. Each sample was tested at three different points and each point ran three assays at 180 seconds each. This was done to insure there were not any inconsistencies with the readings. A standard of Kaolinite powder was also tested at the beginning and end of each pXRF session, three times at three assays of 180 seconds with the exception of the readings taken at the Legrave home in Namur. The machine was set at 40KV 50mA.

After the lab analysis of bricks from the Archaeology Research Lab (ARL) collection was completed on the bricks from the brickworks, the next step of the pXRF analysis process was to test extant structures in Door and Kewaunee Counties. Five structures were chosen and two sets of bricks were brought back from structures to have the pXRF analysis conducted in the laboratory at the UW- Milwaukee ARL. For each structure two bricks were chosen for the pXRF analysis based on observation and the assumption that these were most likely the original brick. Munsell color readings were taken for each brick on the structures. In each case a lighter and darker color brick was chosen. Areas surrounding windows were avoided due to appearance that they could have been bricks that replaced the originals. Each brick was tested in three different locations on the exposed surface that ran three assays at 180 seconds each.

This fieldwork was conducted in February in Wisconsin and the conditions were quite cold. When starting analysis at the first structure, the laptop and Bruker machine were powered by batteries. Fully charged Bruker batteries failed after about 10 minutes; laptop likewise. Electricity was used for all of the tests here after. All readings were taken with the laptop connected to the Bruker machine by serial to USB cable. Outside temperatures ranged from 6º to 20º F. The Legrave, Don and Mary Anne Englebert, and Duvall Cheese Factory readings collected with the Bruker machine and laptop powered from built-in 120v inverter in the field vehicle. Figure 4 demonstrates the equipment set-up at the Legrave home. The David and Dixie Englebert and Luke Ferron readings were powered by 120v house current.

Figure 4: PXRF analysis at the home of Norbert and Barbara Legrave

The team did not observe any deviation from 50/40 power settings and all readings maintained acceptable raw/valid count ratio. The maximum ambient temperature of the pXRF machine was approximately 48º F. S1PXRF software was used to analyze

the elemental readings from the Tracer portable machine. Next Artax® software (version 7.4) was used to generate peak areas, or net intensities, for each sample. Each reading per artifact was checked for internal consistency using the Mahalonobis distance measure and anomalous readings were identified and removed (Richards 2013:5).

Statistical analysis was then conducted using the R Statistical Analysis Program version 2.15.2 that was developed by the R Development Core Team (2012). The methods used are those outlined in Hulit's "Tutorial" which established a standard pXRF statistical method that is currently used by UW-Milwaukee's ARL (Hulit 2012). (Richards 2013:5) The results of this analysis will be discussed in chapter four.

Another source of information for this thesis is interaction with the local members of the community in Door and Kewaunee Counties. I attended two Namur Belgian Heritage Foundation events during the completion of the project. Here I was able to collect information about potential structures and gain permission to complete pXRF analysis on structures. Local residents assisted in the fieldwork as well. Township of Union resident, David Englebert escorted us around to structures in Door County and assisted in gaining permission from homeowners for pXRF analysis. Heather Bauldry did the same for the structures in Kewaunee County. Oral histories from these and other sources were used to assist in determination of timing and the use of specific brickworks for certain structures along with construction dates for some of the structures tested during the pXRF analysis.

CHAPTER 3: HISTORICAL CONTEXT

Geographic Setting

The Walloon Belgian-American settlers came upon the rolling slopes of their new home in Brown, Door, and Kewaunee Counties beginning in 1853 (Holand 1933:10). The moderate weather of Wallonia was far behind them and they faced the extremes of the Northeastern Wisconsin climate. Lake Michigan influences the harsh environment by bringing an abundance of snow, delayed spring and cool summer nights (Tishler and Brynildson 1986:2). The southwestern corner of the Door Peninsula lies on the Niagara Escarpment of high bluffs along the western edge and descends towards the east (Tishler and Brynildson 1986:4).

The landscape as well as the climatic pattern influenced the formation and maintenance of the Belgian-Americans cultural landscape (Calkins and Laatsch 1992, Pansaerts 1993, and Tishler and Brynildson 1986). The climate affected crop selection, the length of the growing season, and the location of cultivated fields. Land that was arable consisted of dairy farms along with cherry and apple orchards. Settlers also utilized the thick forests and abundance of clay to transform the environment into shelters (Tishler and Brynildson 1986:3). The early Belgian-American settlers came upon unsympathetic and unfamiliar terrain but were able to endure and eventually utilize the resources of the landscape.

Belgian Immigration to Wisconsin

Northeastern Wisconsin is home to a unique enclave of Walloon-Belgian settlements. Belgian settlement in Wisconsin began in 1850 and by 1870 the largest

recorded Belgian population in the United States was in Wisconsin consisting of 4,804 people (United States Census 1870: 337-340). Illinois held the next largest population with 1,076 Belgian immigrants (United States Census 1870: 337-340). Figure 5 illustrates the distribution of Belgian immigrants living in Wisconsin in 1890. The majority of these pioneers came from Brabant and Namur Provinces which included both Walloon and Flemish speakers (Rentmeester and Rentmeester 1985:5).

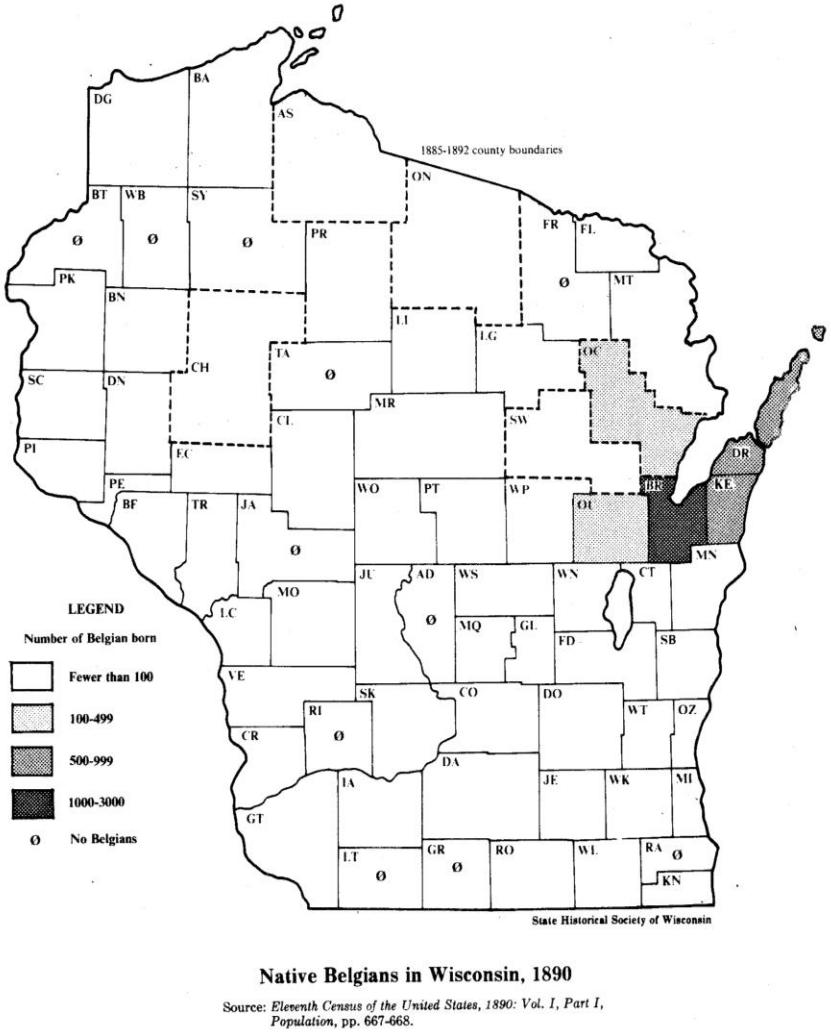


Figure 5: Map of Belgians in Wisconsin
(Wisconsin Historical Society Reference Maps Collection)

The first group of immigrants arrived in Wisconsin in 1853 (Holand 1933:10). Xavier Martin, a young adult that was a part of this first group of Walloon Belgians, was highly influential in helping the community assimilate to a new home. Martin spent four years in Pennsylvania where he learned English prior to coming to Wisconsin (Wells 1968:29). Martin described life for the early Belgian settlers on the Door Peninsula in Wisconsin as follows:

> "the little party was ten miles away from any house, in a virgin forest consisting of a thick growth of pine, maple cedar, basswood- many of the trees being five and even six feet in diameter and some over a hundred fifty feet high- without roads of any kind, not even a trail, with no neighbors, no horses, no cattle; nothing but the occasional visit of a wolf, a deer or a bear coming around their little huts and, on more than one occasion, taking the pork they had brought with them" (Martin 1895:378).

Approximately 70% of Belgians in Wisconsin resided in what Calkins and Laatsch indentify as a "rural Belgian ethnic island" (Figure 6) (1992:196). This area consisted mostly of Walloon-Belgians while a more urban Flemish-Belgian population settled near Green Bay in Brown County. The ethnic island provided an area in which Belgian cultural values were shared and the Belgian immigrants of this ethnic island tended to hold on to their agricultural as well as their architectural roots. Within this area, 80% of the farmland belonged to those of Belgian descent (Calkins and Laatsch 1992:196). Even though the landscape did not originally allow for successful farming, these areas eventually developed into communities that began to service the local agricultural economy surrounding in the tri-county area (Tishler 1989).

To appreciate the Belgian American's story it is essential to understand the conditions that attracted them to America and how their culture, history, and traditions influenced their life in Wisconsin. The mass immigration from Europe to the New World

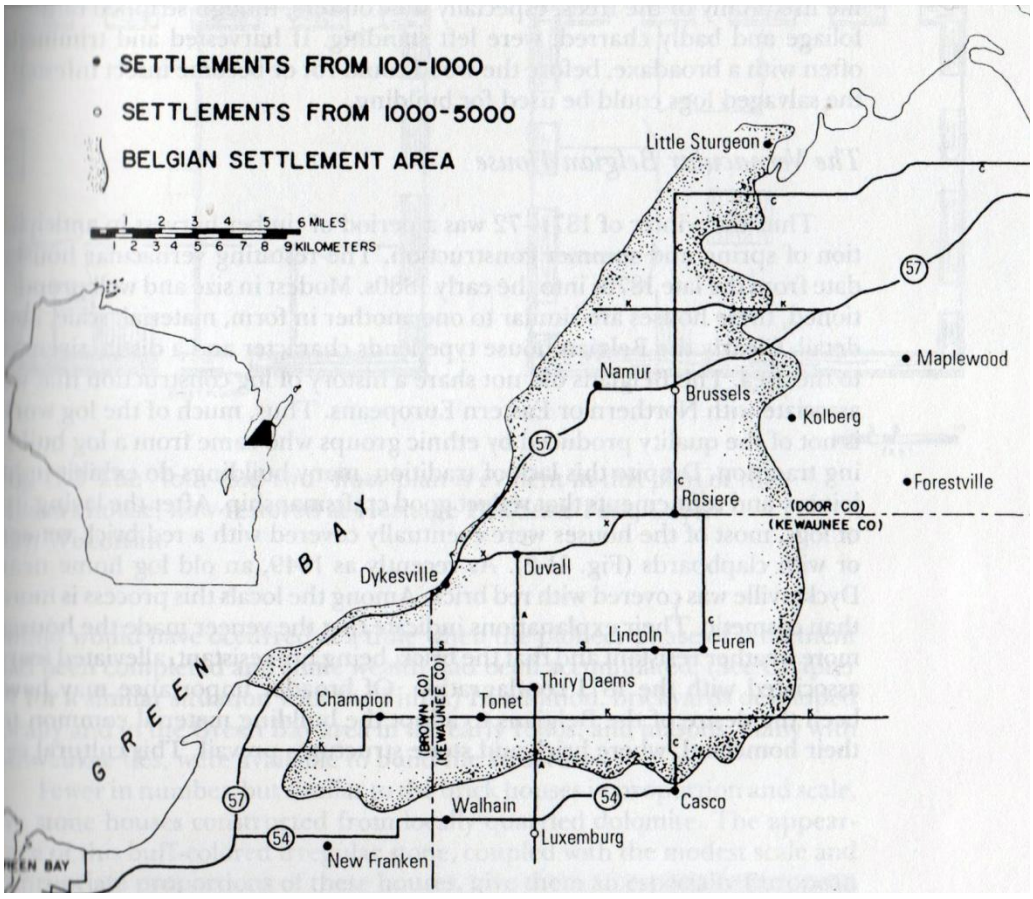


Figure 6: The Belgian ethnic island in Northeastern Wisconsin
(Calkins and Laatsch 1992:197)

between 1850 and 1913 brought more than 40 million people across the Atlantic (Hatton and Williamson 1994:534). Overall motivations for these migrations are complicated and there are many factors to consider. Discussed here are some of the contributing factors related to Belgian immigration to the United States.

The Kingdom of Belgium is separated into two regions; Flanders in the north and Wallonia in the south (Figure 7). This separation is reinforced by a distinct language barrier. The Flanders or Flemish speak Dutch while the Walloons speak Walloon which is a form of French (Barrai et. al, 2003:2). Brussels, the capitol of Belgium, is located in

Figure 7: Map of Belgium
(Central Intelligence Agency, World Fact Book 2013)

the middle region in the Province of Brabant and is encased by Flanders even though the area is officially bilingual. Both French and Dutch are spoken in this region and today it is viewed as a separate entity from both Flanders and Wallonia (Barrai et. al, 2003:2). Brabant Province in Wallonia produced most of the Flemish and a good portion of the Walloon settlers that made their way to Wisconsin (Rentmeester and Rentmeester 1985:9). During the process of immigration the experiences were quite different for the Flemish and Walloon populace one they reached the New World.

There were several contributing factors to the waves of Belgian immigration to the United States in the nineteenth century (Calkins and Laatsch 1992:195). One factor was the crop failure in the 1840s and 1850s among rural Belgian populations. There was also a decline in the demand for local industries as industrialization and transportation

became more centralized (Calkins and Laatsch 1992:195). There was also the pressure of a growing population in Belgium. Migration was further stimulated by the offer of low land prices in Wisconsin advertised by Antwerp ship owners (Calkins and Laatsch 1992:195).

Yet with all of these influential causes, the emigration period was short-lived. The reasons included unsatisfied previous immigrants, corruption of the ship owners, increase in wage demands and decreasing land values in the New World (Calkins and Laatsch 1992:195). The largest immigration wave to Northeastern Wisconsin occurred between 1854 and 1855 (Wells 1968:30). The original settlers that arrived in 1853 wrote in 1855 to the loved ones they left behind. They mentioned the cheap land and their new homes but immigration halted when cholera broke out in Wisconsin (Wells 1968:30). After this event some settlers wrote letters about the unfavorable conditions and hardship they endured but the letters did not reach the pioneer's relatives back in Belgium before people had already started their voyage to America (Tishler and Brynildson 1986:21). Emigration halted after this and it resumed a few years later but not on the same scale (Wells 1968:30).

Those who did decide to leave Belgium had a long journey ahead of them. As with many immigrant journeys, the voyage across the Atlantic was a treacherous one. In 1856 conditions were particularly disastrous. One vessel carrying several hundred Belgian immigrants wrecked at sea which led to a total loss of life. On another vessel, dysentery broke out which lead to the death of 60 of the 200 passengers on board (Tlachac 1976:14). Most of those who did survive the venture arrived penniless in America (Holand 1933:18).

When the Walloon-Belgian immigrants arrived in America, they docked in New York City then traveled the Albany-Buffalo road to sail to Detroit which was followed by a train ride to the eastern shore of Lake Michigan (Laatsch and Calkins 1992:195). Finally, immigrants crossed Lake Michigan to Milwaukee, Wisconsin. These pioneers finally settled north of Milwaukee in Sheboygan. They chose not to stay due problems in the community including the language barrier with their Dutch and German neighbors. They moved further north near Green Bay (Laatsch and Calkins 1992:195).

The Walloons did not assimilate into the economic and social life in Northeast Wisconsin as easily as the Flemish partially because the Walloon immigrants could only speak Walloon (Rentmeester and Rentmeester 1985:15). This resulted in the Walloon settling in a more rural area outside of Green Bay while the Flemish stayed closer to the urban center of the Bay Settlement (Rentmeester and Rentmeester 1985:15). The Walloon group had originally planned to settle south of Green Bay near present day Kaukauna but the death of a child in the group changed everything. The funeral delayed their departure from Green Bay and directed the group to Father Edward Daems, a Catholic priest of the Crosier order who presided over the funeral. Father Daems was a French speaking Walloon Belgian and convinced the newly arrived Belgians to settle in the northeast corner of Brown County (Calkins and Laatsch 1992:195-196).

Belgian Life in Wisconsin from 1850 to 1871

Early Belgian settlers from Wallonia left behind their cultural landscape and now faced the Wisconsin wilderness. The Walloon's past experiences with agriculture made it specifically difficult for them to adapt to the new land of thick forests and harsh

weather. They first took to wheat farming with seeds they brought with them from Belgium or seeds they had acquired in the Bay Settlement (Holand 1933:48). Wheat was one of their main food sources but it was difficult to utilize. It had to be harvested and threshed before it could be used as a food source. This process was left to the women and children since the men were away trying to make money for their families. The nearest wheat mills were quite difficult to reach as they were in Algoma and the Bay Settlement. With no roads to either place, travel was dangerous and difficult for the Belgian women (Holand 1933:49). Wheat farming fell by the wayside due to drought and over use of the land in the end of the 19th century (Apps 1998:20).

The people of the Belgian settlement had a hard time improving their economic outlook due to lack of communication with others in the region. Xavier Martin, one of the only Walloon Belgians that could speak English, joined his family in Wisconsin in 1857 (Martin 1895:381). Martin was frustrated with the language barrier that proved to be an obstacle for the Belgian settlement from the moment they left Belgium. Martin claimed that 15,000 settlers from Belgium were not able to speak English. Martin used his position to convince the Belgian men that in order to be taken seriously in the area they needed to exercise their right to vote (Martin 1895:381).

In April 1858, with the help of Martin all of the Belgian men that ran for office were elected to their positions (Martin 1895:383). After this event Martin claims the Walloons were perceived as "honest, industrious, and intelligent neighbors" by the surrounding settlements (Martin 1895:383). By 1860, the Belgian settlement's outlook began to improve.

When the Belgian men exercised their right to vote they were now eligible to be drafted for war. Martin describes their reaction to being called to service during the Civil War:

> "…they responded nobly. The settlement furnished their full quota of Union soldiers; many fell on battle-fields, while hundreds of them even to this day carry on their persons honorable scars, together with their honorable discharges" (Martin 1895:387-8).

This was a setback for the settlement but the women tried their best to continue to support their families while the men were away (Martin 1895:388).

After the Civil War ended in 1865, the Belgian-American population of the Door Peninsula began to prosper. When the men returned to the settlement there was a new outlook on life with new ambitions (Martin 1895:388). Residents began to transform the resources of the landscape to their benefit. According to Martin, this resulted in the appearance of sawmills and other logging industries in the area. The trees of the rough northeast Wisconsin landscape were transformed into shingles, railroad ties, and lumber. The lumber industry proved fruitful for the Belgian community (Wells 1968:32). Shingles were easily carried to the shore of Lake Michigan and were transported to settlements near Green Bay (Holand 1933:52). Many shingle mills appeared after the war and according to Holand, in 1868 four million hand carved shingles were shipped out of Brussels in Door County to the Bay Settlement (1933:52).

A seasoned shingle maker could make up to three thousand shingles in a single day (Wells 1968:28). This endeavor was useful in clearing the land not only for pathways but for better agricultural use of the land. The money made from selling

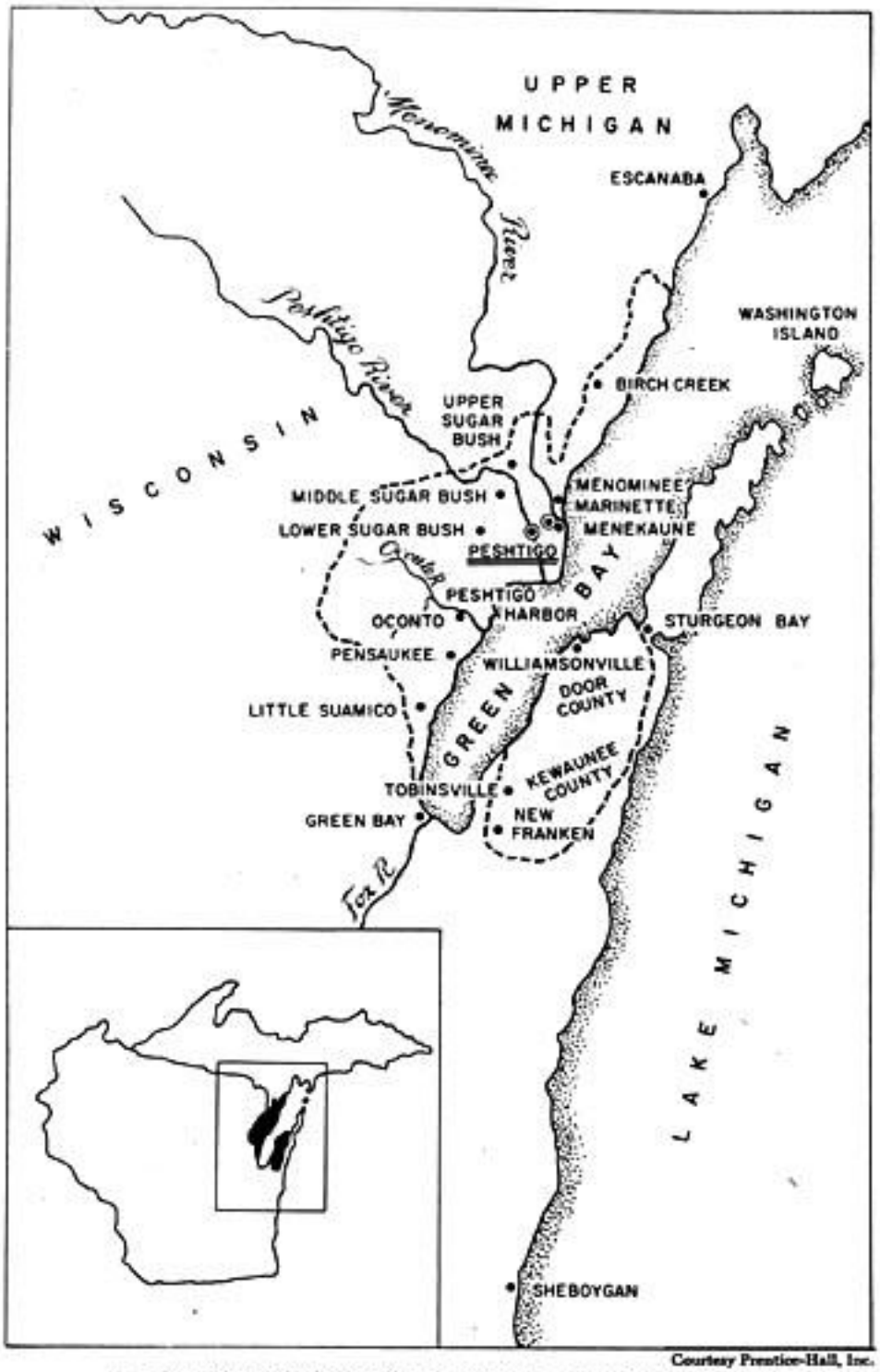
shingles in the Bay Settlement could be used to buy a cow or other farming implements which could then be put to agricultural endeavors (Wells 1968:28).

By 1870, Belgian-Americans of the Door Peninsula thought the worst was finally behind them and looked forward to reaping the rewards of their hard work. Settlements were growing and saw mills were booming as well (Tlachac 1976:31). After fifteen years of hard work, battling and shaping their environment, the Belgian community had finally built a sturdy economy that could support their Belgian families (Wells 1968:32). This all changed on a fall day in 1871.

The Great Fire of 1871

The summer of 1871 was extremely dry; rainfall was below average and the average relative humidity was low (Moran and Somerville 1990:26). Devastating fires broke out in other parts of the country which worried residents (Holand 1933:61). The Great Firestorm swept through Northeastern Wisconsin on October 7, 1871 taking thousands of lives, destroying homes and the landscape which the Belgian community had worked so hard to shape. According to Captain Langworthy, chairman of the Peshtigo Relief Committee, that fire did not burn less than 2,400 square miles in Wisconsin (Gess and Lutz 2002:211). Figure 8 demonstrates the areas damaged by the fire.

On the eastern shore of Lake Michigan the fire spread from New Franklin to the northwest near Sturgeon Bay (Moran and Somerville 1990:24). This fire caused massive destruction to the west coast of Lake Michigan while at the same time a different fire with different causes tore through Chicago; making them the most destructive fires in



Courtesy Prentice-Hall, Inc.

Map adapted from Tilton's Great Fires in Wisconsin, and used in Robert Wells' Fire at Peshtigo to illustrate the burnt district in Wisconsin and Michigan. The dotted lines indicate the approximate extent of the devastation, as do the blackened areas in the insert.

Figure 8: Map of the Great Fire damage areas
(Wells 1968)

United States history (Moran and Somerville 1990:24). The devastation was fueled by a number of factors that alone would not have caused such devastation, but when combined, they were the ingredients for a perfect storm. Wasteful logging practices, drought, low relative humidity, a favorable weather pattern, and unusually strong winds all contributed to this significant historical event (Moran and Somerville 1990:28-30).

An accurate account of the death toll is not known, some sources state that about 1,500 people died in the fires of the Sugar Bush, Peshtigo, and the Door County Peninsula but others estimate closer to 2,500 (Gess and Lutz 2002:211). A death count of the Belgian population is especially problematic because they spoke little English thus it was difficult for the Belgian Settlement to communicate all that was lost. Belgians were recorded dead in Rosiere, Forestville, Williamsonville, Brussels, Union, Red River, and Nasawaupee among other small communities along the Door Peninsula (Wells 1968:54). Brussels was one of the hardest hit communities of these Belgian enclaves.

An eye account described the scene in Brussels; "three or four children were found on their hands and knees, with their heads against a large stump, dead in this position… the victims had apparently died without a struggle, probably killed outright by the first hot breath they inhaled" (Gess and Lutz 2002:171). A man from Forestville relayed to authorities what he witnessed in Brussels after the smoke cleared; "The only living thing found was a pig, burned so badly he could neither see nor walk. The people perished from suffocation before the flames reached them, so dense was the smoke" (Wells 1968:185) (Figure 9). To escape the fire people hid in wells. Al Vandertie talked about his parents telling him that they dug a well for shelter from the fire (UW-Green Bay Archives, Belgian-American Ethnic Resource Center Prospect Questionnaire,

February 1975, Belgian-American Research Collection). They were lucky enough to survive the blaze but others who attempted this were not as lucky. Some died from suffocation while others perished from the well curbs catching fire and falling in on them (Gess and Lutz 2002:172).

Figure 9: Residents attempting to escape the Great Fire
(*Harper's Weekly* 25 November 1871)

Kewaunee County was also severely damaged by the fire and was generally burned over. According to Wells, sixty-two families were burned out of their homes and land. Those families residing along the western shore, however, were able to avoid the worst of the fire (Wells 1968:185).

This disaster was a devastating blow to the Belgian community. All the hard work of the prior fifteen years was lost in an instant. Xavier Martin wrote, "Nearly all the marketable timber having been burned or destroyed, it followed that the lumber and shingle mills which had been destroyed by the fire were not rebuilt, and this alone was a

great loss to the people" (Martin 1895:391-392). Residents lost not only loved ones but their homes and their means of making a living.

The Great Fire of 1871 had a critical impact on the region and its residents. It has permanently impacted the landscape and the economy of the area. The lumbering era ended after the fire and the people of the Door Peninsula were forced to adopt new economic pursuits (Moran and Somerville 1990:29). Relief efforts in the area attempted to help by bringing not only money but also food, clothing and farming tools to surviving residents. The fire became a catalyst that promoted the transition into a more successful agricultural based economy (Moran and Somerville 1990:29).

One advantage that emerged from the fiery destruction of the native forest cover was that it cleared the land and made it more amenable to dairy farming. Martin wrote, "There was nothing left for them to do but to turn their attention strictly to farming, which they did. From that time on, farming, stock and wool raising, butter and cheese making were the main occupations of the Belgian settler" (Martin 1895:392). Martin adds that later he was reminded of his homeland once the Belgian community began to recover from the travesty; "[the fields are] a beautiful sight in the summer time to see fine crops of wheat, rye, barley and oats covering fenceless and stump less fields. The wilderness begins to look like the fields of Belgium" (Martin 1895:392).

Life After Disaster: Brick, Cheese, and Agriculture

After the Great Fire the Belgian-Americans began to use the newly cleared landscape for farming (Martin 1895). The new space and resources promoted two new

occupations including cheese making and brickmaking. Both involved processes that Belgians were familiar with in their homeland.

Cheese factories are an important part of the economic history of Wisconsin and of the Door Peninsula. In this particular region factories were small scale operations that were established in the late 19th century that flourished and then began to decline in popularity during the mid 20th century (Apps 1998). Cheese making was one of the skills immigrants brought with them from across the Atlantic. Before these factories were in use, cheese was produced for household consumption by women in the kitchen. In the late nineteenth century, as dairy farming gained popularity, this task moved out of the kitchen and into the greater community (Burton and Burton 2003:128).

After the Great Fire of 1871 farmers shifted their focus to dairy farming (Martin 1985:392). As the number of dairy farms increased so did the presence of cheese factories (Apps 1998:31). In 1910 Kewaunee County alone had 63 cheese factories (Apps 1998:42). Farmers brought their milk to the cheese factories and received cash which became a significant part of their income (Burton and Burton 2003:129).

After the Great Fire, Belgian-Americans not only needed new economic drivers, they also needed to rebuild the homes that were lost in the fire. Brick was chosen as a new, fire-proof building material readily available. Brick allowed residents of the Door Peninsula to restructure the lost buildings and the landscape. Brickyards in the area thrived at the turn of the century and bricks were cheap. Finished bricks sold for about $4.00 to $5.00 per thousand. (Burton and Burton 2003:26). Little is specifically known about the different brickyards in this area at the time but local residents talk about the local brickyards that produced the red brick that can still be seen on the countryside

today. Vandermissen Brickworks, G. Peters Brickyard, Macco Brickworks, Champion Brickworks, Forestville Brickyard, Kewaunee Brickyard and J. Strew Brickyard all appear in historical documents around the turn of the 20th century but little is really known about their operations (Tishler and Brynildson 1986:43-49).

The primary focus of this thesis is Vandermissen Brickworks. The archaeological investigations at the site are important because it is one of few brickworks in this part of the country to be excavated and because it can provide more information about how brickworks operated in this time and place. This project also discusses the archaeological surveys conducted at G. Peters Brickyard and Macco Brickworks.

Vandermissen Brickworks appears on the 1899 plat map of Door County by Randall and Williams but the brickworks is not mentioned in the 1910 plat map by W.W. Hixon and Company. It is unknown how Joseph Vandermissen learned to make brick but around 1896 he purchased the brickworks site property in the Township of Union and started brickmaking that same year at the age of 22 (Mier 2004:42). It is possible Vandermissen may have learned the skill from his father, Jean Joseph Vandermissen, another relative or another brick maker in the area. Joseph Vandermissen is listed as a "brickmaker" on the 1900 United States Census. The land was also used for dairy farming. According to the 1895, 1905, 1920 and 1930 United States Census data Joseph Vandermissen identified himself as a "general" or "dairy" farmer.

Vandermissen Brickworks is mentioned in the *Door County Democrat* on two different occasions, the first being on November 24, 1906: "Brick is still being hauled to Brussels from the Vandermissen Brick yard for the large store that is being erected." The other mention of the brickyard is on May 27, 1910: "Joseph Vandermissen, Sr., and his

men are busy making bricks. This is their principle work for the summer. They started about a month ago." *The Advocate* also references Vandermissen on April 4, 1904 for a fire that took place on the property when his home and his neighbor to his west, Duchetau, were struck by lightning. "Lightening struck the barn of Jos. Vandermissen at the same time (Ducheteau's did) and the building was burned to the ground together with all the farm implements and machinery." These demonstrate the use of the land as a farm and a brickworks in the early 1900's. The Vandermissen family believes that operations of the brickworks halted around 1925 when business waned. According to Shirley Vandermissen the home on the property was built in 1927 and Mrs. Vandermissen noted that the family wished they had saved some brick for the construction this structure (Mier 2004:46).

According to the Belgian-American Research Collection's architectural survey, Vandermissen Brick was used in the construction of the Pleasant Ridge School and the Maccaux house on County Road N (University of Wisconsin Digital Collections [UWDC] Belgian-American Research Collection). Vandermissen bricks are also believed to have been used to construct the Adam Dier house on the old Highway 57 (Mier 2004:43).

Mention of the G. Peters Brickyard in Brussels in the historical record is scarce but after talking to local residents and reviewing plat maps, it is believed that this business was taken over by the Vandertie family in 1900. G. Peters Brickyard appeared on the 1899 plat map of Door County at the corner of County Rd. D and County Rd C (Randall and Williams 1899). In the 1900 plat map Louis Vandertie is listed as the owner of the property (W.W. Hixon and Company 1900).

David Englebert recalls his grandfather referring to this brickyard as the Vandertie Brickyard. According to Charles Englebert this brickyard produced the brick that was used for the St. Francis Catholic Church in Brussels (David Englebert, personal communication 2013). This church was constructed in 1909 (Door County Democrat [DCD], 19 June 1909). *The Door County Democrat's* article about this construction process mentions that the brick being used was brick produced from the brickyards of Union (DCD, 19 June 1909). This would lead to the assumption that it was not just Vandermissen producing brick at this time in the area. This along with the story told by Englebert could lead to the assumption that the G. Peters/Vandertie Brickyard was producing bricks from at least 1899 to 1909.

The Macco Brickworks is believed to have been in operation longer than G. Peters and Vandermissen according to oral histories. The Macco Brickworks was located in Red River in Kewaunee County near the shore of Lake Michigan. They produced brick well into the 20th century. Both places produced the iconic red brick just as Vandermissen did. Red brick is an architectural element that can be viewed on the rural landscape of Belgium and the Door Peninsula. Belgian-Americans continued to maintain and promote their heritage and cultural values through their architectural choices (Tishler 1989, Pansaerts 1993, and Calkins and Laatsch 1992).

There are a few other brickworks in the area but not much is known about most of them. The Ausloos or Champion Brickworks in Brown County is the best historically documented of these. This brickyard began operation in 1889 (Tishler and Brynildson 1986:43). Other local brickyards are mentioned in plat maps and references including the Forestville Brickyard, Kewaunee Brickyard, and J. Strew Brickyard (Tishler and

Brynildson 1986:46-48). These brickyards date to the late 1880s at the earliest suggesting that they were not supplying the rebuilding surge immediately following the Great Fire of 1871. The brickyards making bricks for these structures are unknown. It is possible that smaller scale production was occurring at the time immediately following the fire. It is possible families were making brick for their own structures and then discontinued production once the structures were completed.

Vandermissen Brickworks and these other brickyards demonstrate the small scale cottage industry following the initial rebuilding process after the Great Fire. Closer investigation of the brickmaking process and the elements of site 47DR388 can provide more information not only about how the brickmaking industry functioned at the end of the 19th and beginning of the 20th century in the Northeastern Wisconsin but also about the economic processes and formation of the cultural landscape of this Belgian enclave. The people of Brussels, Namur, Union, and Red River still identify themselves as Belgian-Americans and embrace this history and their cultural landscape.

History of Brickmaking

Bricks have been used as building material for over 10,000 years. Their presence has been noted in prehistoric sites in places such as India, Peru, Iraq, and China. The Roman Empire is responsible for the spread of the massive utilization of brick and the craft of its production throughout Europe and Britain (Gurcke 1987:39).

Although some brick was imported from Europe there is also archaeological evidence that demonstrates that bricks were being produced in the American colonies beginning in the 18th century (Gurcke 1987:40, Wayne 1998:97). Immigrants from

certain parts of Europe were familiar with the process of brickmaking and were able to utilize this skill to make a living in the New World. Early brickmaking archaeological sites on the East and West coasts have been thoroughly researched but mostly ignored in the Midwest and in Wisconsin (Finney and Snow 1991, Gurcke 1987, and Kelly and Kelly 1977, Wayne 1998, and Wingfield et.al 1997).

Brickmaking in Northeastern Wisconsin

Archaeological and historic analysis of historic brickyards, like Vandermissen Brickworks, can provide insight to different factors of life during this time period in rural areas through analysis of production and distribution of their products. Historic brickyards can provide information for archaeologists and other researchers, particularly relating to architectural history and industrial archaeology (Kelley and Kelley 1977:84). This type of research provides insights into the economic industry of farming and these add-on jobs for Belgian immigrants. Vandermissen Brickworks offers a look into the cottage industry that was tightly imbedded in the local economies and the resulting product that was used to build structures. Their distinctive construction assisted in creating a cultural landscape that is still visible today. Understanding the distribution of bricks from their production site can also be helpful in understanding the economic workings of these small rural communities. Distribution histories of historic brick could be utilized to illustrate the changes in networks and chronological stability (Kelley and Kelley 1977:88). .

The brickmaking process and the development of brickworks on farms, like that of the Vandermissen property, can contribute to the study of materials and labor which

slowly changed due to the introduction of new technologies. These new advancements, however, did not reach these rural farms at the same time as the major brickmaking ventures on the East Coast. For example, early brickmaking machinery was introduced as early as 1867 in other parts of the country but did not become common on the northwest and east coasts until the late 19th century (Gurcke 1987:148 and Wingfield et. al 1997). There is no evidence from the Vandermissen Brickworks that would lead to any other conclusion than that these bricks were made by hand. The bricks produced here were hand molded and do not bear a makers mark.

The Brickmaking Process

The site of Vandermissen Brickworks has provided valuable information about the brickmaking industry of the Door Peninsula at the turn of the 20th century. The Vandermissen Brickworks was located on a small family farm that made "Belgian" or red brick. These bricks were made by hand and the process took months to complete. The bricks produced were used locally due to the difficulty of transporting the finished materials long distances (McKee 1973:41). Although specific techniques vary from brickyard to brickyard there are five basic steps to making bricks by hand; winning or mining, preparation, molding, drying, and firing (Gurcke 1987, McKee 1973, Ricks Bricks 2003). After firing the bricks were then sorted by hand according to quality (Gurcke1987:4).

Brickmaking and the bricks produced were largely dependent on the nature of the raw materials available to the brick maker (Gurcke 1987:4-5). The landscape provided red clay for the Belgians to employ to create their red brick. This area surrounding the

Vandermissen site along Lake Michigan is referred to as the "Red Clay District" (Tishler and Brynildson 1986:41).

Winning or mining was the first step in this process and was usually done in late autumn or early winter. The most common way to mine clay in the 19th century was to dig shallow pits. Due to the lack of advanced technology available at the time, Vandermissen was making bricks from clay dug with shovels. Usually brick makers would seek clay just below the top soil to minimize labor (Ricks Bricks 2003). In Wisconsin different clays could produce different colors. Those excavating the clay knew which material would produce the best white brick and which would produce red brick (Buckley 1901:43). The color could also be altered during the firing stage (Gurcke 1987:29).

Next the clay had to be prepared. The first step in the preparation process was weathering. The clay was spread in a thin layer and exposed to the elements through the winter after the winning (McKee 1973:43). Being exposed to the weather would generate more workable clay that was easier to mold. Frost would break up larger or harder clumps of clay while the rain would wash away soluble salts that could leave an unwanted white scum on the finished structures as the bricks aged (Gurcke 1987:7).

After the clay had sufficiently weathered it was then tempered. Water, sand and other materials were added to the clay to make it more flexible, to give it a specific color and/or to make it burn properly. Pug mills were used for this mixing process. This was one of the first steps in introducing machinery into the brickmaking procedure in the 19th century. These mills could be powered by steam or horsepower depending on what was available to the brickyard (McKee 1973:43). Early forms of the pug mill had a wooden

tub basin with a shaft running vertically through it. This shaft had four blades attached that would rotate. The clay and additives were then poured into the tub and mixed with the rotating blades (Gurcke 1987:10). This is not a revolutionary piece of technology but it is important to the brickmaking industry. A variation of this machinery is still used today (Gurcke 1987:10). Since there is no evidence of machinery at the Vandermissen Brickworks, they most likely utilized a horse powered pug mill (Figure 10).

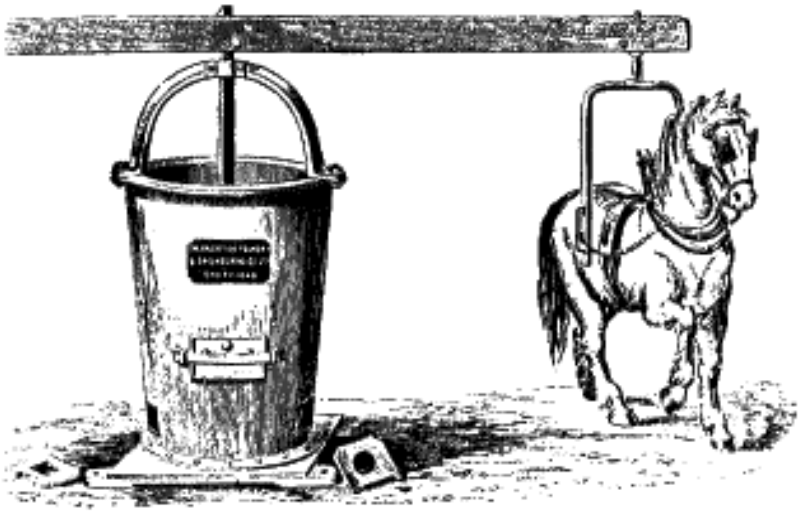


Figure 10: Drawing of an early pug mill (Ricks Bricks 2003)

The molding of the bricks was the next step in this process. During the nineteenth century handmade bricks were pressed in wooden molds to make sand molded brick or iron clad molds to make "slop" brick (Ricks Bricks 2003). Some molds contained to six compartments in order to produce multiple bricks. Once clay was pressed the excess would be removed with a flat stick soaked in water called a "strike" (Ricks Bricks 2003).

Sand and water were used as lubricants to keep the clay from sticking to the mold (Gurcke 1987:17).

After the bricks were removed from the mold they were dried. The bricks were transported to the drying area and arranged in rows on some form of pallets (Gurcke 1987:24). Too little drying and the bricks would be destroyed during the firing process. Too much drying and the bricks would fall apart when they were later handled (Gurcke 1987:24). The amount of time the bricks were left out to dry depended on the weather but the process usually took about two to three weeks. As long as the weather was favorable (meaning no harsh frost, heat, rain, or snow) the bricks could have dried evenly and been in good condition for the next step (Gurcke 1987:26). Wisconsin weather during the winter can be harsh and unpredictable. It is estimated that thousands of bricks were lost annually in Wisconsin due to insufficient protection from frost (Buckley 1901:51).

The final step in the brickmaking process was the firing of the clay which determined the shape, color and strength of the finished brick. The fires were built up gradually and had to be maintained for several days. The bricks then needed to cool gradually (McKee 1973:43). The rate of the cooling directly affected the color of the final brick (Gurcke 1987:29). The kilns used for this step are called clamps and were made out of bricks themselves (Gurcke 1987:28). Clamps are periodic up-draft kilns that fired from the bottom with the smoke coming out of the top (Figure 11). The drawback to this method was occasional uneven firing temperatures that could result in almost one fourth of the clamp contents being unsellable (Gurcke 1987:32).

To complete the brickmaking cycle the bricks that made it through the entire process needed to be sorted and graded. Some bricks, referred to as "culls" or "clinkers", were so defective that they could not be sold for use. "Bats", which were bricks broken during the process, were also deemed unsellable (Gurcke 1987 and Ricks Bricks 2003).

Figure 11: Example of a historic brick clamp from Colonial Williamsburg, Virginia (Colonial Williamsburg, Brickmaking)

The finished and usable bricks were then sold to local consumers for construction. Mortar was used in the building process to fill the voids between bricks (McKee 1973:61). This substance served both composition and the aesthetic purposes. Mortar makes walls watertight, lubricates the bricks during the construction process and also contributes to the appearance of the wall (McKee 1973:61). There are several different types of mortar including limestone mortar, which consists of lime, water, and sand and

is most likely what was utilized in the construction of the early red brick structures of the Belgian Settlement. Limestone predominated as the type of mortar utilized at this time period in most of Wisconsin building (McKee 1973:61).

The brickmaking business boomed at the end of the 19th century for various reasons including the need to rebuild with fire proof materials, residents earning more income, having access to the raw materials and a labor force needed for the brickmaking process. All of these reasons can be substantiated in the historical record and/or the archaeological record as well as on the landscape today.

Comparative Sites

The majority of previous research conducted on brickmaking features in the United States at historic sites comes from the East and Northwest Coasts (Gurcke 1987, Kelly and Kelly 1977, Wayne 1998, and Wingfield et. al 1997). Very little to no work has been done in the Midwest or Wisconsin. Previous studies can still offer insights to the potential of research and projects in these locations, however, evidence from Iowa, Kentucky, South Carolina, and other Eastern sites provide comparative examples that are useful for understanding the Vandermissen Brickworks (Finney and Snow 1991, Kelley and Kelley 1977, Wayne 1998, and Wingfield et al. 1997).

One Wisconsin brickyard outside of the Belgian enclave can provide insights to brickmaking in the state in other areas at this time. The Zerrenner Brickyard (47OU101) in Outagamie County, about 70 miles southwest of Vandermissen Brickworks, is a well documented historic brickyard. The site was identified in a pedestrian survey in 1987 but further excavations did not occur (Hamilton 1988:1). Albert and Otto Zerrenner began

production of bricks at the site in 1898 (Hamilton 1988:2). The site was bought by Clarence Hockers in 1937 and was used as a brickyard through 1967 (Hamilton 1988:3). Even though the site does not contribute to the archaeological record interviews with Hockers proved to be a valuable source about the operations of the brickyard throughout its history (Hamilton 1988:6). The information Hockers provides about brickyard operations in the early 20th century demonstrates the processes of brickmaking in Wisconsin but this brickyard was a larger operation than that of Vandermissen Brickworks.

The Cheshire site (13WA76) in Warren County, Iowa is an example of another small-scale Midwest brickmaking site that may be closer to the size of the Vandermissen Brickworks operations. The Cheshire site is assumed to have been in operation between the 1850s and 1870s (Finney and Snow 1991:66). Brick scatter along with remains of what is believed to be either a scove kiln or brick clamp were discovered (Finney and Snow 1991:69). Similar to the brickyards of the Door Peninsula in Wisconsin this brickyard lacks historical data to compliment the archaeological record (Finney and Snow 1991:69). Finney and Snow argue that small scale brickworks, like these, are often times identified through survey but do not exhibit above ground features; features such as kilns that can lead to a discussion about the economic and architectural character of the landscape (Finney and Snow 1991:67-69).

Wingfield et. al. also evaluated the potential of brick at historic sites through discussion of a brick clamp at the 15SH50 site in Shelby County, Kentucky. The authors extrapolated in comparing these types of sites, one can begin to see regional variations in brick clamps and the brickmaking process (Wingfield et. al 1997). Figure 12 shows a

fired surface from this clamp. The clamp structure and clay from Vandermissen offers a comparative sample to this project.

Figure 12: Kentucky brick clamp at 15SH50 (Wingfield et. al 1997)

In the Wando River Basin of South Carolina between 1740 and 1860 there was a lucrative larger scaled brickmaking industry (Wayne 1998). Wayne utilizes a landscape approach to understand how the landscape is modified to fit cultural patterns through the distribution of these bricks (1998). Difference in brickmaking and the elements surrounding the process can be seen in Wayne's analysis of the Charleston brickmaking site. These brick makers were able to produce large quantities and turn it into a highly lucrative business. They had a more accessible labor force and had more options in transportation of the bricks than the brick makers of the Door Peninsula in Wisconsin. In

the Charleston area the brickyard location was chosen based on the proximity to a shoreline because of the importance of shipping by boat (Wayne 1998:105). The location of Vandermissen Brickworks near Lake Michigan may also have played an important role in making and distributing the bricks at the site.

The well uncovered on the Vandermissen property can also be analyzed in comparison to other historic wells. Wells are a common feature in domestic historic sites and are frequently relied on to provide sources of datable and well preserved artifacts (Hume 1973:1). After wells are abandoned they are often utilized as repositories for trash (Hume 1973:2). Nineteenth century wells are usually hand dug with a lined shaft that connects the ground surface to the underground water table. These shafts can be lined with wood, stone, or brick and the depth of the well is dependent on the depth of the water table. Since early wells are dug with hand tools, it results in a shallower shaft than shafts made after introduction of new mechanized technologies (Mansberger 2003:7).

Three examples of New England 19th century historic wells can be used in comparison to the Vandermissen well. A Williamsburg well dug by Hume recovered datable and preserved artifacts in a hand dug well that averaged a depth of 22-25 feet (Hume 1973:1-2). Another example is the La Rua St. historic well (Figure 13), determined to be approximately 39 feet and neatly lined with brick at some point in the late 19th century; it was turned into a refuse pit. The date of construction is still debated but it is sometime between the late 18th and late 19th century. Artifacts classes include personal, architectural, domestic, bone and shell (Curren and Dobsen 2006).

Figure 13: La Rua St. well (Curren and Dobsen 2006)

The last example is a historic well from the Rumsey/Polk site in Delaware. The well's depth is approximately 32 feet. Built during the 18th or 19th century, more than half of the well was filled with broken brick but the well shaft itself was constructed with wood. It was filled with an array of artifacts including brick, a horse shoe, a brass pistol butt cap and ceramics (Delaware DOT 2012).

All of these examples differ from the well at the Vandermissen Brickworks site. The site's well was excavated to a depth of 13.7 feet but may be closer to 25-30 feet below the original surface. This is not believed to be the final depth but excavation was halted due to safety concerns. It did not produce many artifacts and the shaft was unconventionally structured. It is possible that water from this well was utilized for brick production and not for use for the house or barn.

CHAPTER 4: RESULTS

Introduction

The Vandermissen Brickworks site (47DR388) encompasses roughly 1.77 acres located in the southeastern quarter of Section 21, T26N, R23E roughly 1133 meters east of the Green Bay shoreline on the east side of State Highway 57. The site was discovered during a survey of the Wisconsin Department of Transportation State Highway 57 project (Richards 2004:23).

The State Highway 57 project was a Wisconsin Department of Transportation effort to reconstruct portions of State Highway 57 in Brown, Door and Kewaunee Counties. The University of Wisconsin-Milwaukee's HRMS program was contracted to conduct related archaeological investigations beginning in1992. The construction project was specifically designed to avoid the Namur National Historic Landmark District along the existing State Highway 57;

> "This district is recognized as a National Historic Landmark because it is the best concentration of surviving buildings, farmsteads and landscape-related features associated with Belgian-American settlement of Brown, Door, and Kewaunee Counties" (Mead and Hunt, Inc. 2001:17).

Vandermissen Brickworks was one of forty three sites identified in the initial survey in Door County and was determined to be historically significant but the site could not be avoided during construction of the new State Highway 57.

Phase I Survey

Phase I survey was conducted in 1997 by the University of Wisconsin-Milwaukee. Vandermissen was identified by a scatter of bricks and after further historical

research was identified as Vandermissen Brickworks (Richards 2004:23). As previously noted, the Vandermissen property is referred to as a brickyard in local newspapers, plat maps, and oral histories. The site is located on an upland knoll that occupies a portion of a level lake terrace at an elevation of 630 ft. within the Niagara Escarpment landform that dominates the western side of the Door Peninsula. (Richards 2004:23).

In 2001 further investigations of the site was conducted east of the original brick scatter to determine the site limits. Shovel probe testing was conducted at five meter intervals. Results suggested that portions of the site remained intact within a wooded pasture east of the brick scatter (Richards 2004:25).

Phase II Testing and Data Recovery

In 2002 Phase II excavations were conducted by UWM's Historic Resource Management Services (HRMS) to determine if the Vandermissen Brickworks site was potentially eligible for listing on for the National Register of Historic Places (NRHP). Fifteen 1x2 meter test units were excavated along with eighteen 2x2 meter test units (Richards 2004:25). These were located in two places on the property; the former cattle enclosure and the area east of the fence line of the cattle enclosure to the western edge of the ravine that borders the intermittent drainage. Refer to Figure 14 for a map of the site. Eleven test units were excavated in the cattle enclosure while the remaining twenty-one units were located between the enclosure and the ravine. Eighteen features were identified with the majority being in the area outside the cattle enclosure and close to the intermittent drainage (Richards 2004:25-27).

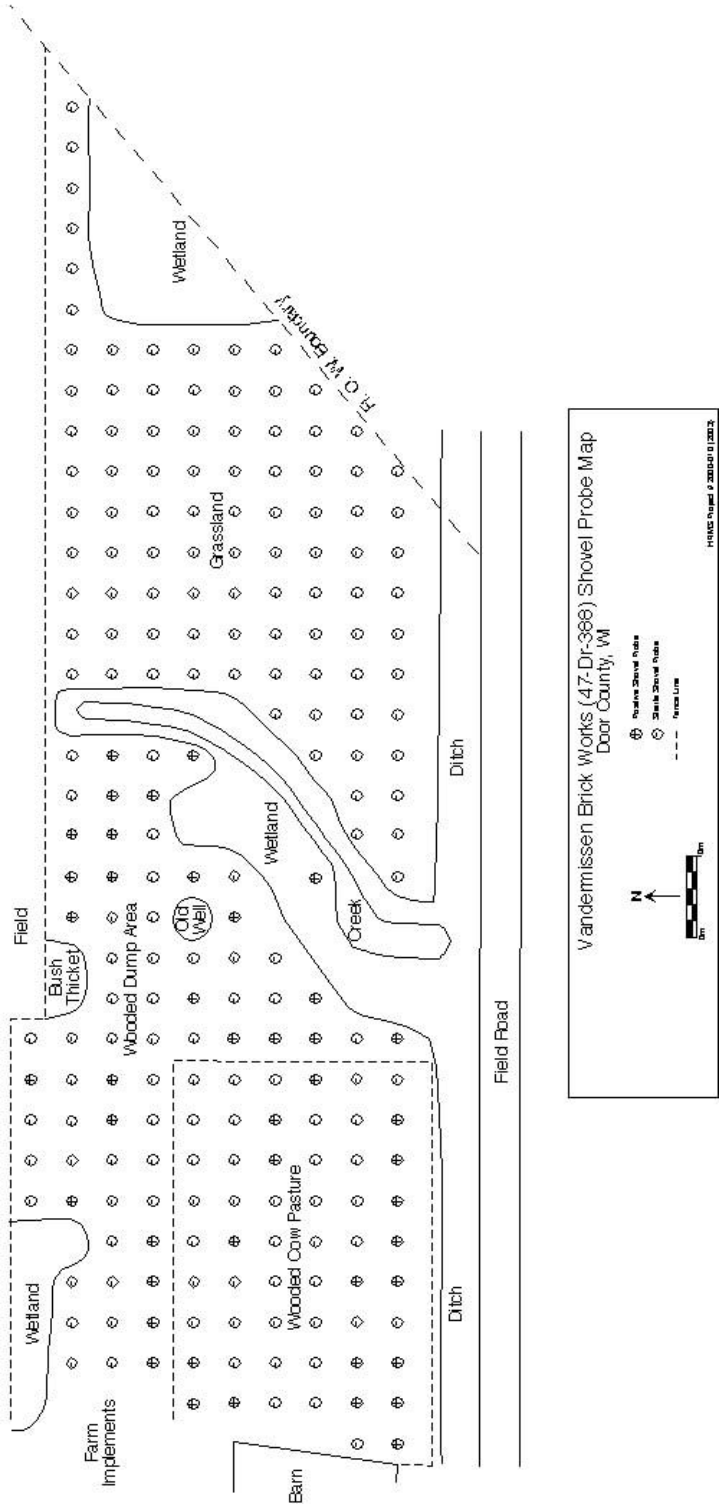


Figure 14: Vandermissen Brickworks (47DR388)

The area of the site on the east side of the cow enclosure produced well-preserved subsurface features that are associated with historic brickmaking. This provides evidence of four different types of brickmaking activities including an area used for mining and processing the clay for the brick, firing areas, a drying area, and a culling pile (Richards 2003:4). At the conclusion of the Phase II investigations over 53 kg of brick fragments and some 500 individual bricks were collected. Farmstead related materials included cut and wire nails, container and flat glass, buttons, domestic animal bone and other miscellaneous debris (Richards 2004:31). The prevalence of brick over other artifact classes that are usually associated with a 19th century farmstead indicated this site represented a single purpose brickworks (Richards 2003:4). Archaeological testing continued in 2004 by HRMS. Features 19 through 32 were assigned during this process (Figure 15).

Feature Descriptions

Phase II and III excavations defined 32 features at 47DR388. Three features were later determined non-cultural and features 14 and 22 were redefined as one feature. Only the features from 47DR388 related to the brickmaking process are discussed in this thesis.

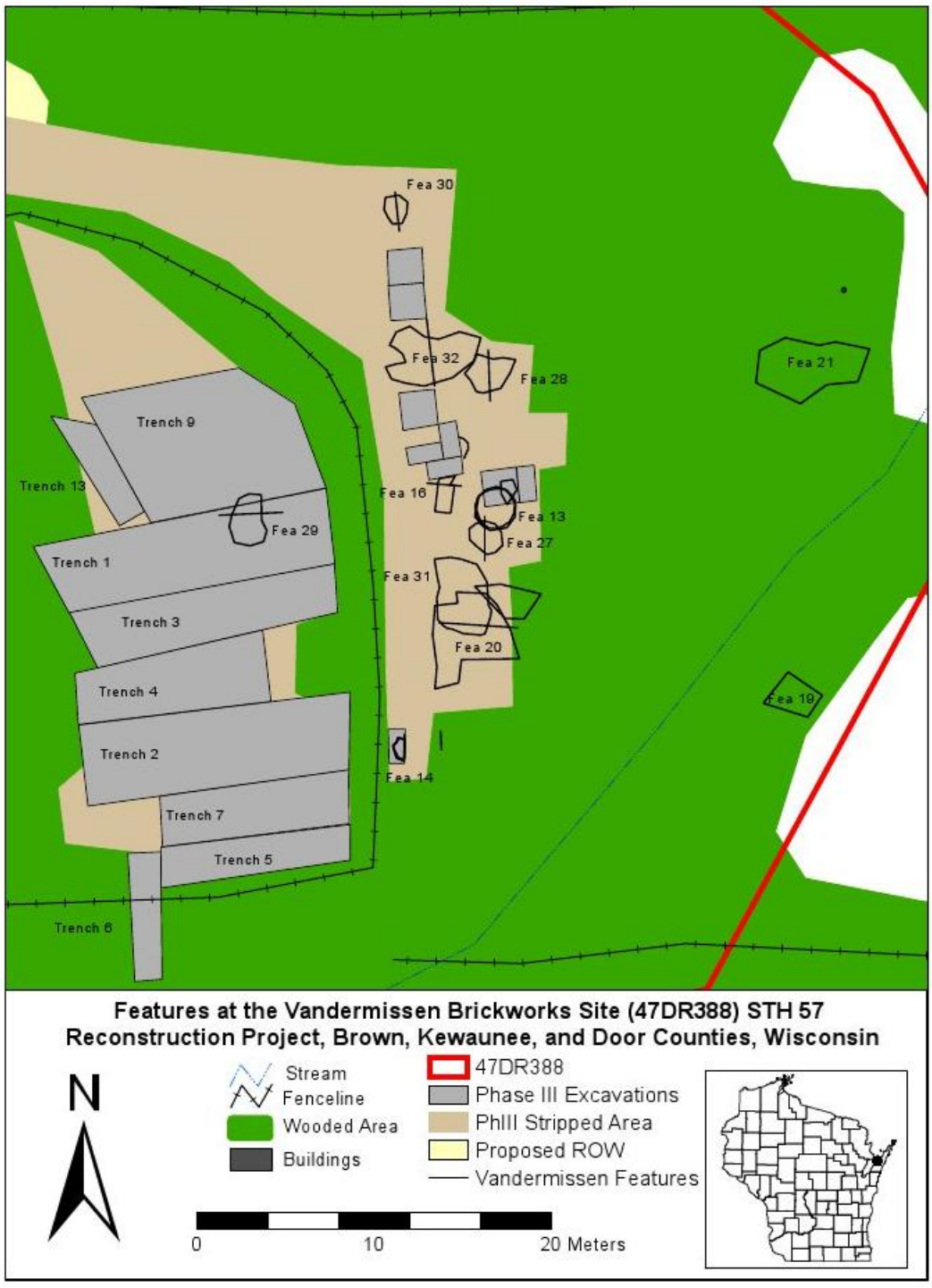


Figure 15: Archaeological testing at 47DR388 in 2004

Feature 2

Feature 2 was defined in test units 3 and 7 and appeared as a faint stain 29-40 cm below surface that measured 190 cm long, 85 cm wide, and 9 cm deep (Figure 16). The feature was basin shape in profile (Figure 17). Charcoal, rock, limestone, and a nail were recovered from this feature. The linear planview shape and differential staining suggested that the feature represented the location of a clamp (Richards 2004:9).

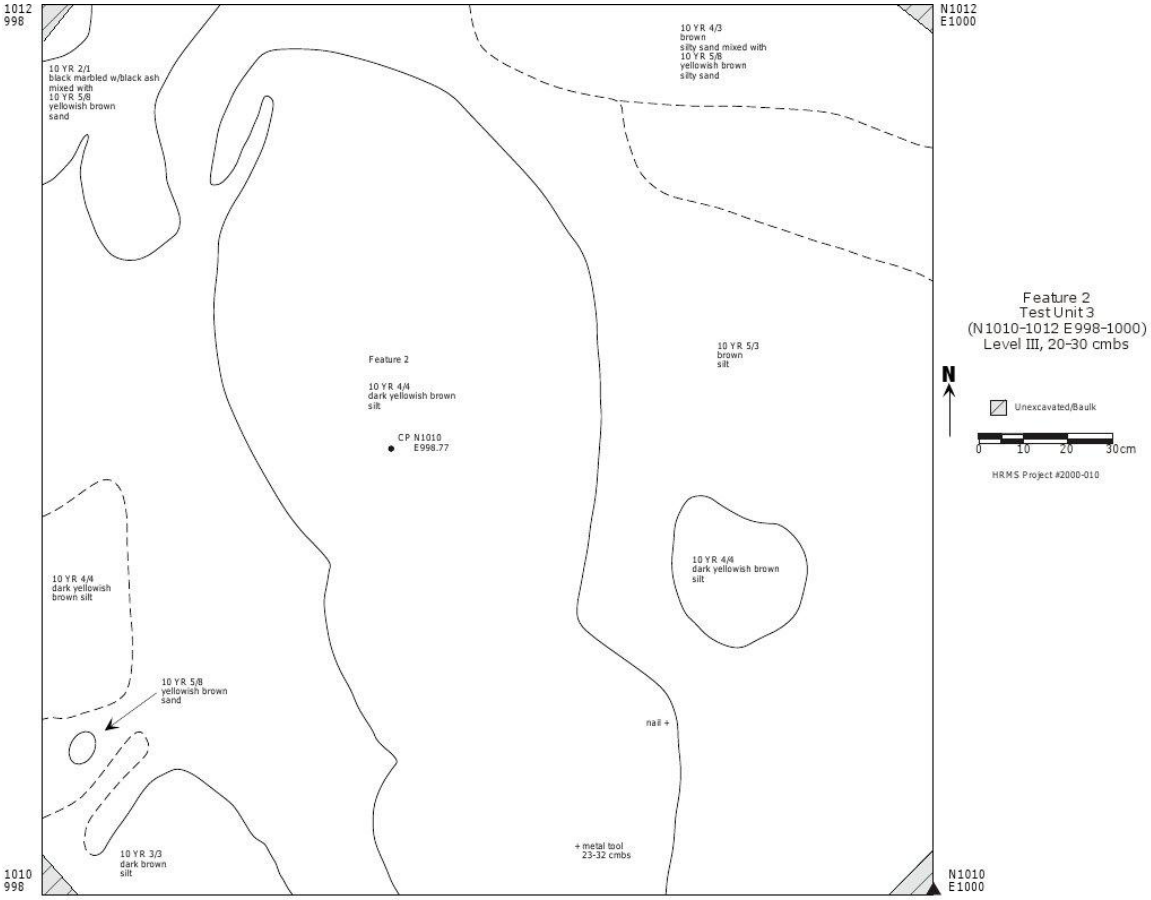


Figure 16: Feature 2 planview, level III, 20-30 cmbs

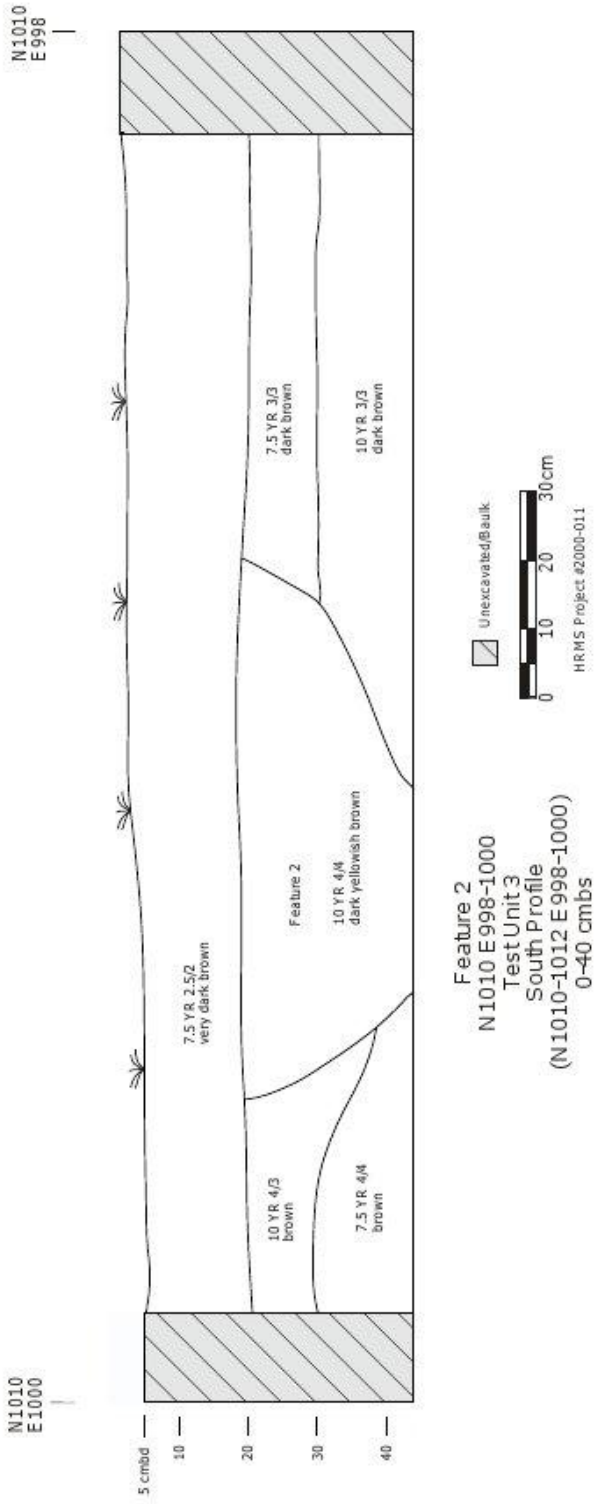


Figure 17: Feature 2 south profile in test unit 3

Feature 4

Feature 4 was defined in test units 4 and 9 at a depth of 30-55 cm below surface. This feature was a dark stain with a maximum length of 115 cm, a width of 70 cm and a depth of 25cm. In planview the feature was roughly oval while in profile it was straight sided and flat-bottomed (Figure 18). The feature produced a small amount of fragmented red brick, limestone and charcoal. Feature 4 is consistent with the description of a small un-mechanized ring pit. Alternatively this space could have served as an extraction pit for clay (Richards 2003:9).

Feature 6

Feature 6 was defined in test units 1, 6, 11, and 15 and appeared at 10 cm below surface. Excavation stopped at 40 cm below surface, therefore the maximum depth is unknown. The feature is approximately 249 cm long, 235 cm wide and 18 cm deep. The concentration is roughly an oval shape in plan and rectangular in profile. This feature is a burned mass of limestone (Figure 19). The area surrounding this feature may have been used for mortar production. This interpretation is strengthened by the presence of Feature 13 which is a hand dug well. A great amount of water is needed during this process and the well could have served this purpose (Richards 2003:10).

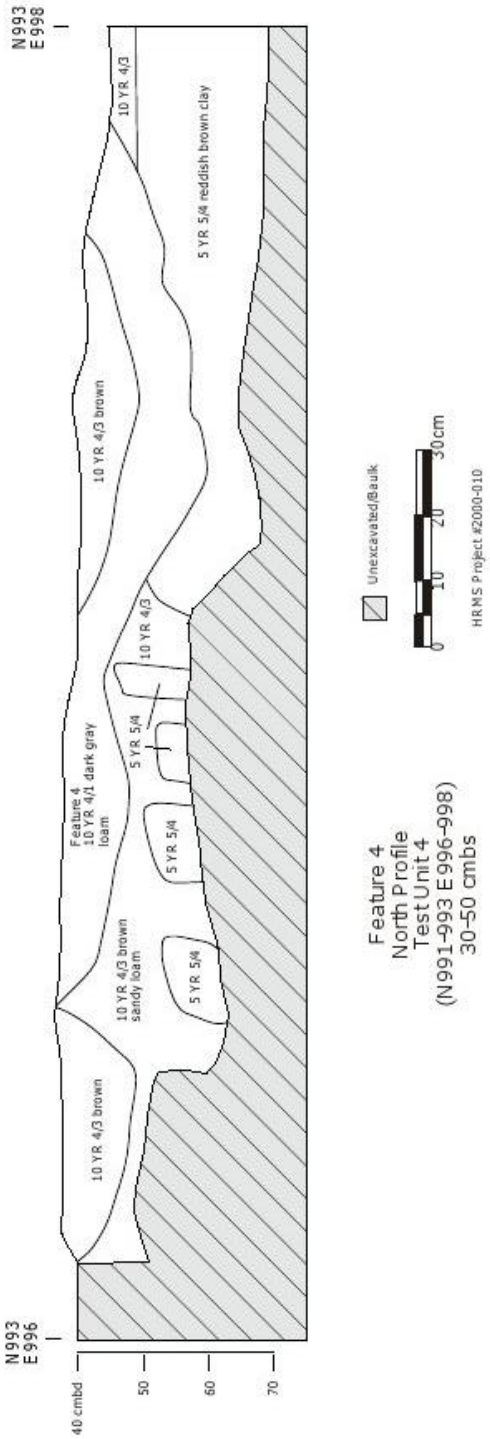


Figure 18: Feature 4 north profile in test unit 4

Figure 19: Feature 6 (Photo on file, UWM-ARL)

Features 8 and 12

Feature 8 was defined in test units 12 and 14 and appeared between 34 cm and 38 cm below surface. The feature measured 148 cm long, 121 cm wide and 14 cm deep. It is a semi U-shape that is a basin in profile. This feature is a charcoal stain that did not produce any artifacts.

Feature 12 was defined in test units 12, 14 and 19 and appeared between 29 cm and 32 cm below the surface. The feature measured 123 cm long, 62 cm wide and 55 cm deep and was rectangular in profile. It had a very slight discoloration in the soil. Refer to Figure 20 for a planview of Features 8 and 12 within test unit 12. Features 8 and 12 may represent the remains of the flues of a brick clamp because these types of stains are typical of clamps. They represent the distance from the center of the flue to the heat source (Richards 2004:9).

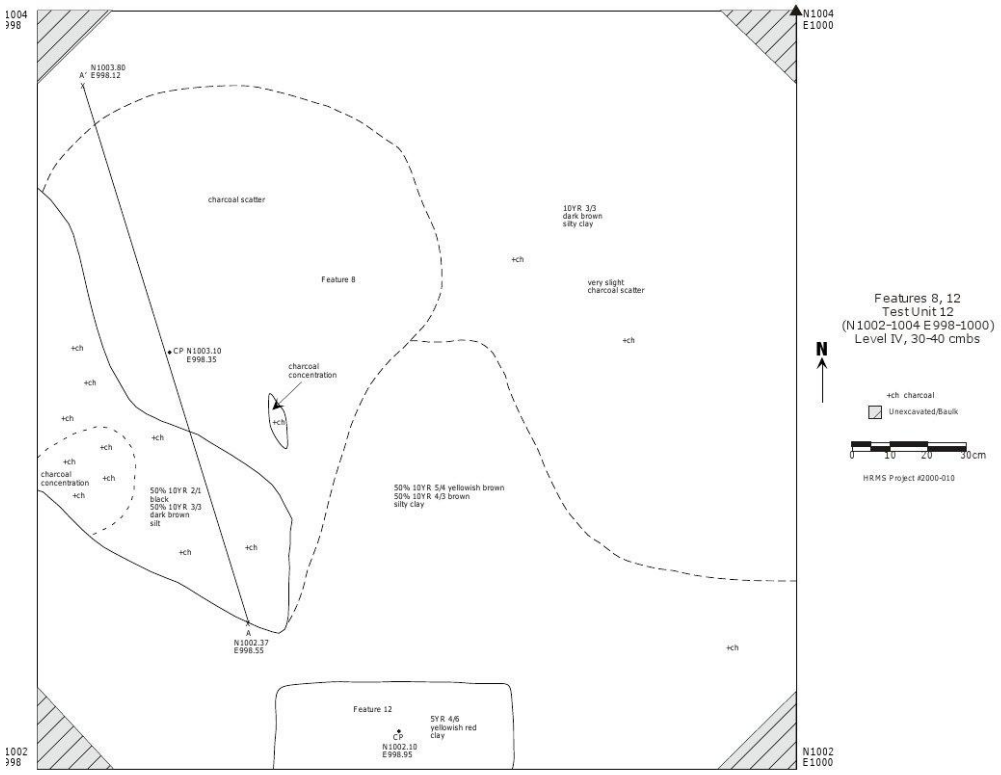


Figure 20: Features 8 and 12 in test unit 12, level IV, 30-40 cmbs

Feature 11

Feature 11 was defined in test unit 4 and appeared 50 cm below surface that measured 44 cm long, 62 cm wide, and 12 cm deep. This feature is a dark rectangular stain in plan and profile. A very small amount of ash and charcoal was recovered from this feature. Feature 11 is consistent with the description of an early pug mill which replaced ring pits for mixing clays for brick production (Richards 2003:9).

Feature 13

Feature 13 is a hand dug well that was defined within test units 16, 22, and 24 and appeared at 10 cm below surface that measured approximately 3 m wide (Figure 21). A thick boulder wall produces a well shaft of approximately 1 m in diameter. Excavation

was discontinued before the maximum depth was reached due to safety concerns for the excavators and equipment. The well was excavated to a depth of 13.7 ft but the originating surface was removed. Therefore the actual depth may have been closer to 25-30 feet but a practical measurement is unknown. Refer to Figure 22 for a profile of Feature 13. The feature only recovered a small amount of artifacts. During the 2000 excavation, besides brick, an 1890 liberty head nickel, as well as bone and metal were recovered. During the 2004 excavation no artifacts were recovered.

It is probable that the well was produced by dumping loose boulders down the shaft. There is no evidence of the materials in the well being hand fit together. The rock used ranges in size from golf ball size rocks to 150 pound boulders all mixed together with patches of similar size cobbles. Tabular limestone is present on the edge rather than laid flat to form a nice, tight well wall. The well most likely would not have been used for domestic purposes. The construction and location suggest that it is the water source for the brickworks.

Figure 21: Feature 13 planview (Photo on file, UWM-ARL)

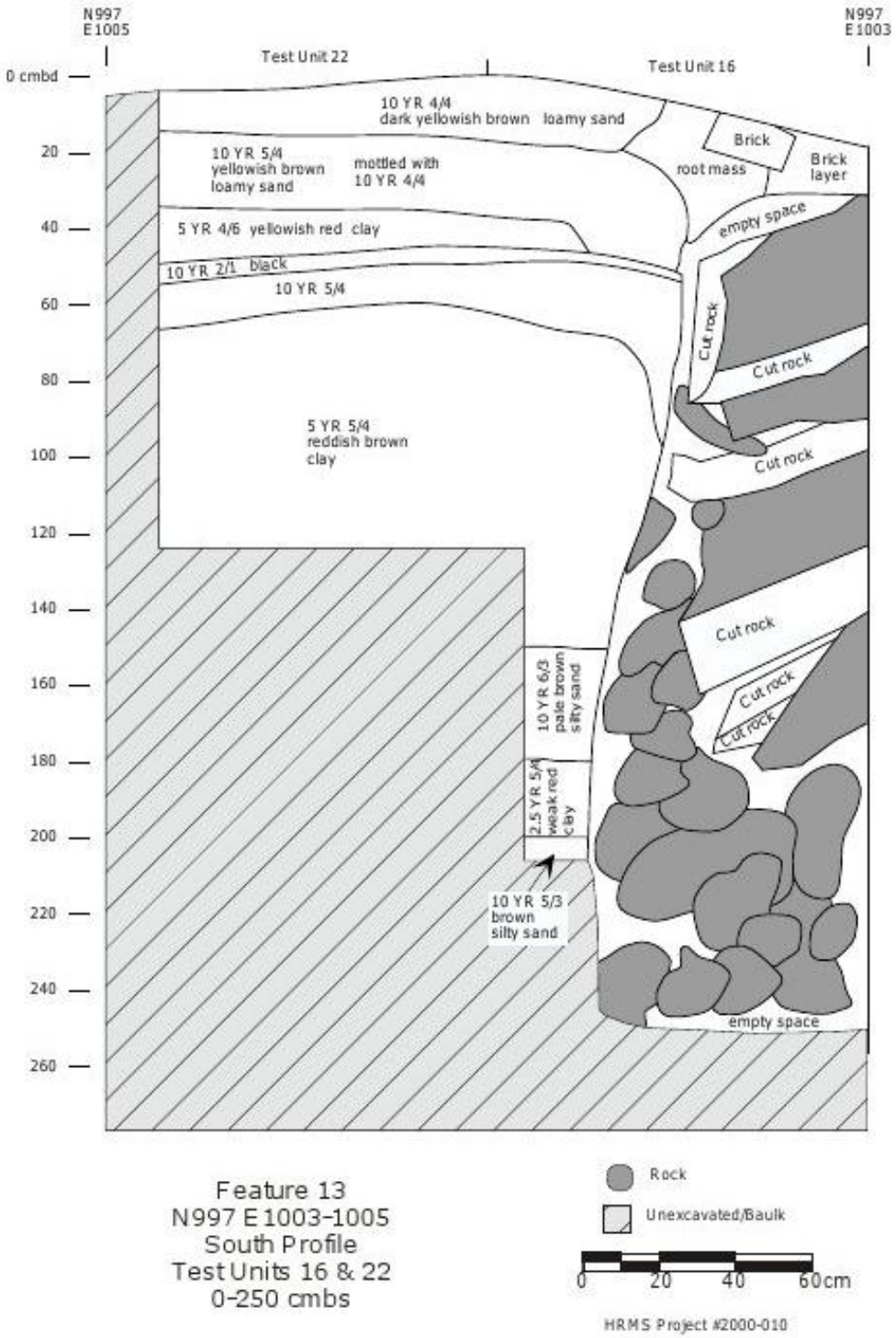


Figure 22: Feature 13 south profile in test units 16 and 22

Feature 14/22

Feature 14 was defined in test unit 8 and appeared 20 cm below the surface that measured 150 cm long, 145 cm wide and 65 cm deep (Figure 23). Refer to Figure 24 for the profile of Feature 14 within Test Unit 8. The feature was an irregularly shaped concentration of bricks, none of which were whole. Feature 22 was defined during the 2004 excavations but later it was discovered that feature 14 and 22 were the same feature because of the linear brick clinker midden dumped along the southeast and southern terrace edge of the entire boundary. Due to the fragmented status of these bricks this could have possibly been a culling pile for the brickworks. Other artifacts recovered include a large metal hoop, wood planks, burned mortar, and charcoal. Approximately 1.25 meters below the random bricks and mottled soil of this feature a charcoal/ash deposit was discovered which could possibly be from the Great Fire of 1871. This indicates that it is probably all fill from the time the land was used for making brick and later.

Figure 23: Feature 14 (Photo on file, UWM-ARL)

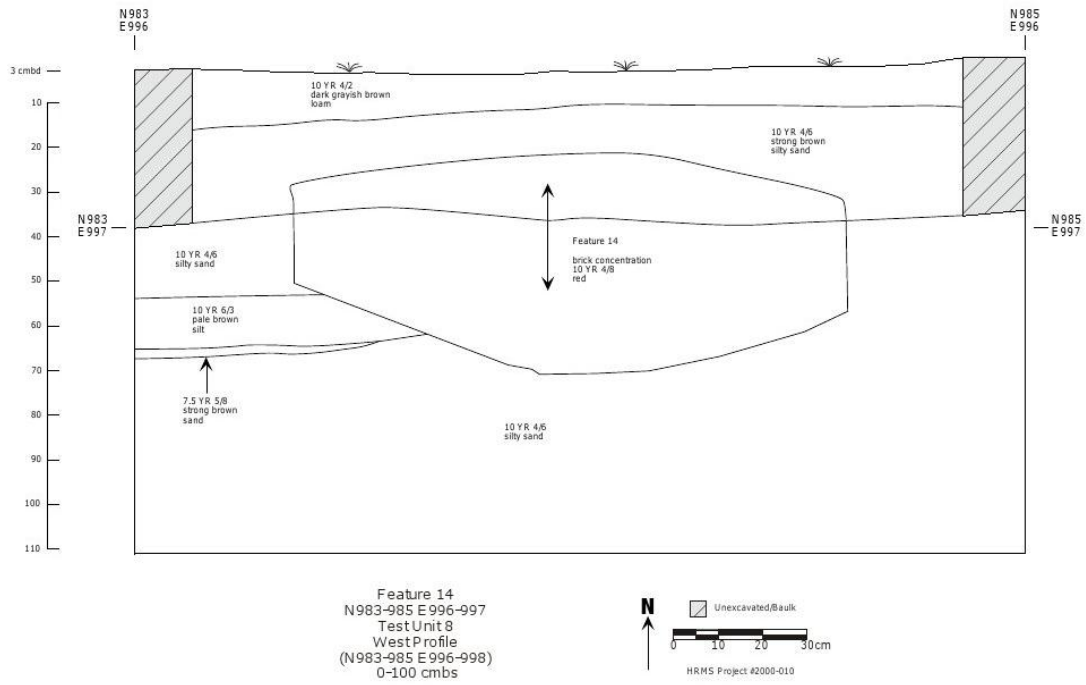


Figure 24: Feature 14 west profile in test unit 8

Feature 16

Feature 16 was defined in test units 20, 23, and 25 and appeared 16 cm below surface. Feature 16 measured 113 cm long, 103 cm wide and 27 cm deep. The stain is oblong in planview and a double basin in profile (Figure 25). Bricks that had been placed into a nice straight line were discovered in this feature along four strips of ash and charcoal that ran parallel to the clamp that are 40 cm apart. Other objects found in the vicinity of Feature 16 include a glass bottle neck and pieces, pieces of coal, a token or coin, an iron key shaped object, and a chain.

The position of the line of bricks and the ash and charcoal stains may indicate that this could have been a clamp used for firing brick during the brickmaking process. Another line of bricks were discovered west of the pile which is defined as Feature 20. These two features are 290 cm apart from outside to outside. Feature 16 ran north/south

with two rows of bricks. The eastern row is two bricks wide as well as at least two bricks deep. The west row is also two bricks wide but it was unclear as to the depth. According to the field notes the feature was very obviously dug into the ground and the material filled in around it. The bricks that comprised the two linear rows were brittle and the bricks were soft in comparison to the linear brick rows of Feature 20.

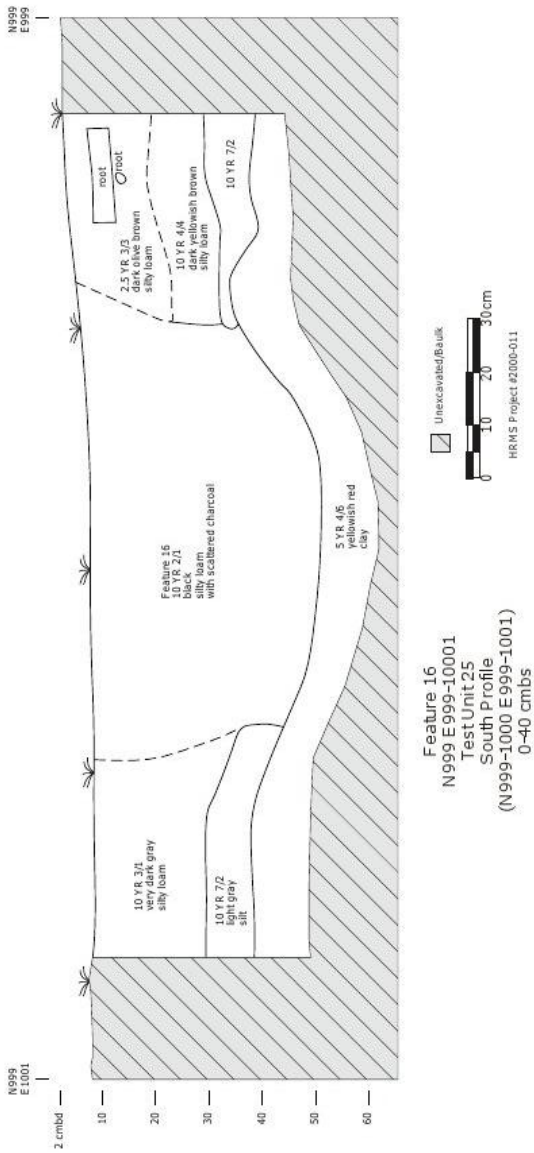


Figure 25: Feature 16 south profile in test unit 25

Feature 19

Feature 19 appeared on the surface and a brick sample was taken (Figure 26). This feature was not excavated or mapped due to it lying outside the right-of-way. Feature 19 is a brick scatter pile or culling pile just east of the stream bed.

Figure 26: Feature 19 (Photo on file, UWM-ARL)

Feature 20

The surface above Feature 20 was stripped to 20 cm below surface (Figure 27). The north half of the feature was excavated and profiled followed by the west half of the feature being excavated and profiled. Feature 20 appears to be a clamp for firing brick made with a limestone boulder foundation and brick walls. Clamp doors, frames, pieces of rebar and metal tools were found just east of the line of bricks and to the south along with a rubble pile of bricks.

Figure 27: Feature 20 (Photo on file, UWM-ARL)

The structure of the clamp was rectangular with two linear north-south lines of bricks and an east/west line at the south end of the clamp. Underneath two layers of bricks were limestone slabs packed with mortar. Vitrified and un-vitrified bricks were also uncovered with limestone slabs and large field stones, which served as the foundation. The structure appears to have been knocked down with bricks falling to the south and foundation stones remaining on site.

It is believed that this clamp is a later brickmaking feature than the other brickmaking related features for two reasons. The clamp was built on top of the blue-grey clay layer (Feature 31) and on top of the metal barrel bands in this clay layer, which are believed to have been transported to the spot for brickmaking. The second reason is the foundation was made of large field stones and some large vitrified bricks all fused

together with mortar. It appears that these bricks were chosen to be used as part of the foundation because they were large, solid and vitrified. The vitrification of these bricks could not have occurred as a result of being part of this clamps foundation. It would seem that there was already a surplus brick source nearby that was utilized for the construction of this clamp, possibly those bricks that were fired by the clamp in Feature 16.

Feature 22

Feature 22 was a brick midden that encompassed trenches 6, 10, and 12 (Figure 28). This included overheated and under heated brick as well as whole and broken brick. The feature was stratified and had different lenses that indicate different dumping episodes. Wood and charcoal was also present in this feature. This was most likely a culling pile for dumping waste brick.

Figure 28: West Profile of Trench 6 (Photo on file, UWM-ARL)

Feature 25

Feature 25 appeared just beneath the ground surface and was partially exposed. The feature consisted of a primary cluster of five kiln doors and one door frame and a secondary cluster of one door and one frame (Figure 29). These may have been used by the clamps at Features 20 and 16. The Vandermissen family was required to clean up the surface of the area by the DOT and claimed to have kept 18 of these frame and doors at this location. This would total to more than 20 doors and frames, which is more than these two clamps would have required. It is possible there may be undiscovered clamps at the site.

Figure 29: Feature 25 (Photo on file, UWM-ARL)

Feature 31

Feature 31 appeared below Feature 20 and measured 13 cm to 43 cm deep in various parts and was approximately 5-10 cm thick. The feature was a blue grey clay lens that was circular shape in planview. This clay is in what is believed to have been a

processing area and no tempering agents were present. It is possible this clay was brought in from another area to be processed.

PXRF Analysis

X-ray fluorescence is an analytical technique that identifies elements by calculating their wavelengths. There are two types of XRF instruments routinely used to examine a diverse range of materials today: wavelength dispersive X-ray fluorescence (WD-XRF) and energy dispersive X-ray fluorescence (ED-XRF). Recent archaeological applications tend to employ portable ED-XRF; however the analysis of ceramics with pXRF spectrometry is not a simple undertaking. There are many considerations that need to be taken into account and calibrations need to be altered depending on the material being analyzed (Aimers et. al 2012 and Shugar and Sirois 2012). A common problem with the use of this technology is the lack of knowledge of the physics involved and the general lack of experience by the users (Speckman et. al 2011: 3884). There have been several studies aimed at discussing the usefulness of this technology focusing on different aspects of the analysis process and material classes. Ceramic analysis and its usefulness for quantitative data along with sourcing clays is not a straightforward endeavor (Aimers et. al 2012 and Speckman et. al 2011).

Analysis of ceramics with a pXRF analyzer has specific issues. There is not a standard calibration that will be sufficient for all types of ceramics due to their heterogeneous nature (Aimers et. al 2012:423). Types of ceramics vary with a number of components of all different particle sizes (Aimers et. al 2012:423). Surface alterations also need to be considered. Different types of ceramics can have surface alterations that

are added at the time of production and over time the surface composition can change as well (Aimers et. al 2012:423). Surfaces of the excavated bricks and the bricks on the structures have been exposed to different conditions that may contribute to variations in the surface composition. This may influence the pXRF data.

Aimers et. al discuss the usefulness of pXRF technology as an analytical tool on-site for chemical characterization in Mayan ceramics from Belize (2012:423). Specific calibrations were used that were specified to the materials being studied. These calibrations differed from the brick analysis conducted in this thesis. One difference was that the authors prepared the surface by vigorously cleaning and drying it before analysis (Aimers et. al 2012:438). This was not done in this detail for the brick in this project and may be a consideration for future data collection.

In another ceramic study Speckman et. al analyzed 75 intact Mimbres and Jornada sherds from the American Southwest using pXRF technology and instrumental neutron activation analysis (INAA) (2011:3884). These two different methods of analysis were used for comparison. It was determined that the pXRF analysis identifies a limited amount of elements in comparison to INAA. Also the pXRF analysis is less precise and accurate than INAA (Speckman et. al 2011:3884).

Speckman et. al discuss the problems with ceramic studies using pXRF analysis. The results here highlight the significant chemical variability within a single ceramic sample which can complicate sourcing studies (Speckman et. al 2011:3495). Also it is difficult to draw quantitative conclusions from the pXRF data but it is able to identify the presence and/or abundance of various elements like heavy metals including arsenic (Speckman et. al 2011:3884).

Arsenic and other heavy metals can be identified on a variety of materials using pXRF analysis. Shugar and Sirois discuss this issue in regard to ethnographic collections (2012:314). Arsenic was used in museums on natural history and ethnographic collections for pest control until the 1980s (Shurgar and Sirois 2012:314). The pXRF analyzer was useful in identifying the presence of these metals but it is not well suited for providing quantitative data in this circumstance.

It is evident that pXRF analysis is well suited for collecting qualitative data but quantitative results are more complex. Shugar and Sirois are in agreement with Aimers et. al in that there is a need for a specific set of calibrations for analysis of specific materials (Shugar and Sirois 2012, Aimers et al 2012). A proper set of standards that matches the material being analyzed will provide the best results (Shugar and Sirois 2012:344-345). It is also clear that pXRF ceramic studies for provenience are not straightforward (Speckman et. al 2011: 3495). Sourcing is still complicated and more research needs to be done to establish a standard method for ceramic analysis (Aimers et. al 2012:443).

This thesis was a pilot study that aimed to source historic bricks. This project attempted to use pXRF analysis to source bricks from extant structures to bricks excavated or collected from historic brickworks. Oral history indicated that the Macco Brickworks produced the brick used for the Duvall Farmers Cheese Factory (Heather Bauldry, personal communication 2013). Also homeowners, David Englebert and Norbert Legrave, believe that Vandermissen Brickworks produced the brick used for their homes (David Englebert, personal communication 2013). This information could confirm sourcing if similarities appeared in the statistical analysis of the data. Analysis

of the brick from all contexts was conducted using the Bruker Tracer III-v ED-XRF analyzer.

Seven structures were analyzed with the PXRF device for this thesis. This included two cheese factories and five homes. Refer to Figure 30 for a map of the structures in relation to the brickworks. The Door County structures were visited and tested on February 8, 2013. Dr. John Richards, Dr. Patricia Richards and myself conducted the analysis. David Englebert, a local resident of the Township of Union, escorted us around the area for the day. Englebert introduced us to the landowners and aided in attaining permission to conduct the analysis on the structures. Bruce Alberts, another local resident of Brussels, also assisted in this process. Alberts retrieved the bricks from the Hayes house for further pXRF testing.

Figure 30: Map of PXRF tested structures and brickworks on the Door Peninsula

The home of Norbert and Barbara Legrave was the first structure tested for this project (Figure 31). This structure is one of the buildings that were researched for the

Namur Belgian-American District Nomination Form in 1989 (Tishler 1989). This one and a half story home with gable roof with the half circle window at the peak is the typical architectural structure for homes built in this area at the turn of the 20th century. This red brick home was built circa 1900 in Namur (Tishler 1989). For this sample one brick on chosen on the north side of the house and one brick from the front porch on the west side of the house. The Munsell color for the brick from the north side of the house was a yellowish red, 5YR 4/6 and the brick from the west side of the house was red, 25YR 4/6.

Figure 31: The home of Barbara and Norbert Legrave

The second structure analyzed on February 8, 2013 was the home of David and Dixie Englebert in the Township of Union (Figure 32). The original red brick farmhouse was built in 1878 (Burton and Burton 2003:30). According to Englebert's grandfather it is assumed that the Vandermissen family provided the brick for this home due to the time period and the close proximity of the brickworks to the property (David Englebert,

personal communication 2013). This structure is unique in that an addition was built in 2000 but was done in a manner that mimics the red brick facade of the home. The readings were taken on an original brick wall inside a hallway connecting the garage and the house. Two bricks of different color were chosen for this analysis. Munsell readings for these bricks were red, 2.5YR 5/6, and dark red, 2.5YR 3/6.

Figure 32: The home of David and Dixie Englebert

The Don and Mary Anne Englebert home was tested as well (Figure 33). According to David Englebert this two story house was built circa 1905 in Brussels. Two bricks of different colors were tested on the north side of the building. The Munsell readings were a red brick 2.5YR 5/6, and a red brownish brick, 2.5YR 4/4.

Figure 33: The home of Don and Mary Anne Englebert

Bricks were collected from the home of John and Christine Hayes in Brussels (Figure 34). This house appears to be the typical design of red brick houses in the area with a one and half story layout with the gable roof and the half circle window at the peak, but this structure is different. Built in the late 19th century, the house was originally a log structure over which a brick veneer was added either for aesthetic or fire proofing purposes (Tishler and Brynildson 1986:73-75). Some log structures were built before brick became available or affordable for the people in the area. A few log structures also survived the Great Fire of 1871. Instead of starting over homeowners would add a brick veneer to the already standing structure (Tishler and Brynildson 1986:73-75).

People potentially made these structural choices for one of two reasons. The first being that they had already built their homes with logs before the brick was readily available. The second reason for these types of structures was that this style was a less expensive way of fitting into the emerging norm of the community (Tishler and Brynildson 1986:73-75). Either way these structures are unique and some homeowners today are not aware of their home's construction. John Hayes did not realize this when they started upgrading the house and the brick. After starting the re-bricking process and realizing logs were beneath the brick he decided to leave it as seen in Figure 35 for now.

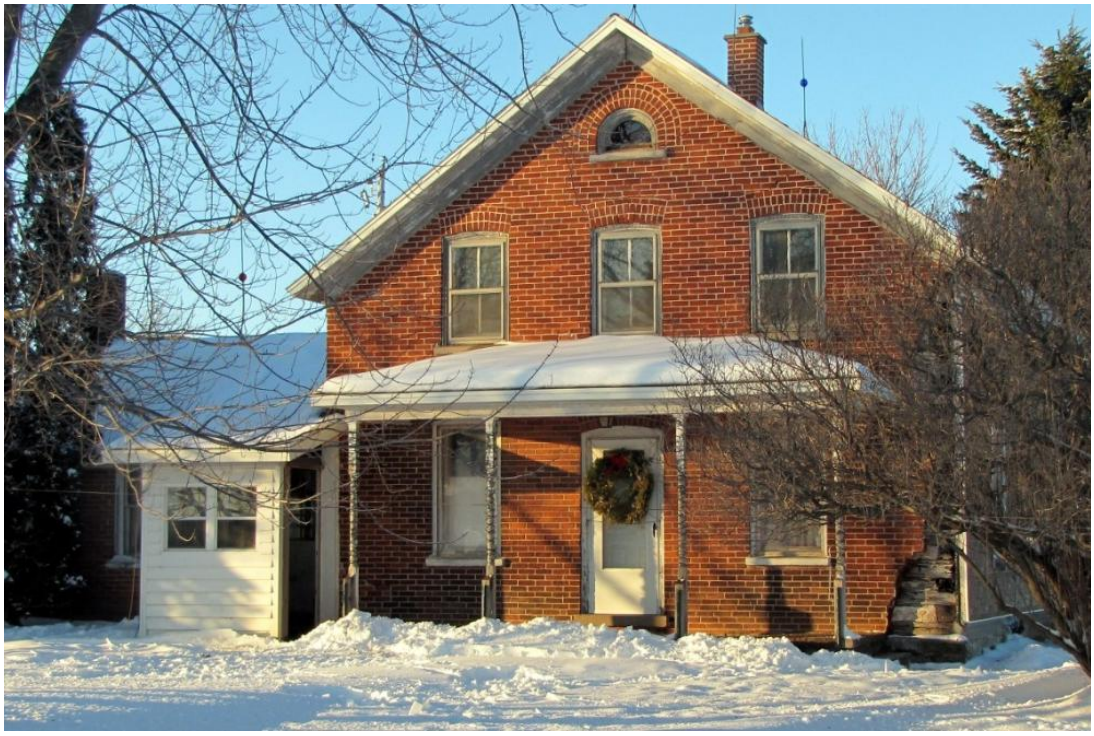


Figure 34: The home of John and Christine Hayes

Figure 35: The log underneath a brick veneer on the Hayes home

On February 9, 2013 the researchers continued additional pXRF testing of red brick structures in Kewaunee County. Dr. John Richards, Dr. Patricia Richards, and myself met with Heather Bauldry, a local resident that grew up in Duvall. Ferron escorted us to two different structures that Mrs. Bauldry's family is connected to in the area and helped gain permission to conduct pXRF testing on these structures.

The first structure tested was the Duvall Farmers Cheese Factory in Duvall (Figure 36). The building is constructed of red brick with glazed or polished surfaces and is located on the JB Corroy property. The structure was built circa 1910 and appears on the 1912 plat map and tax roll (Geo A Ogle and Co. 1912:33). The cheese factory closed in 1989 and the building is now used for storage. Two bricks were chosen from the north side of the building. The Munsell readings for these bricks were a reddish brown, 2.5YR 4/4, and a dark reddish brown, 2.5YR 3/4. The cheese factory bricks differed from others tested in this study. These bricks were significantly larger as well as exhibited a glazed

exterior surface. In order to avoid skewing the pXRF data readings were taken at locations that lacked glaze due to weathering or incomplete firing. Mrs. Bauldry noted that she had been told that the brick in this structure was produced by the Macco Brickworks.

Figure 36: The Duvall Farmers Cheese Factory

The final structure tested was the home of Luke Ferron in the Township of Lincoln (Figure 37). The red brick home was built in 1905. Two original bricks of different shades were chosen on the north side of the house for the pXRF testing. The Munsell color readings for these bricks were a red brick, 2.5YR 4/6, and a dark reddish brown 2.5YR 3/4.

Figure 37: The home of Luke Ferron

Luke Ferron also provided two bricks from The Lincoln Cheese Factory which was formerly located next to his property but was demolished in 2009. According to Luke Ferron it was built in 1925. He collected bricks from this structure just in case he would ever need to replace any bricks on his home (Luke Ferron, personal communication 2013). These bricks were analyzed in the ARL in Milwaukee.

After the data collection was completed statistical analysis was conducted. First, a principle component analysis (PCA) was completed. Using all of the elements the main source of variation in the brick dataset indicated was the opposition of calcium (Ca) and zirconium (Zr) which accounts for 14.35% of the variation in the dataset. The next most significant source of variation is the relative proportions of manganese (Mn) and niobium (Nb) which accounts for 10.06% of the variation in the dataset. Together these two principle components account for 24.41% of the variation in the dataset. This suggests

the dataset is weakly structured and results were interpreted with caution (Richards 2013:5).

A bi-plot of the mean compositions of each brick demonstrates the general trends along the first two principle components. The bi-plot indicated something that was unpredicted; one isolated group of Vandermissen bricks and an isolated group consisting of the structures (Figure 38). The isolated group of Vandermissen bricks was excavated from the brick clamp of Feature 20 (Richards 2013:5). Because they were from the clamp feature these were vitrified bricks that were fired repeatedly (Richards 2013:6).

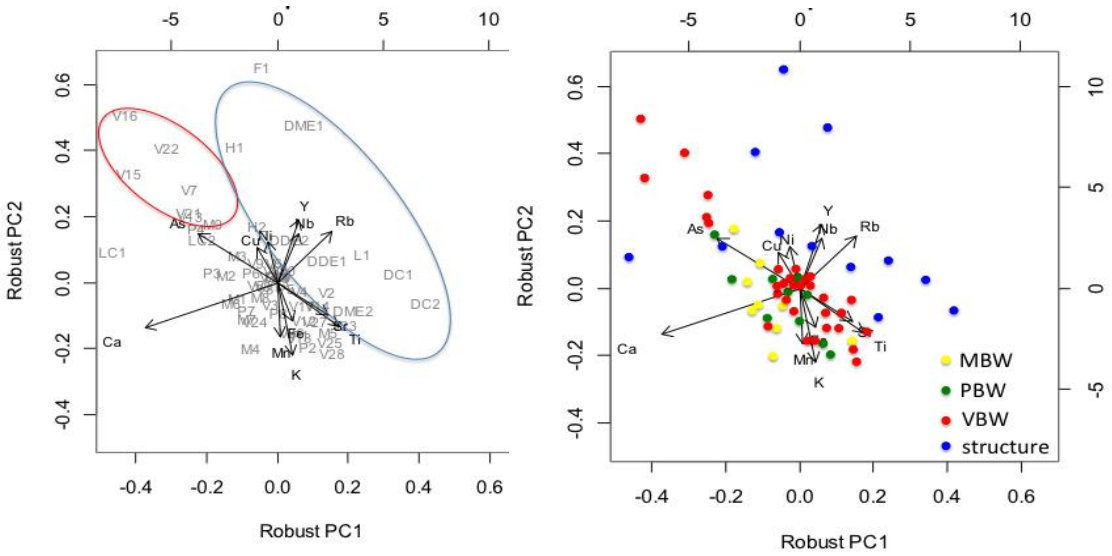


Figure 38: Bi-plot of the first principle component analysis

The isolated group of the structures from the rest of the brickworks is more difficult to account for. Historical documentation suggests one or more of these specific brickworks produced the bricks used in these structures. But statistically all the brickworks are different from the bricks tested in these structures. It was first

hypothesized that diagenesis due to the amount of calcium in the groundwater may account for the variation observed. Door County lies on the Niagara escarpment which is a Silurian age dolomite ridge (Richards 2013:6). The bricks excavated and those collected from the ground surface were assumed to have absorbed more calcium from exposure to the groundwater but absorption by vitrified brick is less likely. This may account for the isolation of the clamp bricks (Richards 2013:6).

A second principle component analysis was conducted using all elements minus calcium to test the influence calcium had on the results. The main source of variation in this brick dataset derives from the opposition of arsenic (As) and strontium (Sr) followed by the next significant source of variation, potassium (K) and rubidium (Rb). Just as in the first analysis, the variation of these two principle components explains 24.41% of the variation in the dataset. Despite the removal of calcium, the structures still group separately from the brickworks (Figure 39). However, the Vandermissen bricks do separate from the bricks collected at G. Peters and Macco but the highly vitrified bricks may account for this distribution (Richards 2013:6).

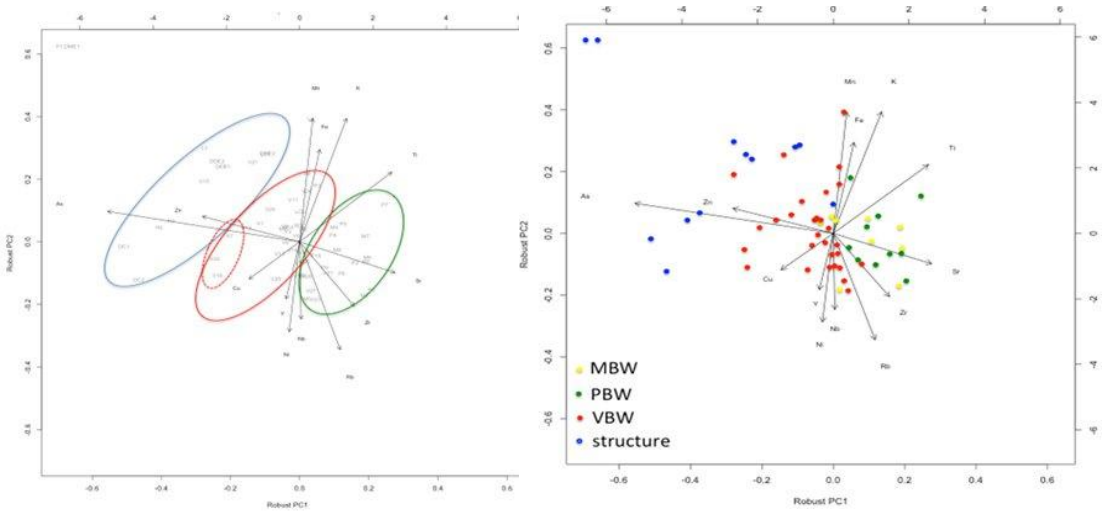


Figure 39: PCA of mean compositions of brick data without calcium

ANOVA tests conducted on the first two principle components, which identifies significant variation between indentified "sites" in the dataset, was conducted (Figure 40). Post hoc tests feature several significant trends. The first principle component scores do not show a significant difference among the structures. This is also the case among brickworks with the exception of the bricks from the Vandermissen clamp. The clamp differs significantly from the other brickworks but not from other Vandermissen bricks. However all of the structures are significantly different from the brickworks bricks (Richards 2013:6).

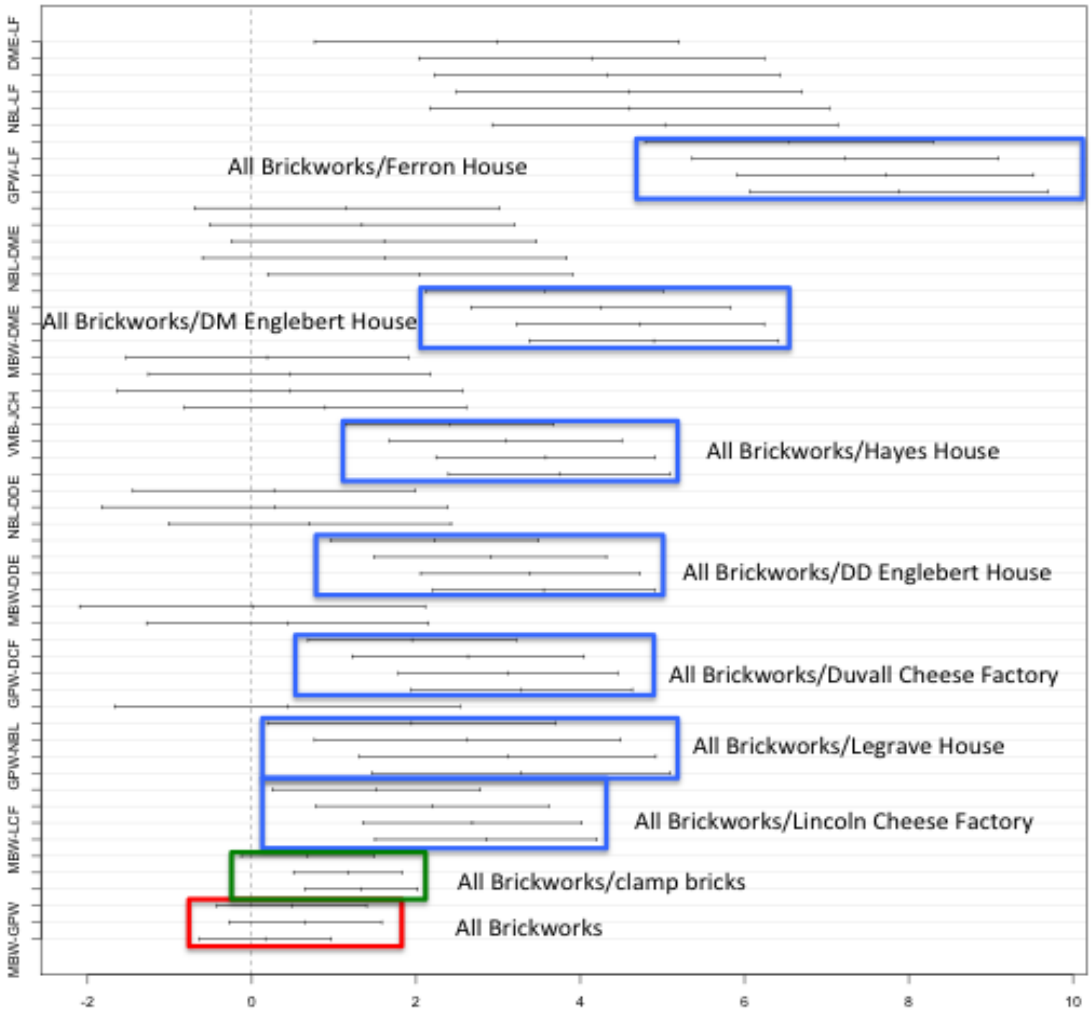


Figure 40: ANOVA test demonstrates the differences between "sites" in the data

Apple and cherry orchards were very common on the Door Peninsula from the end of the 19th and through the 20th century and throughout the last 100 years a wide variety of pesticides have been used in the area (Davis 1999). An arsenate based pesticide was used to control the pests that plagued the cherry and apple orchards of the Door Peninsula up until the late 1950s. Residues of this pesticide still reside in the soil today, but are typically considered non-toxic (Wisconsin Department of Health and Family Services Division of Public Health 2002:1).

After initial analysis it was proposed that it is possible that the presence of arsenic may have contributed to the difference of the pXRF readings between the structures and samples of the brickworks. A third principle component analysis was conducted using all the elements minus arsenic to test the influence arsenic had on the results. The main source of variation in this brick dataset derives from the opposition of calcium (Ca) and titanium (Ti) followed by the next significant source of variation, potassium (K) and nickel (Ni). This differed from the other two analyses in that the variation of these two principle components explains 34.78% of the variation in the dataset. The opposition of calcium and titanium explained 22.14% and the opposition of potassium and nickel explained 12.64%.

The removal of arsenic does not demonstrate any similarities or differences between brickworks however the bricks from the clamp still clump together and separate from the rest. A bi-plot of the mean compositions for each brick demonstrates the general trends of the brick along these principle components. Even though some of the outliers remain the same these results differ from the previous tests in that the structures do not separate as they did before (Figure 41). ANOVA tests conducted on the first

principle component scores do not show a significant difference among the brickworks (Figure 42). This test differed from the previous two in that the clamp bricks did not significantly vary from the rest of the bricks tested. Through this analysis it has been concluded that the arsenic does not account for the separation of the structures from the brickworks.

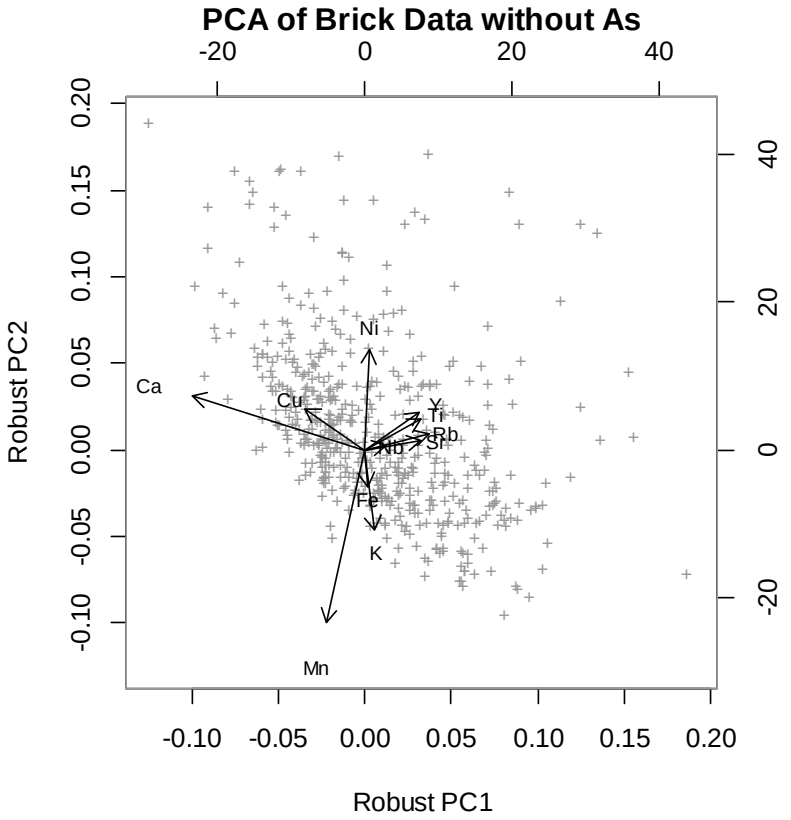


Figure 41: PCA of mean compositions of brick data without arsenic

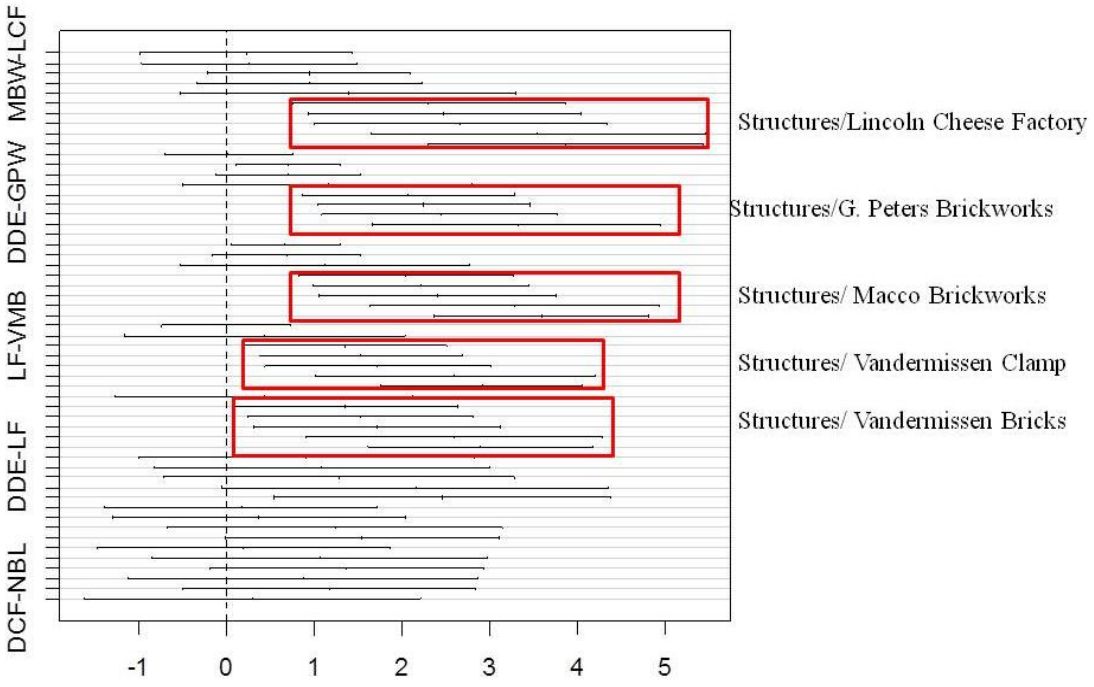


Figure 42: ANOVA test demonstrates the differences between "sites" in the data without arsenic

The assumption before this analysis was undertaken was that the results of the pXRF would reveal mostly homogeneous bricks due to the similarity of local clay sources. This process was also hoped to reveal chemical compositional differences that might allow association of specific structures to specific brickworks. This was not the case. In all three principle component analyses, the bricks tested were more heterogeneous than anticipated, the structures were statistically different from the rest of the bricks in this analysis and the bricks from the three different brickworks were not statistically different from each other. The bricks recovered from the brick clamp (Feature 20) at Vandermissen Brickworks were statistically different from the other brickworks but not from the other bricks recovered from the Vandermissen site in the first two PCA tests with all of the elements and all elements minus calcium. In the analysis minus arsenic the structures do not vary from one another other. It is clear that

there is a factor that is leading to the separation of the brickworks bricks from the structures but more research and analysis is needed to conclude what these factors are. Arsenic and/or other environmental factors may be contributing to this but more analysis and research is needed in order to confirm this hypothesis.

One important detail to note is that there is a difference between the bricks tested from an archaeological context and those tested on the structures. The bricks and fragments found at Vandermissen, G. Peters and Macco represent rejected bricks. Brick tested from Vandermissen was for the most part soft brick or vitrified brick. The bricks from the structures, on the other hand, are bricks that were made well enough to sell. This may account for the statistically significant differences between the structures and brickworks.

Even though the pXRF results did not demonstrate a relationship between the brickworks and the structures in the way that was expected results did demonstrate other relationships. The pXRF results demonstrated that this technology does detect a statistically significant difference between bricks tested from an archaeological context and a non-archaeological context as well as the difference between bricks used as a part of a kiln and the rest of the brickworks bricks. Much more research and analysis is needed to complete this undertaking. A larger sample size of extant structures may lead to more conclusive results and may identify what type of information can be collected from the pXRF analysis of historic clays.

This attempt in using pXRF analysis to analyze historic brick was an introductory endeavor. Due to the inability to significantly differentiate the elemental composition between bricks from the various sources it is clear that the clay used for these bricks are

from the same areas or source. PXRF analysis of clay sources is also needed for future work. The brick makers were using the same type of clay to create the red color of the brick rather than using different firing techniques to alter the color of the clay. Slight variations may also be due more than one brickyard supplying brick for a structure. Through historical research it has been confirmed that more than one brickyard provided the bricks for the St. Francis and St. Mary Church in Brussels (DCD, 19 June 1909). This may have been the case for other structures in the area built around this time as well.

Community Participation

The choice to use red brick to rebuild after the destruction of the Great Fire of 1871 was a deliberate one made by Belgian-Americans on the Door Peninsula. The landscape provided the resources to create this familiar building material and the people then took it upon themselves to construct a similar architectural landscape of rural Belgium in their new home in Wisconsin (Martin 1895). The red brick proved to be a superior building material than the logs previously used not only because it was fireproof but it also translated into a familiar cultural and economic symbol.

Belgian-Americans made choices at the end of the 19th century on how to use the landscape. Their descendants continue to maintain these choices today by living in homes that were built over 100 years ago while also preserving them for future generations. The Namur Belgian Heritage Foundation works to preserve these structures and the Belgian history of the area. The foundation has three goals to achieve the preservation of their Belgian heritage; (1) to promote the preservation of Belgian-American history, culture and buildings, (2) to promote the preservation of the Namur

National Landmark Historic District, (3) to redevelop the former St. Mary of the Snows Church building as the Wisconsin Belgian Heritage Center to preserve and promote the unique Belgian settlement of the area (Namur Belgian Heritage Foundation). They not only aim to preserve the architectural landscape, they also maintain cultural traditions through different social events such as Belgian waffle breakfasts, Booyah dinners, and Belgian Days which celebrates Kermiss. These events and the Foundation's meetings are held at the former St. Mary of the Snows Church located at the southern edge of the Namur Rural Historic District (Figure 43). This red brick church was acquired by the foundation in 2010 from the Catholic Diocese of Green Bay. For over a century this space has been used as a gathering place for residents of the Door Peninsula and is one more way in which the decedents of Belgian immigrants maintain the cultural landscape their ancestors forged.

Figure 43: The former St. Mary of Snows Church in Namur

Members of this Foundation are not the only ones working to preserve the cultural landscape; individual property owners also take the responsibility to maintain their homes and other structures. When the Lincoln Cheese Factory was torn down in 2009, Luke Ferron collected a stack of the red bricks from the demolition. Ferron's house is constructed of the same type of red brick and he collected these bricks in case he would ever need to replace any on his own home (Luke Ferron, personal communication 2013).

The Englebert family is another example of a family holding on to their Belgian heritage through their architectural choices. David and Don Englebert's great-great grandfather emigrated from Belgium in the mid 1850s and was one of the unfortunate individuals who perished in the Great Fire of 1871 (David Englebert, personal communication 2013). Both of the Englebert properties utilized as a part of this study are historic red brick homes on farmsteads that also have wayside chapels.

Wayside chapels are another form of architecture that Belgian immigrants brought with them to the New World. Both in Belgium and on the Door Peninsula these chapels are usually located adjacent to well traveled roads and even today most are open for public use (Tishler and Brynildson 1986:79). Originally these wayside chapels were constructed by Belgian immigrants because of the difficulty in attending a Catholic service due to distance, difficulty of travel, or lack of clergy who spoke the language (Pansaerts 1993:109-110). These chapels are also used for tribute to their ancestors (Burton and Burton 2003:33). There are at least 18 of these structures in Door and Kewaunee counties (Pansaerts 1993:109). Today some of these original structures along with newly constructed ones can still be seen on the landscape. David and Dixie Englebert's chapel includes beautiful historic pieces that have been collected from around

the area in the past few years. Don and Mary Anne Englebert's chapel is different in that it was completed in 1990 after their daughter was killed in a tragic snowmobiling accident. The chapel, "La Petite Chapel al Sacra Crued", was built on their property in her memory (Figure 44) (Burton and Burton 2003:33). The wayside chapels are still visited by residents and tourists today.

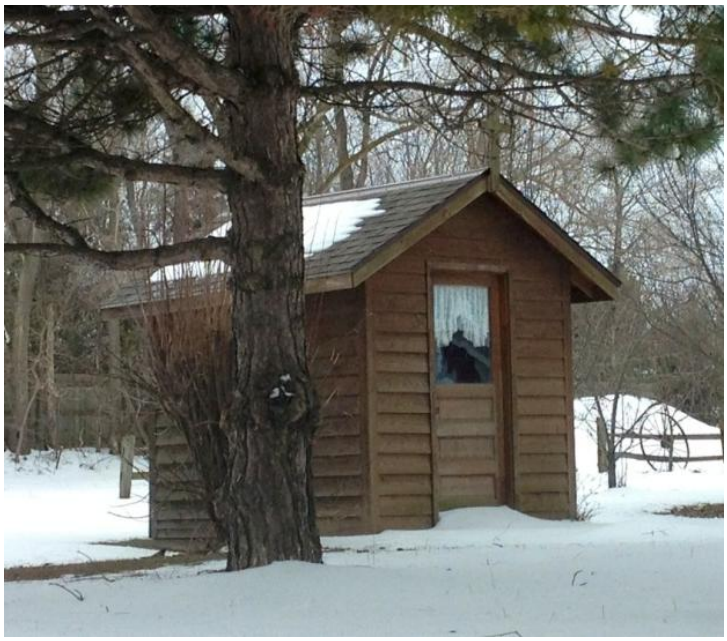


Figure 44: The La Petite Chapel al Sacra Crued, the wayside chapel and the home of Don and Mary Anne Englebert

The home of David and Dixie Englebert also demonstrates another way in which those of Belgian decent make deliberate choices to maintain the Belgian influenced architecture their ancestors built. This original red brick home was built in 1878. In 2000 the Englebert's constructed an addition to the house but maintained the look of the home by completing the addition, which included a two stall garage, in red brick to match the original façade of the home (Figure 45).

Figure 45: The two stall garage addition in red brick at the home of David and Dixie Englebert

While conducting research for this project, I attended two of the Namur Belgian Heritage Foundation's events to talk to community members about gaining permission to use pXRF analysis on certain structures. I was surprised that for such a small community how popular these fundraisers proved to be. The church was filled with people from the area. Walloon, not Belgian, flags decorated each table and people were eager to talk about their red brick homes. At this point it cannot be said if the popularity of these events is due to the connection people feel to their Belgian heritage or possibly the sense of community people feel by attending. Either way the success of these fundraisers is assisting the maintenance of the Belgian character of the area.

CHAPTER 5: CONCLUSION

This thesis examined the relationship between historic brickworks and historic structures of the Belgian-American community on the Door Peninsula. To complete this project historical research and pXRF analysis of the three brickworks and seven structures was utilized. Each avenue of research presented its own set of problems but also provided interesting results.

The historic research of these brickworks and the structures they contributed to can be challenging. In general historical documentation of small scale brickworks from the late 19th and early 20th centuries is limited (Finney and Snow 1991:67). There is very little information in the archival records that indicated anything other than the presence of these smaller brickyards. Plat maps and newspaper articles proved to be the best source for this research but the records are still scarce and sometimes circumstantial.

Oral histories can also be a helpful source of information in these types of studies. There are several considerations when discussing the use and collection of oral histories that will not be discussed in length here. In this project, as is often the case, some of the oral histories do not correlate with the historical documentation and the archaeological record. In discussions with local residents many believed that Vandermissen Brickworks produced the red brick used for construction of their structures. David Englebert stated that his family believed Vandermissen produced the brick for his home because of the close proximity and friendly relations with between the Englebert and Vandermissen families. However, Englebert's home was built in 1878. Joseph Vandermissen did not buy the property on which the brickworks was situated until 1896. It is possible that another local farm or Joseph Vandermissen's father, Jean Joseph Vandermissen may have

contributed to the brickmaking for this structure but with the lack of historical records it is difficult to conclude where the original brick for the Englebert home was made. Initially it was anticipated that the pXRF analysis could have shown correlations that could assist in discussions of sourcing a structure to a specific brickyard.

The use of pXRF analysis in this project was a preliminary attempt to use this technology for sourcing the brickworks that produced bricks used in structure construction. The goal of this process was to test if the elemental composition of the brick from the structures would correspond with the bricks and fragments collected from the three local brickyards. When an association between brickworks and the structures tested could not be made, alternative explanations were sought. The first hypothesis, that calcium from the soil altering the brickworks readings could not be accepted. The second hypothesis that the arsenic content of the bricks resulted from extensive use of an arsenate pesticide was also rejected. A principle component analysis did not account for the differentiation between the brickyards and the structures either.

Though the pXRF results did not turn out as anticipated they did present alternative results. At the Vandermissen site, the bricks from the clamps statistically differed from the rest of the brickworks. Bricks from each of the structures statistically differed from all of the brickworks. These results serve to delimit the kinds of questions that can be answered through pXRF analysis. The results here demonstrate how pXRF analysis can be used to differentiate samples from an archaeological context and a non-archaeological context as well as differentiating bricks over fired in kilns from other bricks.

All of the work that has been done on historic brickyards and brickmaking pertaining to the archaeological record has demonstrated the necessity for more site analysis and research. Modern development endangers brickworks, along with other archaeological sites. Without additional investigation these unique and valuable cultural resources may be lost (Wayne 1998:106). Locating, identifying and excavating well preserved brickworks is important, particularly in the case of small brickworks without adequate historical documentation. The lack of archaeological testing is unfortunate because it could potentially prove to be a valuable tool in comparing sites (Wingfield et.al 1997).

Kelley and Kelley discuss this necessity arguing that four aspects of the brickmaking industry should be discussed; the types and sizes of bricks, the brands or maker's marks on bricks, other sources of usefulness, and the potential analytical and interpretive uses for this data (Kelly and Kelley 1977:85). Wingfield et. al agree with Kelley and Kelley in that this type of research can contribute to the documentation of the characteristics of handmade bricks. Wingfield and co-authors argue that the aspects of dimension, orientation, associated features and soil patterning should become commonly established characteristics that may be used for the comparison of sites (Wingfield et. al 1997).

Specifically these types of projects can focus on an analysis of the different types of kilns used in various regions over time. Better identification and documentation in the archaeological record could determine variation in firing techniques in different regions (Wingfield et. al 1997). The excavation of well preserved sites can help determine the types of kilns and processes that were used (Wayne 1998:107). There are very few of

these historic kilns that have been archaeologically tested in the Midwest. Vandermissen Brickworks provides the only example of a clamp from the turn of the 20th century in Wisconsin. The Zerrenner site in Wisconsin is another example of a historic brickworks but due to continuous reuse for brickmaking, kilns were torn down and replaced making it extremely difficult to see them in the archaeological record (Hamilton 1988:6). But this site does possess a strong historical record about the brickmaking and the firing process that can be used for comparison to other brickworks.

Analysis of kilns can determine the size of the kiln which can then lead to a discussion of production volume and the industry's impact on a region (Wayne 1998:107). This can also provide details of the brickworks operation such as what type of wood was used for firing and the nature of associated structures. Technological analysis of well preserved samples of bricks can assist in discussion of trade network patterns and sourcing brick to specific buildings (Wayne 1998:107). This is what was attempted with this study and the use of pXRF analysis.

This project is a pilot study with the use of pXRF analysis of historic brick sources. Further research is necessary to understand the trade networks and the brickmaking process in this area. PXRF data of clay sources in Door and Kewaunee counties should be collected to provide a comparison to the bricks used in this project. A larger number of extant structures should also be tested for future research (Richards 2013:7).

Brick and brickworks are often overlooked in the historical and archaeological record. Brick is created from the resources the land provides and shapes the cultural landscape of places like the Belgian-American community of the southwestern portion of

the Door Peninsula. The brickmaking industry of this area demonstrates Belgian immigrant cultural values and how they influence the cultural and architectural landscape. The Great of Fire of 1871 inspired residents to rebuild with red brick but the brickworks analyzed in this study represent the late 19th and early 20th century small-scale cottage industry that escalated the brickmaking business. The results of these industries are still being maintained and preserve on the landscape today.

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