5-2013

Technological Adaptation on the Frontier: An Examination of Blacksmithing at Fort Michilimackinac, 1715-1781

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Abstract

This research examines the blacksmith and his work within the 18th century fur trade community at Fort Michilimackinac (1715-1781). Located at the northern tip of the Lower Peninsula of Michigan, this fortified trading post was important to the French (1715-1760) and British (1761-1781) fur trade economies in North America. Archaeological data and historic documents describing the use, trade, and demand for iron products at Fort Michilimackinac are used to understand the blacksmith and his work within the 18th century fur trade frontier and the wider socioeconomic landscape of which he was part. Blacksmiths were essential in supporting the material needs of frontier communities and the technological adaptations necessitated by frontier conditions are examined through the archaeological remains of the blacksmith workshops at Fort Michilimackinac, as well as metal artifacts found across the site. A model for identifying blacksmithing activities within workshops was applied to archaeological data from Fort Michilimackinac and three blacksmith workshops were identified. These are described in terms of the archaeological features represented and their spatial attributes. Several artifact groups were selected for analysis based on trade records and other historic documents that described their local production and/or repair at the fort. Trends in repair methods and potential technological adaptations of blacksmithing techniques exhibited by these repairs are identified. Portable x-ray fluorescence analysis was used to further examine traits of frontier metals and identify types of artifacts that were likely produced by the blacksmiths at Fort Michilimackinac. By examining the blacksmith and his work, this research contributes to a holistic understanding of the fur trade frontier and the

importance of individuals and craftsmen, like the blacksmith, within the communities that aided the continued success of the fur trade and European expansion in North America.

TECHNOLOGICAL ADAPTATION ON THE FRONTIER: AN EXAMINATION OF BLACKSMITHING AT FORT MICHILIMACKINAC, 1715-1781

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Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Anthropology in the Graduate School of Syracuse University

May 2013

Acknowledgements

I could not have made the accomplishments in my professional and personal life that I have thus far without the love, help and support of family, friends, and colleagues. My parents, Pam Gincel and Jim Roache, encouraged a love of learning and a desire to explore. Throughout my adolescence, my dad would spend hours in the book store with me and my sister, then take us out on adventures, which usually involved tromping through woods or fishing at the nearby reservoir. My mom's love, kind words, encouragement through all the ups and downs that go with life and academic pursuits, and the celebration of each one of my accomplishments, gave me strength to finish this research and writing. Chuck Gincel, my step-dad, has also been extremely supportive throughout this endeavor. I appreciate all the care and encouragement that my late mother-in-law, Marilyn Mason, gave to me and my family. My sister, Amanda Roache, consistently challenged me to think about life experiences differently and to understand the world beyond what I am able to perceive. Thank you for everything.

I also could not have completed this chapter in my life without the love and support of my husband, Nick Fedchenko. With all the patience in the world, he helped me accomplish everything I have set out to do during the past eight years that it has taken me to complete my doctorate. Insisting that I read, bringing me a hot meal after I've sequestered myself to my academic work, making me laugh when I have had the veil of seriousness enshrouding my every thought, and taking care of our children when I leave for days to attend conferences or visit archives, are among the many things that Nick has done to help further the development of my research and career. My children Nico and

Drago remind me to be patient with life, force me to take breaks so I can come back eager to do more, and help me remember to always pursue what I love. I love and cherish you all. Thank you for all you have done, the sacrifices you have made, and the love and humor that you have brought to my life.

This research could also not have been completed without the guidance and advice of my committee, Theresa Singleton, Douglas Armstrong, Shannon Novak, and Lynn Evans. They have provided valuable feedback and insight throughout my graduate career. Their questions and comments have improved my ability to analyze, interpret, and write. Thank you for fostering these skills which are vital to my continued success. I am also particularly grateful to my advisor and mentor, Christopher DeCorse for all that he has done for me throughout this endeavor, some of which I know I will never be cognizant. The questions and challenges that he put before me helped to enrich my thinking and understanding of my own research and made me realize the potential for inquiry that I have inside me. His passion to teach and unquenchable desire to explore, inspire me and have helped to shape my vision of my future. I cannot express how appreciative I am to have had you as my advisor and mentor.

Rachel Horlings, Holly Norton, Stephan Lenik, Liza Gijanto, Zach Beier, Meredith Ellis, Rachel Collins and Elvin Delgado have all contributed feedback and much needed commiseration. At various times throughout this pursuit, they have helped to reignite my passion in archaeology and love of research.

This research was also made possible through support from the Mackinac State Historic Parks, the Society for Industrial Archaeology Industrial Heritage Preservation

Grant, the Bruker Corporation, and the Maxwell School of Citizenship Roscoe-Martin Grant.

Table of Contents

Table of Figures

Chapter 1: Introduction

> *"From the beginning one indelible characteristic of colonial American society was mobility and that freedom of movement was omnivorous. As the frontier expanded the gunsmith often preceded the settler." (Brown 1980:242)*

This research examines the blacksmith and his work within the 18th century fur trade community at Fort Michilimackinac (1715-1781). Located at the northern tip of the Lower Peninsula of Michigan, this fortified trading post was essential to both French and British colonial expansion and fur trade in North America. Within this remote and sometimes isolated fur trade community, the blacksmith was essential in maintaining daily life, trade, and military operations because of his specialized skills to repair and produce metal objects. Metal working was an invaluable skill within a frontier community and the importance of the blacksmith cannot be overstated. Metal objects were infused in every aspect of daily life within the frontier setting: from cooking, gardening, cutting wood and other domestic activities, to hunting, fishing and trapping, to architectural requirements. Through metal objects and their repair and production, the blacksmith would have been immersed in the maintenance of daily life at Fort Michilimackinac. The seasonality and remoteness of Fort Michilimackinac would have necessitated the blacksmith adapt his skills to meet the demands of the community while working with the limited supplies he possessed. While the blacksmith supported the use and reuse of metal objects at Fort Michilimackinac, he also consumed metal objects. As a producer and consumer of metal, the blacksmith would have also been affected by the same supply/demand/reuse challenges that others in the community faced and upon whom they relied to assist them in adapting to the frontier environment. The social, economic, and political complexities of the frontier community at Fort Michilimackinac provided a unique setting in which to examine the blacksmith as a supporter of the fur trade community and the processes of technological adaptation exhibited through artifacts recovered at the site. This dissertation builds upon previous research on North American fur trade communities by focusing on the blacksmith, his work, and technological adaptations of metal working at Fort Michilimackinac.

Technology and Material Adaptation of 18^{th} Century Blacksmithing

There have been numerous historical and archaeological studies of blacksmithing, many of which provide a framework for identifying the blacksmith's workshop and work areas (e.g. Bealer 1976; Andrews 1977; Light 1984; Faulkner 1986; Watson 2000; Bessey and Pogue 2006). One goal of the present research was to draw on these studies to identify blacksmith workshops within Fort Michilimackinac and examine the associated technological characteristics of blacksmithing. Prior to this research, blacksmith shops had been preliminarily identified in the archaeological record at Fort Michilimackinac (Maxwell and Binford 1961; Armour 1976; Brown 1992). These sites, however, were interpreted prior to Light's (1987) model for spatial analysis which identified activity areas within frontier blacksmith workshops. In this research, Light's (1987) model was modified and applied to confirm the presence of these previously identified smithing workshops and identify other potential blacksmithing areas within the fortification. This spatial reanalysis was completed to better understand the chronology of blacksmithing at Fort Michilimackinac, further build upon studies of 18^{th} century blacksmithing within the frontier setting, and better contextualize the blacksmith within the site to understand who may have been using the services of the blacksmith. Better understanding the spatial dynamics of the blacksmith and his workshop enables this research to expand beyond the workshop and examine the characteristics of blacksmithing within the larger community.

The social, economic, and political significance of the 18th century blacksmith within frontier communities is manifested through the multidimensional use of metal objects within these settings. Despite the fact that everyone's daily life during the 18th century was dependent on the use of metal objects, metal artifacts are often neglected in archaeological material analysis. Aside from typologies and basic identification, metal artifacts are often not analyzed to the same depth as other archaeological materials, such as ceramics. In terms of studying the blacksmith, most archaeological and historical depictions of 18th century blacksmithing tend to focus on the blacksmith workshop and identifying the blacksmith work areas (e.g. Richardson 1888; Hasluck 1904; Wigginton 1979; Andrews 1977; Bealer 1976; Hawley 1976; Ford 1971; Lambert 1971; Light 1984, 1987; De Vore 1990; Wylie 1990; Keller and Keller 1996; Stein 2000). While the workshop's significance as the site of labor is relevant to examining 18th century blacksmithing, it is common to examine ships beyond shipyards, European militaries beyond the confines of Europe, and the processes of economy beyond urban centers. In order to understand the products of the blacksmith and their consumption by the community, it is necessary to examine evidence of blacksmithing outside the blacksmith workshop.

Another goal of this research is to examine metal artifacts that have been altered by the blacksmith during their lifetime by analyzing objects from various contexts within the fort to identify specific types of artifacts being repaired or locally produced. At Fort Michilimackinac, Stone (1974) completed a typology that included metal artifacts, but the processes of blacksmithing, including repair and local production, has not been examined during the past 50 years of excavations at the site. Portable x-ray fluorescence (pXRF) is used to identify the chemical variation of metal objects recovered at the site in order to better understand characteristics of frontier metal and analyze processes of repair and local manufacture. These characteristics also provide information that allows for the examination of trends in methods used by the blacksmith to alter and produce objects to meet the needs of the community within the frontier environment. This research contributes to the archaeological and historical analyses of the site by examining the characteristics of metal objects at Fort Michilimackinac that exhibit evidence of repair and local manufacture. Identifying trends in repair and production practices also informs the study of processes of technological adaptation by identifying the ways in which the blacksmith adapted his technological skills in order to ensure his success as a metal worker and the success of the fur trade community at Fort Michilimackinac.

This research focuses on the spatial orientation of the blacksmith within the community, technological abilities of the frontier blacksmith, and adaptive processes of technology evidenced in metal artifacts recovered from Fort Michilimackinac. In summary, the objectives of this dissertation are to:

- establish a methodology to identify the spatial arrangements of frontier blacksmithing and specifically identify blacksmithing areas at Fort Michilimackinac;

- identify technological techniques and adaptive processes used by the blacksmith;

- determine the procedures by which European goods were adapted to the frontier setting;

- and compile data that identifies the spatial organization of metallurgical technology and the material characteristics of metal within the 18th century frontier setting of Fort Michilimackinac for comparison with other sites in future research.

Secondary goals of this research relate to the broader significance of studying archaeological metals and utilizing archaeological archives and collections. The work presented in this dissertation illustrates how new and interesting questions can be answered through the use of archaeological archives and collections. Metal objects contain a wealth of information and should be examined as a primary material type to illustrate complex cultural phenomenon, such as technological adaptation to the frontier setting. The use of portable x-ray fluorescence (pXRF) in this study enabled the identification of the characteristics of 18th century metal artifacts at Fort Michilimackinac. Portable x-ray fluorescence analysis and other scientific applications is one avenue that should be pursued in order to better understand the cultural and material significance of metal objects. The creation of this data provides a means to study blacksmithing and metal artifacts, particularly within the frontier and fur trade settings in North America.

Theoretical Framework

This research focuses on the blacksmith and his work within the community of Fort Michilimackinac. Focusing on blacksmithing and metal artifacts provides a perspective from which to better understand the complex dynamics of frontier communities like that of Fort Michilimackinac. Those who entered the fur trade frontier relied on metal objects to successfully negotiate dynamic physical, cultural and social environs. The blacksmith possessed a specific skill set and all members of the community at Fort Michilimackinac would have required access to his services. This study focuses on the blacksmith's ability to provide material support and services to the diverse community at Fort Michilimackinac in order to maintain daily life that was inundated with metal objects. The ways in which the blacksmith participated in maintaining daily life at the fort is evidenced through the spatial relationship of the blacksmith workshop within the fortification, the characteristics of frontier metal, trends in repair and locally produced objects, and the subsequent methods the blacksmith used to adapt his metalworking abilities to the condition of the frontier. This research relies on the concepts of technology and labor through the perspectives of daily practice and adaptation in order to frame the interpretation of the material remains of 18th century blacksmithing. A brief review of technology, labor, and adaptation is presented in the following subsections. These theoretical paradigms informed the analyses of the blacksmith, and his work, at Fort Michilimackinac.

Technology

Technology has been examined through multiple lenses, going beyond understandings of the process or mechanics of production and use to inform analyses of cultural interactions and social structures, such as labor (e.g. Shackel 1996), daily practice (e.g. Miller 2009), and agency (e.g. Dobres and Hoffman 1994; Dobres and Robb 2000). Studies of technology are approached differently in archaeologies of prehistoric and historic sites. Prehistoric archaeologies utilize the term 'technology' more often and have grappled with a variety of theoretical vantages from which to examine the phenomenon. In contrast, historical archaeologies tend to avoid the term 'technology', and instead, focus on the social and cultural processes affected by technology. A brief review of these approaches to technology is presented in order to contextualize the use of the term in this research.

Prehistoric analyses tend to utilize the term 'technology' more often and do so in contexts of discussions of behavior and process (e.g. Skibo and Schiffer 2008, 2001; Pauketat 2001). There remains consensus among prehistoric analyses of technology that "technologies are socially constructed" (Killick and Fenn 2012: 567). However, the analyses of the aforementioned "technologies" and "constructs" remain focused either on product and process in terms of utilitarian function or phenomenological use of technologies (Dobres 2000: 59). For example, Skibo and Schiffer (2008: 25) place emphasis on the "various forms of knowledge that include unconscious, spontaneous, nondiscursive, practical, and commonsensical." They go on to state that the method for examining this "knowledge" materially should be focused on "explor[ing] the utilitarian performance characteristics first" (Skibo and Schiffer 2008: 26).[1] In contrast, Dobres and her colleagues tend to focus on technology and innovation through the lens of agency and/or practice theory (Dobres and Hoffman 1994; Dobres and Robb 2000; Dobres 2010). One example of such work lies in Miller's (2009) research on the analysis of technology which focuses on social processes in the analysis of ceramic production. Dobres (2001) explains technology and technological change in terms of the practice of knowledge that leads to the production and reproduction in processes of material production and consumption. Generally, prehistoric archaeologists analyzing technology tend to do so by either 1) focusing on identifying the behavioral and environmental circumstances that lead to adaptive strategies and/or innovation which relies upon functional characteristics of objects (e.g. Skibo and Schiffer 2008: 25; Gould 2001; Wilk 2001) or 2) examine technology and the material results through an agency perspective that focuses on materiality and daily practice (e.g. Miller 2009; Pfaffenberger 2001; Dobres and Hoffman 1999). The latter exploration of technology tends to lend itself better to this research and will be explored more in association with historical archaeologies of labor in the subsequent section.

Studies in historical archaeology typically avoid the use of the term 'technology' and those studies that do utilize the term tend to focus not on technology itself, but on historically situated social processes that influence elements of technology, or conversely, specify social processes that are influenced by technology. Class, race, gender, labor, and other social structures tend to inform the analyses of these archaeologies. For example,

[1] Skibo and Schiffer (2008) also cite Pauketat (2001) and Lemmonier (1993) as illustrative of this stance that focuses on behavior, knowledge, and utilitarian use of technology.

Singleton (1985), Shackel (1996), Young (1997) and Wurst (1999) examine the effects of technology upon the structures of labor using themes of power, class, race and gender to better understand these phenomena. The formation of technology and the processes of adaptation are not included in these analyses of technology. The study of industrial archaeology has provided some avenues for historical archaeologists to examine technology, but these have often focused on process, such as changes manufacturing or construction techniques, as opposed to the social processes involved with technology. There have been several critiques to this approach, which reiterate the necessity of including cultural constructs, most often labor, in analyses of technology (e.g. Casella 2005: 3; Symonds 2005: 46; Cranstone 2005: 86; Shackel 2004: 46; Staudenmaier 2002: 176-77).

In terms of examining blacksmithing or metallurgy, the study of technology as viewed through the lens of historic analysis is also often dependent upon specific time periods or milestones in human achievement, which may influence the use of the term (Layton 1970: 29; Hounshell 1981: 865). With regard to metal, technology is primarily reserved to describe the advent of metallurgical manipulation (i.e. Bronze Age, Iron Age, etc.) or in large-scale phenomena that allowed for the mass production of metal (i.e. the Industrial Revolution).[2] For instance, technology is often associated with events surrounding the Industrial Revolution or 20th century development, which may deter historians and archaeologists from describing processes like 18th century blacksmithing, or other small scale practices of technology, as a means of technology (Hounshell 1981:

[2] Reviews of the study of technology which substantiate this statement include Flemming (1989), Fox (1996), Reynolds and Cutliffe (1997), and Killick and Fenn (2012).

857; Buchanan 1991: 373-74). However, the blacksmith was an individual who not only facilitated the use of technology in everyday life, but also utilized his technical knowledge to adapt and help others adapt to the frontier setting.

There are several studies that present a historicized view of blacksmithing but tend to present the information in a way that compliments reproduction or re-enactment of historical blacksmithing (e.g. Bealer 1976; Andrews 1977; Watson 2000). These texts focus on process in order to recreate process and generalize the work and tools of the blacksmith. Other approaches to the study of historical blacksmithing vary from the phenomenological perspectives of blacksmithing (Keller and Keller 1996) to the economic and materialistic analysis of specific community settings, such as account books from rural or urban blacksmith workshops (e.g. Bedell 2000; Daniels 1993). Notable, most of these studies deal with 19th century blacksmiths; a time period which produced an abundant amount of primary text sources that provide information regarding the material context of the blacksmith workshop and the social nature of the patrons of the blacksmith. For example, account books, ledgers, inventories and daily transactions are among the types of documentary sources that have been drawn from to analyze 19th century blacksmithing (e.g. Rotenstein 1987; Reichman 1991). A few studies, such as Daniels (1993) and Bessey and Pogue (2006) examine blacksmiths from late 18th century – early 19th century plantation settings. These historical contexts also produced more documentary resources than are typically found for frontier fur trade sites. As with many aspects of the past, blacksmithing was romanticized during the mid-late 19th century through literature, artwork, and folklore (e.g. Longfellow 1885; Vendler 2010 citing

Dickinson *Dare you See the Soul at the 'White Heat'*; Gassies' *Le Forgeron,* circa 1868). Presenting particular views and situated within specific historical contexts, these depictions of blacksmiths and blacksmithing contribute to the conscious or unconscious exclusion of 18th century blacksmithing as 'technology'. The abundant "snap-shots" of blacksmithing available through primary documents from the 19th century also fail to promote the idea of blacksmithing as a form of technology and an avenue for technological innovation. Rural and plantation blacksmiths of the 19th century soon became obsolete as items became more commercialized and accessible. In the early 20th century, it became easier to replace a broken item or purchase a new part from a local store (Wigginton 1979: 50).

If the application of the term 'technology' is not restricted to a specific time period, it may be visible along a continuum and at various scales. Even though the term 'technology' may not be commonly used to describe or analyze 18th century blacksmithing, it is a relevant application of the term if technology is allowed to be considered from the *long durée* (Braudel 1982: 27, 30-31; Tomich 2012: 16). Complementary to placing the cultural phenomena of technology within the *long durée* is the subsequent framework of the 18th century blacksmith within a microhistorical framework as related to overall technological processes and adaptation (Tomich 2012: 9, 16). Studies in microhistory, broadly defined, do not deal directly with literal scale (Levi 1991:93), but are more concerned with the expression of broader cultural and historical processes, like technological adaption, which may not be well understood without this lens of analysis (Ginzberg 1993: 24). Analyzing the blacksmith from a microhistory perspective provides a way to analyze larger processes of technology and adaptation within the frontier environment. Furthermore, the blacksmith facilitates technological adaption within the frontier setting through labor. The following section builds upon the application of microhistory through the lens of labor.

Labor

The presence of the blacksmith is economically and politically charged since global events and European agendas (in this case, those of Great Britain and France) to control land, resources, and peoples within the frontier areas of North America necessitated his presence. The blacksmith was a social actor within the community who played a central role in the support of wider hegemonic processes of colonization, political expansion, and economic sustainability (Hall and Chase-Dunn 1993; Gosden 2004; Johnson 1996; Renfrew and Shennan 1982; Rowlands 1998; Wilkinson 2000). Yet, the blacksmiths at Fort Michilimackinac, and other frontier enclaves, were not conscious crusaders of this colonial agenda and were likely more interested in maintaining a quality of life for themselves, their family, and the community through their labor as a blacksmith (Blanton 2003: 199; Silliman 2001a: 193).[3] That is not to say that some blacksmiths employed by the British or colonial governments were not aware of their role in colonization. However, focusing on the blacksmith as an individual with a specific skill set that was necessary for the continuation of daily activities for the diverse community within the frontier setting creates a theoretical framework that is more

[3] The statements about the degree of consciousness among blacksmiths in regard to colonialist agendas is conjecture and is based on the work of Blanton (2003) and Silliman (2001) who examined frontier experiences, Silliman in particular regard to labor.

appropriate to understanding localized processes of adaptation through technology to the frontier environment at Fort Michilimackinac.

In this research, the blacksmith is defined by his labor; his ability to produce and repair metal objects. Silliman defines labor as “the social and material relations surrounding any activities that are designed to produce, distribute, or manipulate material items for personal use or for anyone else” (Silliman 2001b: 380). Following Silliman’s (2001b) theory of labor-as-practice, particularly in regard to the “materiality of labor in daily experience” provides a theoretical undertone to examining the blacksmith and his work as manifested in daily practices. Similarly, McGuire might describe the labor of the blacksmith as “the production and reproduction of real life” (McGuire 2002: 143) via the production and repair of metal objects, as per his discussion of materiality.

While the blacksmith supported the continuance of ‘real life’ through the use and reuse of metal objects at Fort Michilimackinac, he also consumed metal objects. As both a producer and consumer of metal, the blacksmith would have also been affected by the same supply/demand/reuse challenges that others in the community faced and upon whom they relied to help them adapt to the frontier environment. As McGuire (2002:104) states: “Labor consumes products in order to produce products,” and the blacksmith and his work exemplify this dynamic. Not only was the blacksmith depended on for production and repair services, he also faced the same shortages in supplies that drove the demand for his work due to the isolated setting of the outposts on the fur trade frontier. While military personnel received provisions from their country, and traders received provisions from their trade companies, it has not been documented at Fort

Michilimackinac or other frontier sites that blacksmiths were receiving provisions from specific urban based suppliers. These social, political, and environmental dynamics fueled the work of the blacksmith who may or may not have been cognizant of the global and local political practices that influenced his work, such as the political-economies of iron trade between European countries during the 18th century (Braudel 1977: 5-6; Dobres 2000: 133; Ingold 1999: x).[4] Yet, political fluctuations, material shortages, severe weather, varied demands from diverse communities, and the remote settings are factors that encourage technological innovation within frontier settings like Fort Michilimackinac (Smith 1985: 164; Pfaffenberger 1992: 496; Ehrhardt 2005: 17-18; Parker and Rodseth 2005:4). It would have been necessary for the blacksmith to alter common techniques in order to adapt to the frontier conditions that may have prevented the use of appropriate materials or manufacturing methods. Innovation and creativity, and other methods of adaptation, are exhibited through the trends identified in methods of repair and local production.[5]

The blacksmith was also, indelibly, a social actor. As a member of the fur trade community, the blacksmith provides a unique perspective from which to examine processes of technological adaptation. The need to patronize the blacksmith, minimally for repair services, was a regular occurrence within the frontier setting. The ways in which the blacksmith altered or adapted his techniques is exhibited through locally produced items and repaired goods. These items were then incorporated into daily practices and provide an illustration of the complex socialization of technological

[4] The international dynamics specific to iron import/export is briefly described in Chapter 3 in order to better contextualize the availability and use of iron objects at Fort Michilimackinac during the 18th century.
[5] These trends are further described in Chapter 5.

adaption and labor-as-practice. In short, the dynamics of the blacksmith place him as a specific social actor, who consumes products and produces products, colonizes and is colonized, and maintains daily life for the community and whose daily life is centered on the community.

Frontier Adaptation

The definitive and conceptual margins of frontiers has been widely debated and variously applied in different disciplines (e.g. Green and Pearlman 1985). For the purposes of this study, it is important to define some of the general characteristics of the fur trade frontier setting in North American during the 18^{th} century. In doing so, the dynamic nature of the frontier environment becomes clearer. Furthermore, the instability and varying degrees of permanence described in the following characteristics had significant implications for the interpretation of processes of repair and production.

Most North American fur trade sites have broadly similar characteristics, in that most fur trade sites are:

- relatively isolated from urban centers and rural populations and located within 'territorial' or 'borderland' areas (e.g. Adelman and Aron 1995; Peltonen 2001; Braudel 1980:203; Parker and Rodseth 2005);

- serve as a gathering place for economically driven interactions most often dependent on the procurement of natural resources (e.g. Nassaney et al 2007; Landers 2003; Usner 1987);

- saturated with European based agendas and political affiliations like Great Britain, France, Spain, or Russia (e.g. Skaggs and Nelson 2001; Stevens 1916);

- have the ability to accommodate a variety of political, economic, and social investments by multiple Native American groups (e.g. Rich 1960; White 1991; Fixico 1994; Lightfoot et al 1998);

- and have fluctuating degrees of permanence and transferability of social structures, which is evidenced through semi-permanence, alteration and stagnation in material culture (e.g. Fowler 1987; Pfaffenberger 1992; Turgeon 1997; Rogers 1990; Giddens 1986).

The dynamic of a constantly fluctuating environmental, political, social, and cultural setting is contentious, and at the same time supportive of adaptive ingenuity. While each of the above elements of the definition of 'frontier' used for this research contribute to adaptive processes, the first and last points are framed within this dissertation as two of the primary factors driving technological adaptation. The blacksmith's work relied upon the availability of material goods and the fluctuating degrees of permanence in regards to the social and material situation of the community would have also affected the ways in which the blacksmith produced and repaired metal objects. In other words, these variables initiate adaptive processes (Ehrhardt 2005: 21; Parker and Rodseth 2005: 4; Smith 1985: 164). The way in which the blacksmith and his technological abilities were affected is visible in the ways in which the blacksmith produces and repairs objects at Fort Michilimackinac.

Within the frontier setting, there were new cultures, objects, technologies, and challenges for survival that Europeans and European-descendants faced. Therefore, it is not farfetched to conclude that Europeans adapted to new situations and cultures which they encountered through the alteration of material goods, use of technology, and of course, social interactions. These adaptations occurred using the resources available to Europeans, which included existing knowledge and material culture as well as new relationships and social interactions (Miller and Hamel 1986: 327; Rubertone 1989: 36;

Pfaffenberger 1992: 511). The process of technological adaption and the alteration of material goods or techniques in repairing or producing objects would have undergone a decision-making process that relied upon the availability and commonality of the object and/or material (Gordon and Killick 1993: 269; Turgeon 1997: 3; Dietler 1998: 300; Ehrhardt 2005: 20-21). Furthermore, as per Dobres (2000: 125), McGuire (2002: 143) and Silliman (2001b: 379), the labor of the blacksmith was essential within the community of Fort Michilimackinac. On a microscale, the blacksmith would have made conscious decisions about how objects were repaired and produced at Fort Michilimackinac. This decision making process would have been dependent upon the availability of materials, the materiality of the object he is manipulating, and the acceptability of the degree of alteration that he may be able to make depending on the metallurgical properties of the object and the satisfaction of the customer for whom he is making or repairing the object. In other words, alterations made to metal objects and deviations from the norm were in the hands of the blacksmith. Essentially, the blacksmith was accepting or rejecting the available technological adaptations and materials. The material evidence of technological adaptation is exhibited through the material culture, specifically metal objects, found within the fur trade frontier setting at Fort Michilimackinac.

Imbued in the study of technological adaptation are those whose livelihood depended on the manufacture and maintenance of objects, in this case metal objects. Focusing on the blacksmith and his work at Fort Michilimackinac provided a localized perspective which informed a broader understanding of the significance, use, and properties of the adaptation of technology within the frontier setting. Analyzing the blacksmith as an individual with a specific skill set necessary to the continuation of daily activities for the diverse communities within the frontier setting informed the methodology and interpretation of data for this research.

Methodology of this Research

Several analytical approaches were implemented to investigate the role of the blacksmith and technological processes represented at the site. These included: spatial analysis of blacksmithing workshops; identification of the attributes of metal objects that have been repaired or locally manufactured; portable x-ray fluorescence (pXRF) analysis of the chemical variation of frontier metal from the site; and examination of adaptive processes exhibited through the material culture and supported by documentary records. The methodology for these analyses incorporated archaeology, historical documents, and portable x-ray fluorescence analysis and are further described in the following sections.

Documentary Source Material

An important asset of research at Fort Michilimackinac is the well documented history of the military, trade, and several civilians associated with the site. Primary historic documents used in this research include maps, military journals and correspondence; personal journals; a church register that details marriages, deaths and births; trade imports and companies; and accounts and inventories. Archival research was conducted within the Petersen Archaeology and History Center, the Burton Historical Collections, the William Clements Library, Michigan Pioneer and Historical Collection, the State of Michigan Library, the State of Michigan Office of the State

Archaeologist, Wisconsin Historical Society, and Parks Canada.[6] The vast majority of the information found during archival research had been documented and referenced in previous reports and publications, namely Armour and Widder (1986), Morand (1994), and Kent (2001, 2004). Regardless, information that had been attained through previous research, even specifically concerning the blacksmith, had not been analyzed from the perspective of this research.

Because the site has been excavated for over 50 years, archaeological archives and numerous secondary resources contributed to the knowledge base of this research including archaeological reports, maps, and field journals/notes, historiographies of individuals who lived within or near Fort Michilimackinac, period studies relevant to the fur trade, military personnel, and dissertations and theses about Fort Michilimackinac or nearby sites.

Archaeology

The site of Fort Michilimackinac is located in present-day Mackinaw City, Michigan. At the northern-most point of the Lower Peninsula, the site is positioned on the shore of the Straits of Mackinac, where Lakes Huron and Michigan meet. Characteristic of a shore environment, scrubby-brush vegetation is present, along with large pine trees that were planted during the early 20th century. Typical soil composition is composed mainly of sandy loam, a burn layer of charcoal-loam matrix (a remnant of the demolition of Fort Michilimackinac), and sterile beach sand underlying the site. The

[6] Petersen Archaeology and History Center, Mackinaw City, MI; Wisconsin Historical Society, Madison, WI; Parks Canada, Cornwall, ON; Michigan Pioneer and Historical Collections, State of Michigan Library, Lansing, MI. Collections from the William Clements Library, University of Michigan, and the Clark Library, Central Michigan University were also used. Archival research took place from May to Aug 2006, December 2006, January 2007, May to Aug 2007, December 2007, and January 2008.

site's location has been relatively well preserved. After the fort was dismantled and the remnants burned in 1781, the area remained unsettled until Mackinaw City was platted in 1857 (*Northwest Reporter* 1899: vol. 79, 6-7). It was at this time that the area of the former fort was reserved as a community park. The park was transferred to the State of Michigan in 1904 and was designated as the Michilimackinac State Park in 1909 (King 1909: 1130-1131). The State of Michigan continues to maintain and preserve the fort as an archaeological site and for tourism under the auspices of the Mackinac Island State Park Commission.[7]

Formal excavations at Fort Michilimackinac began in 1959 under the direction of Moreau Maxwell and Lewis Binford (Maxwell and Binford 1961). A grid of 10 foot squares was established for the entire fort area and levels were excavated in arbitrary 3 inch intervals. Quarter-inch screens were used to sift through the excavated dirt. Excavations during the 1960, 1966, and 1967 field seasons revealed the possible presence of two blacksmith shops. Interpretations of both shops (designated Locus B and Locus D is subsequent chapters) have been ambiguous in chronology, location, and spatial layout. As each field season was directed by different investigators, three different interpretations and analyses of the shops have been proposed.[8] The archaeological archives provided significant data for the analyses of these shops.

The archaeological collections from Fort Michilimackinac serve as a significant type collection, particularly due to the work by Lyle Stone in the 1960s to create typologies for various categories of 18th century cultural material (Stone 1974). Since

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[7] Now operated as one of the Mackinac State Historic Parks (http://www.mackinacparks.com).
[8] Further details concerning the excavation methods will be provided where relevant within the following chapters during more specific analyses of the archaeological archives and material remains.

excavations began in 1959, several researchers have produced material-specific reports that have aided in understanding the distribution of different types of material culture and the various functions of different objects (Maxwell 1964, Miller and Stone 1970, Brown 1971, Stone 1974, Hamilton 1976, Shapiro 1978, Heldman 1980, Blake 1981, Hauser 1982, Frurip et al 1983, Hamilton and Emery 1988, Adams 1989, Rinehart 1990, Scott 1991c, Morand 1994).[9] Over one million artifacts have been recovered from Fort Michilimackinac, approximately 35,000 of which are metal artifacts.[10]

Several factors complicated this research. These included the varied archaeological excavation methods, differences in recording field data, and the condition of the collections used for this study. Different interpretations concerning the location, chronology and spatial layout of blacksmithing activities also provided significant challenges. These problems and the ultimate solutions are addressed where appropriate throughout the dissertation.

Fort Michilimackinac provides a unique opportunity to examine blacksmithing due to the large amount of previous and continuing archaeological research of the site. This research produced a large amount of material likely manufactured or modified by blacksmiths at the fort. Therefore, metal artifacts and the contexts from which they were recovered are examined across the site in order to better understand the materiality of the political, economic, and social realms of blacksmithing, and more broadly, the technological connections between people and populations at Fort Michilimackinac.

[9] This list of references is focused on material analyses of artifacts from Fort Michilimackinac and is not exhaustive of the research that has been completed at the site.
[10] This count is accurate as of 2009. Since excavations continue each summer, these numbers will grow.

Portable X-ray Fluorescence Analysis

In addition to macroscopic examination of metal artifacts, portable x-ray fluorescence (pXRF) analysis was used to identify the chemical composition of metal artifacts from Fort Michilimackinac that exhibited evidence of repair or were more likely to have been locally produced based on information from historical trade lists and inventories. Following professional consultation[11] and a brief literature review of the applications of pXRF and XRF analysis and approaches to chemical analyses of metal objects, it was determined that pXRF would provide data needed to determine the degree of chemical homogeneity of artifacts recovered at Fort Michilimackinac (Schmidt and Wetzig 2013, Pollard et al 2007, Čechák et al 2007, Bonizzoni et al 2006, Shaley et al 2006, Ferretti 2004, Poulsen 2004, Henderson 2000, Guerra 1998, Lambert 1997).

While there is some debate about the reliability of using a pXRF device,[12] there are four main advantages to pXRF in this research. First, the use of a pXRF device prevents destruction of archaeological objects. It was extremely important to the Mackinac State Historic Parks that no objects be physically damaged or destroyed during this research. Second, since destruction of the objects was prohibited, the traditional method of pulverizing either an entire specimen or a small portion of the specimen and condensing the remains into small tablets for energy-dispersive or wavelength XRF was

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[11] Following consultation with Dr. James Spencer, Professor and Associate Dean for Science, Mathematics and Research at Syracuse University, Dr. Marion Bickford, Professor Emeritus in the Department of Earth Sciences at Syracuse University, and Michael Chatham, Senior Research Specialist in the Department of Earth Sciences at Syracuse University, it was determined that portable XRF would be most appropriate for this research and the preservation of the artifacts.

[12] This debate exists informally among researchers, but generally, pXRF data has proven to be reliable, particularly in terms of qualitative analysis which is the basis of this research (Goodale et al 2010). Independent research comparing the quality of data between various portable and traditional XRF devices and standardized analytical techniques has yet to be comprehensively studied and published (Shackley 2010).

not done. This allowed for the acquisition of readings on very large objects and on specific areas on all objects (large or small) that would provide the most information for the questions of this research, primarily concerning the homogeneity of the object and the degree of inclusions and alloys present within a single object. Third, due to the ability to maneuver the pXRF it was possible to attain multiple readings on an object, reducing the degree of error sometimes present in selecting samples for pulverizing for traditional XRF analysis. Additionally, the element of human error involved in preparing samples for traditional XRF analysis was completely eliminated. Use of the pXRF allowed for accurate readings of multiple areas on objects that were not homogenous. Finally, the use of a pXRF device for this research was extremely efficient and cost effective. Since there was little to no preparation process required, each reading took eight minutes and the analysis of 100 metal objects with a *minimum* of two readings for small objects and four readings for larger objects, required approximately 70 hours of work to obtain readings. The instrument and software used for this research was a handheld or portable x-ray fluorescence (pXRF) device manufactured and distributed by Bruker AXS Inc., which was acquired for a month at no cost due to the generous nature of Dr. Bruce Kaiser, Bruker AXS Handheld Inc. A titanium aluminum filter was used focus x-rays on the elements of interest and the device had an eight millimeter lens. The results of the pXRF analysis are further discussed in Chapter 5 within the context of identifying locally manufactured goods and the potential for examining trade practices given information concerning chemical signatures present at Fort Michilimackinac.

Framework of the Dissertation

This dissertation combines historical, archaeological, and pXRF analyses to examine technological adaptation or change through the perspective of 18th century blacksmithing within the frontier setting using Fort Michilimackinac as a case study site. As briefly outlined, there are several questions pertaining to the technological abilities of the blacksmith at Fort Michilimackinac, adaptive processes of technology exhibited in the material culture at the site, and the spatial orientation of the blacksmith within the community. Chapter 2 details the historical contexts of 18th century blacksmithing and identifies the contributions of this research to a broader understanding of the importance of the blacksmith at Fort Michilimackinac. Chapter 3 further contextualizes 18th century blacksmithing through a brief discussion about the colonial history of iron and the political and economic mechanisms of the production and consumption of metal objects within European colonies in North America. Common tools, techniques, and materials required for 18th century blacksmithing are also described. Following the generalized material requirements of blacksmithing, a model for identifying 18th century blacksmithing work areas and techniques is then defined. Chapter 4 illustrates how this model was tested using data from Fort Michilimackinac. The spatial characteristics of blacksmithing at Fort Michilimackinac are identified through the reanalysis of data from excavations of potential blacksmithing areas within the fort. Following the analysis of the blacksmith workshops, artifacts recovered from Fort Michilimackinac that exhibit repair or attributes of local manufacturing are detailed in Chapter 5 based on physical and chemical analysis. While repair and locally manufactured goods may be identified, the application of portable x-ray fluorescence analysis highlights trends in adaptive processes exhibited through metal technology. Drawing together the archaeological, historical, and applied methodologies to examine blacksmithing within the context of the fur trade fortification of Fort Michilimackinac, Chapter 6 summarizes and expands on the analysis of repair and local manufacture at the site, reiterates the broad significance of this research, and highlights future avenues of theoretical and methodological inquiry.

Chapter 2: The North American Fur Trade and Fort Michilimackinac

> *"It is situated exactly in the strait connecting the Lake of the Hurons and that of Illinois, and forms that key and the door, so to speak, for all the peoples…" (Thwaites 1959: 157)*

The blacksmith was essential to the survival of the fur trade communities at Fort Michilimackinac based on his ability to repair and produce metal objects. Metal objects were part of nearly every aspect of daily life during the 18th century within the frontier setting. The fur trade provided a unique, diverse setting, within which the blacksmith was an important component. The diverse nature of the fur trade, the history of Fort Michilimackinac and the material components of blacksmithing, are further described to highlight the importance of the blacksmith within the 18th century fur trade frontier. This chapter contextualizes the fur trade frontier, Fort Michilimackinac, and 18th century blacksmithing.

The Fur Trade in the Western Great Lakes

The North American fur trade was economically and geographically extensive. Furs, primarily beaver, were widely sought after due to their importance in the fashion industries of England, France, Russia, and many other European countries (Wolf 1982: 159; Payne 2004: 9). Furs were a viable commodity in the fashion market and the most common use of furs in fashion during the 17th and 18th centuries was in the production of what has become an almost iconic symbol of North American colonialism, the felt hat (Gilman 1982: 83). The fur trade became particularly important in colonial North America for a number of reasons. The primary reason was to meet the continued demand for furs despite the rapid decline of animal populations in France and Great Britain (Wolf

1982:159). In order to remain competitive in the trade, these two countries had to expand their resource base and trade networks to obtain furs (Pomeranz and Topik 2006: 119-121; Payne 2004).[13] Additionally, expansion and territorial claims through expeditions into the interior of North America allowed France and Great Britain to ultimately gain control and influence over other natural resources, land, and allies to further propagate each country's own colonialist agenda (e.g. Bond 1969; Eccles 1983; Dunn 1998; Carlos and Lewis 1999). As with all increasingly globalized markets of the 18th century, the fur trade took place over diverse geographic settings with the procurement of the resource taking place within the frontier settings.

One way in which France advanced the exploration and settlement for the purpose of resource procurement in North America was through the work of Jesuit missionaries and the establishment of missions. Once established, trade of European and Native goods inevitably occurred and with this trade followed economic stakeholds (Eccles 1983: 345).[14] Several phases of Jesuit occupation in the northern Great Lakes had occurred prior to the building and occupation of Fort Michilimackinac by the French in 1715. Initial European contacts in the region involved various Native American populations such as the Huron, Ottawa, Ojibwa, Fox, and Potawatomi (Kintietz 1940; Quimby 1966; Fitting 1970; Mason 1981). It was these groups who forged economic, political, and trade alliances with French missionaries, explorers, and traders during initial voyages into the western Great Lakes in the 1630s (Quimby 1966; Fitting 1970; Cleland 1992).

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[13] Other colonial powers were present in North America, including Spain and Russia, but I am concerned primarily with France and Great Britain because of their involvement in the fur trade during the 18th-19th centuries in the Great Lakes region of North America.

[14] There are numerous examples of mission-centered economic gains in the history of colonial expansion in North America, including Hornbeck 1989, Farnsworth 1992, Graham 1998, and Silliman 2008.

One of the first sustained European fur trade posts in the region began in 1671 with the Jesuit mission founded by Father Marquette in present day St. Ignace, Michigan (Thwaites 1896; Quimby 1966; Fitting 1976; Cleland 1992; Dunnigan 2008).[15] The mission was successful and in 1673 establishment of trade routes began between Marquette Mission and Montreal (Thwaites 1896; Quimby 1966; White 1991). Although initial attempts for peaceful trade failed elsewhere in the region, over time both Native American groups and Europeans saw the economic potential of the fur trade, which lasted nearly 250 years (Thwaites 1900; Quaife 1928; White 1991; Devens 1992).[16]

As the fur trade grew, the French government established Fort du Baude in the late 1680s to protect assets and trading relationships in the northern Great Lakes (Dunnigan 2008: 26; Kent 2004: 68; Bald 1961: 140; Cleland 1992: 98).[17] The exact location of the fort is still unknown but historic maps depict the fort in or near present day St. Ignace, Michigan (Bald 1961: 140; Cleland 1992:98; Dunnigan 2008: 22-25, Figures 1.10, 1.11, 1.12). The post was protected by the French military and served to further the Jesuit mission as well as the fur trade. Despite the success of the post and several petitions noting its importance in the western Great Lakes region, Fort du Baude was officially closed by the French government at the end of the 17th century as part of a colonial policy implemented to limit trade activities on the interior frontier of New

[15] Father Marquette actually entered the area in 1670 and established a mission on Mackinac Island. This location, however, had many disadvantages and the mission was moved to St. Ignace in 1671 (Dunnigan 2008; Kent 2004: 26; Thwaites 1959: vol. 55, 157).

[16] The *Jesuit Relations and Allied Documents* (Thwaites 1896-1900) details several attempts by missionaries to penetrate Native American groups of the frontier. According to these documents, even if the missionaries or traders did not become lost to the wilderness, most of the missionary occupations ended in either abandonment of the missions or sometimes enslavement, murder, or cannibalism of the priests by some Native American groups.

[17] The exact date of Fort du Baude's construction is not known. The Lahontan map depicting the region from 1687-89 does not include the fort, but does show the presence of the Jesuit mission near St. Ignace and associated Huron and Ottawa villages (Kent 2004, Figure 11).

France, (Kent 2004: 155-160). Limiting trade in the interior was meant to support growth and other industries at more eastern, urban areas like Montreal and Quebec in general. For instance, Champigny notes in 1697, that trade licenses had been revoked in an effort to deter trade and expeditions to "the interior of the woods" so that the fur trade did not divert efforts from the farming and fishing industries "in which we cannot fail to succeed" (Licenses to Trade are Revoked, Champigny Oct. 13, 1697). Champigny also stated that some French presence should be maintained in the Straits of Mackinac region.[18]

The closing of Fort du Baude and removal of the French military did not end trade in the Western Great Lakes. In fact, illicit trade continued despite the prohibition of direct trade with Native Americans, the perpetrators of which were known as *coureurs de bois.*[19] As Cadillac notes "At Michilimackinac there are 20 of the Frenchmen who have been there with the Jesuits who carry on the forbidden trade there, through correspondents they have at Montreal" (Cadillac Complains of Vaudreuil, Oct. 1, 1708, MPHC, 1904, (33): 341). The unlawful trade of furs and other goods also undermined the French authority and actually promoted England gaining a stake in the western frontier. Because the French ceased trading and the limited amount of goods procured from illegal traders were not sufficient to meet demands of a number of Native American tribes, English trade became sought out on some occasions, primarily by those trading with the Iroquois. Referring to the potential growth of English trade, Cadillac observed:

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[18] As Wolf (1982: 160) noted: "Initially, however, it was not the search for fur but for fish that drove European sailors to move into the waters of the North Atlantic. Fish was one of the strategic commercial items in medieval Europe: dried and salted, it furnished essential proteins during the days of obligatory fast and through the bitter winters."

[19] Remarks on the War with the Fox Indians c. 1701, MPHC, 1904, (33): 579.

> …if the post of Missilimakinac were given up entirely, and all the Outaois [Ottawa] there were to go and settle at Detroit, the greater part of the beaver-skins of Canada would go to the English, by the agency of the Iroquois. …we should lose the trade of the northern part of Lake Superior altogether. Which would also go to the English, through Hundon's Bay, for Detroit is too far away to be able to transact it. This trade in the north is the only good trade there is in Canada, on account of the good quality of the furs obtained from there (Letter from Sr. d'Aigremont Denouncing Cadillac Methods, Nov. 14, 1708)[20]

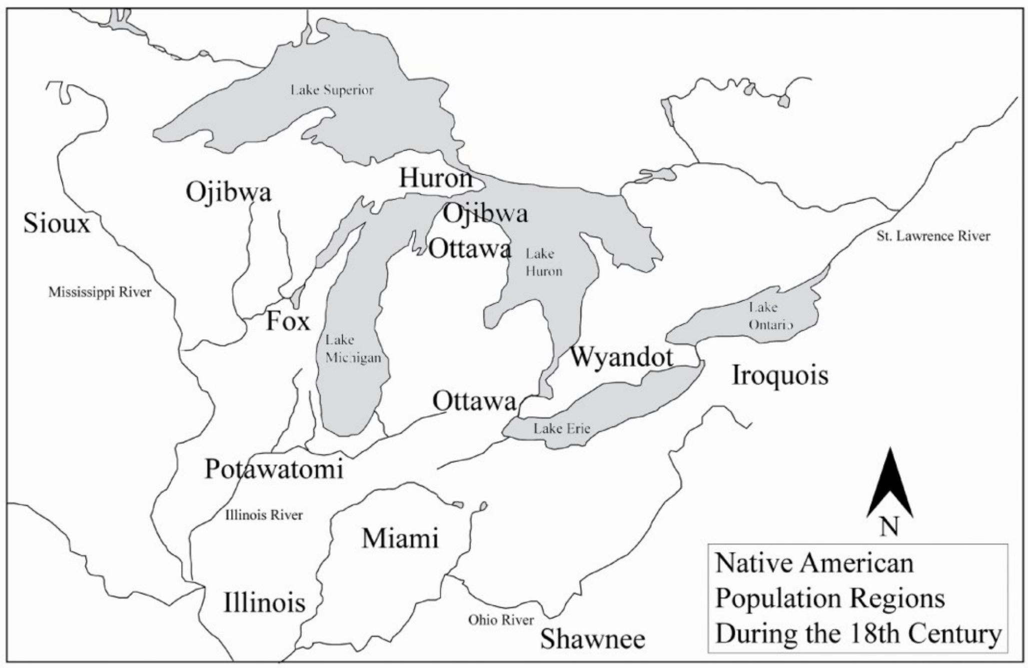

Figure 2:1 Map depicting the Native American Population Regions (Redrawn from Tanner 1967 and 1836 Map of the Indian Tribes of North America about 1600 A.D. along the Atlantic; and about 1800 A.D. Westwardly from the American Antiquarian Society).

Due to the centralized location and the threat of losing valuable allies to the British, the Straits of Mackinac area was re-established by the French with the construction of Fort Michilimackinac in 1715 in present day Mackinaw City, Michigan (Kent 2004:175-76). Beginning as a small fortified trading post, the palisade and interior

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[20] MPHC, 1904, (33): 441-442.

buildings went through several phases of renovation and reconstruction (Armour and Widder 1986; Heldman 1991). In the 1730s, the fort was expanded to accommodate more military personnel, stores, and row houses (Heldman 1991, 1993). The increase in trade activity created a diverse labor market, which intensified the complexity of business transactions and types of work available to traders and non-traders within the community. Likewise, an increase in the number of individuals participating in craft industries at the fort coincided with the success and growth of the fur trade (Morand 1994).

The increased fortification and military presence also accompanied the growing number of competing trade companies or trade partnerships in the region (Kellogg 1935). As more individuals and groups entered the trade market at Michilimackinac, this authoritative presence helped to control access to the trade, regulate policies such as pricing, and enforce regular procedures of trade. The significance of Fort Michilimackinac is illustrated by the vast geographic region which it served. As Jackson (1930: 231) noted "The trade of a quarter of a continent was centered in the little stockade fort on the south side of the Straits of Mackinac". Located north of the Mississippi, west of the St. Lawrence, and south of Hudson Bay, the centrality of Fort Michilimackinac facilitated extensive seasonal trading, which proved to be politically and economically valuable in controlling the regional fur trade (Armour and Widder 1986:26-28; White 1991; Dunbabin 1998).[21]

Throughout the occupation of the fort, the population and activity of both military personnel and civilians fluctuated with the seasons. This became more pronounced with

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[21] The importance of Michilimackinac was also reiterated during the 18th century within map titles like: *Plan of the Straits of St. Mary, and Michilimackinac : to shew the situation & importance of the two westernmost settlements of Canada for the fur trade, 1761* (Wisconsin Historical Society).

the success and long term occupation of Fort Michilimackinac as regional trade was restricted to Fort Michilimackinac and is illustrated through the record-keeping of both traders and the British military. Movement of supplies relied on the seasons and were requested during the summer months in order to obtain and stock-pile the goods in time for the winter months.

During the winter scarcely 50-100 people were present, while during the warm months potentially 1,000-2,000 people could be present within and outside the fort walls, conducting trade or other business (Vincent 1978; Armour and Widder 1986:22-23; Widder 1999). Indeed, the isolation experienced by the fort's occupants during the winter months is expressed throughout personal journal entries and letters. For instance, in a letter addressed to William Edgar, a trader who conducted business with John Askin, Mr. Askin expresses his relief that Mr. Edgar had "…Once more got to a part of the World where your friends can hear from you" (Askin to William Edgar, April 28, 1778).[22]

Furs procured at Fort Michilimackinac and other western posts belonging to the French and later to Great Britain, were traded in the global market, which was affected by events across the continent of North America and beyond. For instance, traders grew uneasy about the prospect of furs and the risk of expeditions to Fort Michilimackinac. Tensions grew throughout the Americas between Britain, France, and Native American groups, culminating in the Seven Years' War (1754-1763), also known as the French and Indian War. Since the fur trade was a source of substantial economic gain for Montreal, London and Paris, control of this trade was important to maintain through a military

[22] Askin to William Edgar, Edgar, William Correspondence and Papers, MS William Edgar, L5, 1776-1778, p. 676, Burton Historical Collection, Detroit Public Library.

presence, especially on the borderlands of the Great Lakes (Dunbabin 1998). While no battles were fought in the northern Great Lakes, the political implications were felt on the frontier after the French surrendered at Montreal in 1760, giving control of Canada to Britain (Hays 1924; Armour and Widder 1986:13; Dunbabin 1998; Anderson 2001). Not only was this an economic gain for Britain, but it also served as a strategic move for monitoring political and economic activities of the nascent United States (Hays 1924). Captain Monsieur Beaujeau de Vellemonde apparently abandoned Fort Michilimackinac, leaving the fort, civilians and a cannon behind before moving on to Illinois Country (Nov. 5, 1761, Gladwin to Amherst, Amherst Papers).[23] In 1761, a full year after the signing of the Treaty of Montreal, British Captain Balfour and approximately forty-five military personnel began occupation of Fort Michilimackinac.

> …upon his [Capt. Balfour] arrival at Michilimackinac, he found the Indians in pretty good temper, which induced him to send back 75 of his party, in order to reduce the consumption of provisions, so that his command consists but of two subs one sergeant, and forty four rank and file… (Nov. 5, 1761, Gladwin to Amherst).[24]

After this political transition, the British nonetheless relied on the French occupants and traders to maintain fur trade and Native American liaison procedures (Stevens 1916: 173; Rich 1960: 38). In order to sustain the growing fur trade economy, French civilians were allowed to maintain the Catholic Church and continue occupation of their homes inside the fort; both of which were mandated by treaty after the Seven Year's War (Shortt and Doughty 1918; Armour and Widder 1986). Both the presence of

[23] Nov. 8, 1761 (Donald Campbell to Amherst, Amherst Papers, W.O. 34/39, pp. 62-63, microfilm copy, Reel 40 (Sept. 1760-Oct. 1763), PRO

[24] Nov. 5, 1761 (Gladwin to Amherst, Amherst Papers, W.O. 34/39, pp. 58-59, microfilm copy, Reel 40 (Sept. 1760-Oct. 1763), PRO)

French civilians inside the British fort, and the reliance upon these civilians to maintain the local economy and provide intelligence regarding the region and Native American populations, gave rise to complex economic relationships that would have affected local craft industries, including blacksmithing.

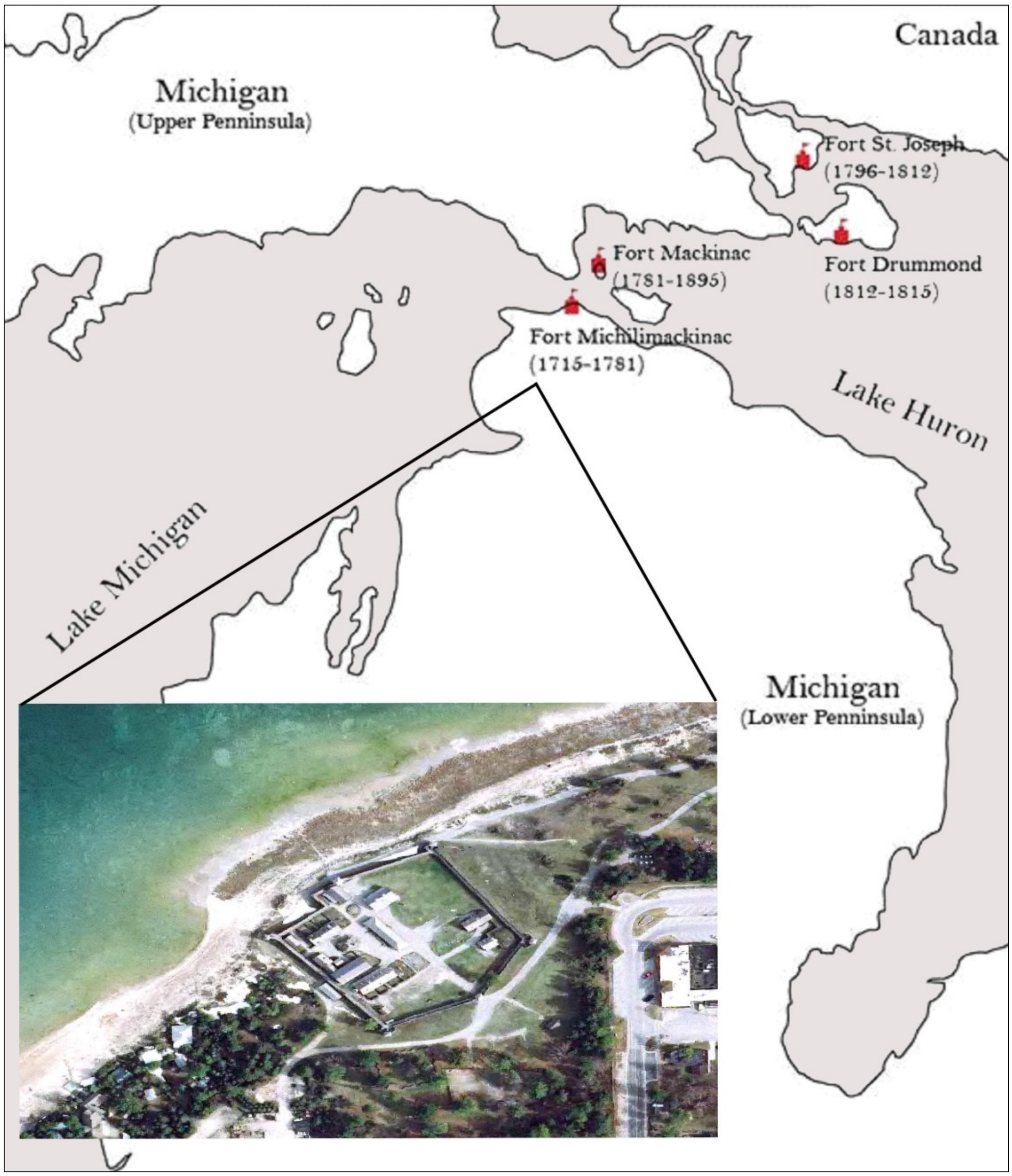

Figure 2:2 Map of study area with inset of plan view of Fort Michilimackinac.

As an attempt to establish authority over the fur trade, the British attempted to modify trade practices and procedures with Native Americans. These new policies eliminated gift giving, restricted regional trade to be conducted solely within the walls of Fort Michilimackinac, and altered exchange rates or prices within the trade (White 1991; Kent 2004). Liquor was prohibited from being traded to any Native Americans in the western Great Lakes region.[25] Despite these prohibitions, some exchange took place between British military personnel and Native Americans. As noted in several letters written by Donald Campbell, the consistent justification for giving ammunition and "small triffles" to "Indians" was to maintain good relations, yet without a gift-giving policy, the distribution of goods remained inconsistent between tribes. In a letter to Amherst, Campbell recognizes the prohibition of gifts yet justifies his participation in gift-giving practices to specific tribes:

> I know so much of Indian Affairs that there is no Necessity of Making Large presents, But I think it Absolutely Necessary to betstow Some triffles on them in our taking Possession of the Posts. As the Garrisons are Small & the Distances great, there is no other Method to be taken but that to keep them in good humor Which maybe done at a Small Expence. The Nations of Detroit, Dellewares, & Shaunees were the only Indians that received presents last Summer. (April 20, 1762, Donald Campbell to Amherst).[26]

Not only was the military dependent upon these relationships to maintain civilian based fur trade activities, but the relationships with various Native American tribes ensured

[25] While the garrison at Fort Detroit was provided liquor on rare occasions, Donald Campbell stated in a note to Amherst "…And particular care shall be taken that none is Sold to Indians." (June 1, 1762, Donald Campbell to Amherst, Amherst Papers, W.O. 34/39, pp. 88-89, microfilm copy, Reel 40 (Sept. 1760-Oct. 1763), PRO).

[26] April 20, 1762 (Donald Campbell to Amherst, Amherst Papers, W.O. 34/39, pp. 81-83, microfilm copy, Reel 40 (Sept. 1760-Oct. 1763), PRO

their survival within the frontier setting.[27] British troops at Fort Detroit and Fort Michilimackinac relied upon Native Americans to supplement their food provisions throughout the winter: "As the Troops must Depend upon purchasing Venison for the Winter from the Indians by reason that the Transportation is so Difficult & uncertain" (Sept. 18, 1761, Campbell to Amherst).[28]

The altered policies concerning gift-giving and trade created tensions between the British and Native Americans. The presence of the French within the fort added to the contempt of British authority at Fort Michilimackinac (White 1991:248, 256-268) and supported loyalty to the French by numerous Native American leaders. Consequently, difficulties arose in fur trade business due to the lack of British social relationships and alliances with both French inhabitants and Native American groups, who continued to trade according to previously defined relationships, practices, and procedures (White 1991; Skaggs and Nelson 2001). Native Americans, traders, and military personnel appealed to the British Board of Trade to re-open the trading practices that allowed traders to conduct trade outside Fort Michilimackinac, winter with Native populations, and trade within the Native American communities. In one letter to the Board of Trade, traders at Fort Michilimackinac expressed their grievance that the British military not

[27] Not only does it illustrate one way that Europeans and European-descendants were reliant upon Native Americans to adapt and survive within the frontier context, but is also connected to the materiality of relationships. Gift giving and trade for survival assist in identifying the ways in which the blacksmith was employed in the community since many gifts or trade items were metal objects. Services, such as free arms repair, were also a commodity negotiated between the British military and Native tribes. This is briefly examined in the description of blacksmiths at Fort Michilimackinac in Chapter 3.

[28] Campbell notes the environmental constraints felt by Europeans and European-descendants which limited their transportation of goods and supplies to the western posts. Sept. 18, 1761 (Donald Campbell to Amherst, Amherst Papers, W.O. 34/39, pp. 52-53, microfilm copy, Reel 40 (Sept. 1760-Oct. 1763), PRO. It is also likely that not only were soldiers purchasing venison, but fish were readily available. Jesuit Fr. Louis Hennepin commented in 1679 that there were abundant freshwater fish, such as whitefish and trout "of 50 to 60 pound Weight" (Hennepin 1698, 116) in the Great Lakes which would have no doubt provided a continued source of subsistence.

only limited trade to the fort, but also corrupted trade practices by participating in trade activities themselves (Sept. 6, 1775, "Memorial of Merchants trading to Canada, to the Board").[29] Major Robert Rogers of the British military and stationed at Fort Michilimackinac also wrote to the Board of Trade to illustrate costs and benefits of restricting trade in the region to Fort Michilimackinac (June 2, 1763, Robert Roger's Memorial to the Board of Trade).[30] The benefits of restricting trade would cut costs by an estimated 40,000 *livres*, according to Rogers' calculations of the cost of supplies, provisions, trade goods, labor, canoes, and other overhead costs. Yet, according to Rogers (June 2, 1763), the negative impacts of this policy outweighed the benefits: restricted trade would actually decrease trade activity, destroy positive relationships with Native American tribes, and promote the advancement of Spanish and French trade, troops, and influence into the Great Lakes region and westward. With the advancement of Spanish and French trade posts up the Mississippi River and toward the Great Lakes, Native Americans would seek more convenient trade partnerships and goods since Fort Michilimackinac is only accessible during the summer season.[31]

These dynamics, among others, fueled Pontiac's Rebellion in 1763 (Parmenter 1997). Pontiac's Rebellion was a widespread uprising of "Indians from the Senecas west to the Illinois and from the Chippewas [Ojibwa] south to the Delawares" who attacked a number of recently occupied British posts with the goal of restoring French authority in

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[29] "Memorial of Merchants trading to Canada, to the Board, dated Septr. 6, 1765, proposing the appointment of a proper person to preside over the civil department at Michilimackinac & Detroit, & recommending Mr. Simon Mc. Kenzie to that Employ, presented by Mr. Mackenzie, Recd. Septr. 6, Read Novr. 8, 1765, (CO 323/18, f. 169, Public Record Office.)
[30] May 24, 1767 "Robert Rogers's Memorial to the Board of Trade, C.O. 5/85, f. 178-194, Public Record Office.
[31] May 24, 1767 "Robert Rogers's Memorial to the Board of Trade, C.O. 5/85, f. 178-194, Public Record Office.

the region (White 1991:269; Cleland 1992:134). Yet, the attack and attempted takeover of several recently occupied British outposts did not produce the intended consequence of reinstating French authority. Fort Michilimackinac was the only fortification that was successfully attacked and captured by the Ojibwa.[32] Upon several agreements between the British and a number of Native American groups concerning trade practices, quality of goods, exchange rate, and accessibility, the British were allowed back into Fort Michilimackinac and trade resumed (Parkman 1966; White 1991:290-314; Cleland 1992; Parmenter 1997; Dunn 1998).

Following the 1764 reoccupation of Fort Michilimackinac, the British began modifications to the fort and structures, which were rebuilt in an attempt to make the post more military in function and less of a fortified town. Reconstruction was constant within and surrounding the fort in order to accommodate the increasing population and trading activities. As trade grew, so did the community, and after 1765 approximately 100 houses had formed a village around the walls of Fort Michilimackinac and was referred to as "the suburbs" (Quaife 1928:69; Morand 1994:8; Magra Map 1765). Within this community existed a variety of cultural and ethnic groups including: British, French,

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[32] On June 2nd, 1763, in celebration of King George III's birthday, British troops leisured and enjoyed the entertainment of an Ojibwa vs. Sauk game of *baggatiweg*. After throwing a ball over the fort walls and relying on British soldiers to retrieve the ball twice, the soldiers finally allowed one of the Ojibwa players to enter the fort himself. On cue, women revealed the weapons underneath their blankets and numerous armed Ojibwa and Sauk men invaded the fort (White 1991:290; Cleland 1992:138; Dixon 2005: 122). After killing several British military men and capturing the rest along with several British civilians inside the fort, (not one French-Canadian was harmed), the Ojibwa controlled Fort Michilimackinac (Cleland 1992:138). It should be noted that Widder (2013) states that the Sauk did not take part in the attack, nor did they enter the fort, despite being informed of the attack plan by the Ojibwa and assisting with the distraction by participating in the game. Widder does not cite references to substantiate this specific statement within his work, but does provide a thorough overview of the event as described through numerous firsthand accounts and contemporaneous descriptions of the attack.

French-Canadian, Irish, Scot, Métis, Ottawa, Ojibwa, Potawatomi, and Huron, with occasional visits by the Sauk, Fox, Miami, Winnebago, Delaware, and Sioux.[33]

While tensions dissipated between the various groups present at Fort Michilimackinac, Britain had to deal with new political resistance with the American colonies. From the onset of the American Revolutionary War (1775-1783), several successful U.S. campaigns along the St. Lawrence River and in the Mississippi Valley caused unease with the position and defensibility of Fort Michilimackinac (Armour and Widder 1986:161-162).

Regardless of the 1764 modifications made to the fort, Lieutenant Governor Patrick Sinclair claimed the post indefensible and ordered the movement of the fort and associated village to Mackinac Island (Armour and Widder 1986:161, 175). The construction of an elevated fort on the island was thought to be a better strategic military position for defense from an attack of American forces. Relocation of Fort Michilimackinac began in 1780 with the church and other buildings being dismantled and moved for use on Mackinac Island. By 1782, the majority of the buildings and most of the building materials had been relocated or reused in the creation of the settlement on Mackinac Island. The remnants of Fort Michilimackinac were torn down and burned. Evidence of the fort remained visible above ground, as was noted by Henry Schoolcraft during his 1820 expedition in the area (Schoolcraft 1855). The site of Fort Michilimackinac was preserved through the designation of the area as a community park during the development of Mackinaw City in 1857 (*Northwestern Reporter* 1899).

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[33] This list is meant to reveal the diversity present at Fort Michilimackinac and is not meant to be exhaustive since the trade was complex and Native American nations and tribes traveled and intermingled to conduct their own business outside the European and European-descendant community.

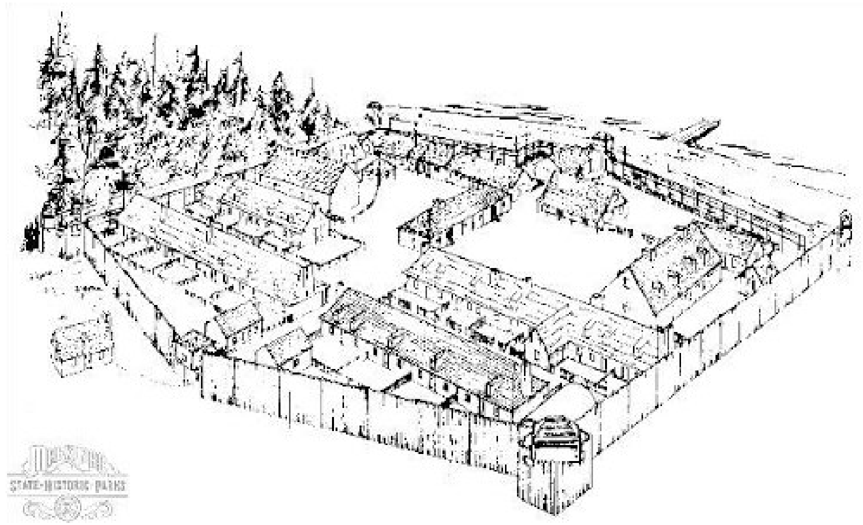

Figure 2:3 Artist's rendition of Fort Michilimackinac 1775 (by permission of the Mackinac State Historic Parks).

Contextualizing 18th Century Blacksmithing

Little has been written about the methods and techniques required for the skill of blacksmithing during the 18th century, particularly in frontier settings.[34] Few contemporary accounts of 18th century smithing techniques exist and none from Fort Michilimackinac. With regard to the lack of description, Landers notes: "Technical knowledge in particular was transmitted orally, through informal networks often based on kinship or affinity, and various institutionalized forms of *learning by doing*" (Landers 2003: 2, emphasis in original text). Early accounts of blacksmithing were recorded, but

[34] There are numerous descriptions of historical blacksmithing but few of these are specific to 18th century blacksmithing, with the exception of Diderot (1751) who provided illustrations of blacksmithing tools and the act of smithing and Moxon's 1703 *Mechanick Exercises* that describe tools and techniques of blacksmithing. Most of the historic blacksmithing books and articles describe blacksmith practices from the 19th century (e.g. Bealer 1976; Andrews 1977; Watson 2000; see also Chapter 1 section on technology). While the skill and technique may not have changed substantially between the 18th and 19th centuries, there are social, cultural, political, and economic nuances that would have varied and from which this research would have benefitted. For instance, there appears to be significant variation between the way in which blacksmiths were trained in England and how they were trained in colonial America (Elbaum 1989). Also, as described later in this chapter, specialization of blacksmiths may not have been commonplace during the 18th century or may have been specific to the setting in which the blacksmith worked.

the skill of blacksmithing was not dependent upon the ability to read and write (e.g. Richardson 1888; Wigginton 1979). Instead, protégés learned skills through apprenticeship, often with multiple smiths in order to diversify their skill set. Metal workers learned the processes of iron production, casting, refining, and smithing by participating in these tasks repeatedly and what account books do exist simply "…tell what was done but not how" (Light 1987:664). With this lack of written documentation of blacksmithing during the 18th century comes a lack of knowledge about the technical and social aspects of the craft, particularly of the nuances in workshops within different social settings (i.e. rural, urban, plantation, frontier).[35]

It is important to keep in mind that the apprentice system and the process of learning the craft of blacksmithing occurred through vastly different social structures in Europe, colonial America, and the frontier. For example, in England, the knowledge of metalworking was guarded through highly structured guilds in which membership was earned through years of apprenticeship experience (Epstein 2004).[36] In colonial America, the apprentice system changed to accommodate the communities in which the blacksmith

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[35] Variations in workshop setting influenced the type of work, skill of the blacksmith, and availability of materials and resources, including apprentices. In Ford's (1971) description of blacksmithing at Colonial Williamsburg, historical documents indicate blacksmiths were specialized. For instance, one blacksmith shop may have held a reputation for making the best wrought iron architectural objects. These specialized, urban blacksmith shops at Colonial Williamsburg also maintained the employment of several blacksmiths and apprentices. Bessey (1995) compares historical and archaeological data from urban and rural blacksmith sites during the 18th century and finds that rural blacksmiths were meeting the needs of community with work primarily focused on the production and repair of agricultural equipment. The urban sites she analyzed reflect Ford's (1971) description of specialization. Light's (1984) and De Vore's (1990) description of frontier blacksmithing and workshops indicate that smiths were repairing and producing a variety of mainly small goods with limited resources. The variation in products and services between settings reflect the population and economic demands within the communities they worked. These generalized observances are not noted in historical documents, nor are they very often recognized within analyses of 18th century blacksmithing.

[36] A significant discussion on the reasons why the apprenticeship system remained successful in Europe, particularly in England, while it failed to take hold in colonial America and later the United States is discussed by Elbaum (1989). Elbaum summarizes the success of the system in Britain as due in large part to tradition, the guild system, and controlled certification requirements, all of which failed to persist in colonial America.

worked. In urban areas with higher populations, some craftsmen taught multiple apprentices at the same time, which may have numbered in the dozens (Quimby 1984: 9-10). Within this arrangement room and board accommodations were not practical and shortened the tenure of learning for the apprentice as well (Quimby 1984: 10). In rural areas, apprenticeships were costly due to the absence of a guild-system which often provided support and due to the fact that room and board were typically provided by the blacksmith. In this situation, many blacksmith apprentices would travel between blacksmiths in order to diversify their skill set (Elbaum 1989: 346).

Knowledge and skill of smithing was passed on through generations of apprenticeships, usually to kin or fictive kin of the blacksmith due to the cost effectiveness of training family (St. George 1984: 112-113; Epstein 2004: 383). For example, one blacksmith at Fort Michilimackinac, Jean-Baptiste Amiot, trained his oldest son (Armour 1976: 25; Morand 1994: 17). This work relationship would have been convenient to Amiot for several reasons. First, the blacksmith's wage was limited to 400 *livres* during the French occupation and every time Amiot worked in the Jesuit run workshop after 1737,[37] he was required to pay half his wage to the Jesuit priest (Boynton 1996: 39). Second, Amiot's son was able to serve as an assistant allowing Amiot to potentially take on more work without paying another person to help. It is unknown at this time whether or not other smiths' children served as assistants or apprentices at Fort Michilimackinac but it is generally understood to have been common practice during this time period in colonial America.

[37] The year he was fired by Jesuit priest Du Jaunay (Armour 1976).

With the apprentice system weakened in colonial America, and particularly on the frontier, new technological advancements in blacksmithing would have happened slowly on the frontier. Frontier blacksmithing also reflected the informal training the smiths received as well as varied vernacular innovation and improvisations. The written information that is available about smithing techniques in North America stems primarily from the British tradition (Andrews 1977; Bealer 1976; Hawley 1976; Light 1987; Watson 2000). Since there are virtually no manuals that describe the process of blacksmithing prior to the 19th century, exact techniques of frontier blacksmiths are subject to analogies and interpretation of the historic record from other areas (Light 1987: 664; Watson 2000: 7-11). It should be noted, however, that the most basic techniques of blacksmithing remained largely unchanged but most likely varied dependent upon apprenticeship lineages which, in turn, relied on the types of work demanded from their various communities.

Changes in blacksmithing most often occurred within technologies related to smelting, fining, casting, and heating. It is widely assumed that most blacksmithing techniques within the workshop remained unchanged in North America until the late 18th century when charcoal-fueled forges were eventually replaced with coal-fueled forges and side-blast *tuyère* were replaced by bottom-blast *tuyère* (Hyde 1977; Light 1987). Coal-fueled forges had been used in Europe since the early 17th century along with several other iron production techniques and technological advances, like the puddling process (Hyde 1977: 53-116). The actual techniques of smithing may have remained relatively unchanged in frontier areas like Fort Michilimackinac, regardless of the type of fuel used. The diffusion of these technological changes is not well understood in terms the process of transition and application of changes within cabin industries or frontier settings.

During the late 19th century, documentation of blacksmithing techniques and tools primarily occurred as a result of the Industrial Revolution. Documenting the work of the blacksmith was seen as a necessity as it became recognized that the trade was slowly becoming obsolete (Richardson 1888). It became more efficient and economical to entirely replace an object as opposed to taking an item to the local blacksmith for repair (Ford 1971: 22). But the intrigue of metal working and the unique skill required to craft an object from raw material was still passed on through generations to some degree. Nineteenth and twentieth century metal working technologies are often detailed in writing and illustrated for several levels of production, including the bloomery process, smelting techniques, and finished products of artisans (Kauffman 1966, Sonn 1979, Gordon 1996). By the 1920s, the community blacksmith was a figure of the past as industrialized methods of mass production better served the population in North America (Quimby 1984: 4-6; Schlereth 1982: 34-52). In the 20th century, this passing of knowledge and skill was usually confined to familial relations and usually only consisted of the necessary skill set to repair basic items or fulfill community needs, such as work related to agriculture and farriering (Ford 1971: 24-27; Quimby 1984: 13-14; Watson 2000: 93-98). Records of more intricate and aesthetically driven metal working practices were also made but increasingly moved from essential, primary work to works of hobby during the 19th and 20th centuries (Sonn 1928). These early 20th century documents and ethnographic accounts of blacksmithing are often used as analytical tools for examining 18th and early 19th blacksmiths (e.g. Davidson 1992, Downs 1995, Evans 1998, Lasansky

1980, Wigginton 1979, Untracht, 1968). While some insight into smithing may be obtained from these documents, generalizations about blacksmithing based on these sources should only be applied to late 19th and early 20th contexts.

The few resources that do depict 18th century blacksmithing in North America are often 'idealized': a large shop with plenty of assistants, ample stock and raw materials, and a plethora of tools for specialized jobs (e.g. Diderot 1751). Yet, this context was not common and most smiths, depending on their geographic location, would have had limited resources and access to apprentices or assistants. At western outposts on the Great Lakes during the 18th century, some blacksmiths were required to pay fees to the military who operated the post in order to provide services and, in most cases, were unlikely able to afford to pay assistants (Armour 1976:26, Kent 2001:433). At Detroit, for example, in a letter complaining of Monsieur de La Mothe-Cadillac's management of Fort Ponchartrain, Seuir d'Aigremont states:

> He [de la Mothe-Cadillac] extracts from the man Parent, a blacksmith, for permission to work at his trade, the sum of 600 livres,…But I do not think that will last long, for it will not be possible for this workman to make a living at Detroit on these terms. He made a man named Michel Massé, a blacksmith, pay 150 livres for having worked at his trade, merely in passing. Those My Lord, are outrageous exactions. (Nov. 14, 1708, Letter from Sr. d'Aigremont Denouncing Cadillac Methods).[38]

This quote reflects the duality of the blacksmith as a community member who assists in supporting the continued presence of trade and political processes, yet, the blacksmith is represented as a community member suffering monetarily due to the political processes he aids in maintaining. In addition to the prices associated with carrying out their work, blacksmiths were also subject to varying availability of goods or raw materials due to the

[38] MPHC, 1904, (33): 425

remote locations and environmental conditions that essentially isolated western outposts on the Great Lakes during the winter months, as illustrated in Chapter 2. While some 18th century documents note the presence of a blacksmith at a particular site, these documents do not reflect 18th century technologies and techniques utilized within the frontier setting. The unique setting of the fur trade significantly alters the ability to examine the blacksmith through the perspective of the written record.

In terms of attempting a historical archaeology of blacksmithing within the fur trade frontier setting, references to other archaeological studies of the blacksmith provide a different set of shortcomings. Nearly all archaeological studies of blacksmithing focus on spatial layout of the workshop, tools used by the blacksmith, and inferences about repairs – the analyses of which remain within the boundaries of the workshop (Ford 1971; Light and Laflhche 1979; Light 1984; Faulkner 1986; De Vore 1990; Bessey 1995). For example, Light (1984), Faulkner (1986), and De Vore (1990) provide a thorough examination of the tools, artifacts recovered, possible repaired items, and spatial layout of blacksmith workshops at Fort St. Joseph, Ontario, Fort Pentagoet, Maine, and Fort Union, North Dakota. Light also includes a brief appendix about the blacksmith, ownership of the shop, and employer of the blacksmith at Fort St. Joseph, Ontario (Light 1987:43-46). While this degree of detail concerning the tools, techniques, and workshop of the blacksmith is necessary (Barker and Majewski 2006), most researchers do not expand their analysis beyond the blacksmith workshop. Unfortunately, what is absent in all of these studies is an understanding of *how* (not why) the blacksmith fit within the fur trade community. Examining metal objects distributed across the site further identifies the adaptive processes utilized by the blacksmith in the production of consumed goods within the community.

In contrast to the focus on spatial and material analysis, historiographies of blacksmithing provide a different perspective to historical blacksmithing that serves to personalize the individuals creating and maintaining material life. For instance, Martin Bruegel (2006) examined the blacksmith as social actor within the community and describes multiple scales of interactions between craftsman like blacksmiths, wagonmakers, shoemakers, etc. and a farming economy, arguing for "an actor-centered mode of retrieving history in which historical subjects seek out chances, confront limits, endow constraints with significance, and transform their world by engaging it" (Bruegel 2006: 527). Bruegel (2006: 545) also noted the importance of examining the blacksmith as a social actor because: "Blacksmith Fowks matters for another reason: the diffusion of technological innovations". The significance of ingenuity lies not only in the products but also in the social influences that created technological alterations.

As another example, in her discussion of blacksmithing in Kent County, Maryland during the 18th century, Christine Daniels (1993) also describes the blacksmith as an individual engaged in labor. Daniels argues changing capitalistic and preindustrial ideologies within the community were reflected in the types of jobs recorded in the blacksmith account books she examined, noting that:

> A capitalist system of labor relations, in which artisans were capitalized and sometimes paid by merchants, in which artisanal products were marketed by merchants, and in which workers were alienated from capitalists, was not a product of industrialization but was evident in Maryland by 1720. (Daniels 1993: 767)

In Daniels' view, the blacksmith not only to supports community interactions but is also affected by the structures of exchange within rural capitalism. Daniels (1993) and Bruegel (2006) provide examples of the potential scope of analyses that archaeologists have yet to utilize in examining the role of blacksmithing within a community and the broader technological, economic, and social significance of metalworking.

Eighteenth century North American colonial development and policies supported extensive innovation and invention, consumption and production. Within the frontier, raw materials and finished goods were not easily controlled in terms of access, the production of goods, and the profitability of various items. More specifically, for instance, the British Iron Act of 1750 prohibited the production of goods or finishing of goods from raw materials obtained within the colonies, meaning raw iron and pig iron was exported to Great Britain and other European countries, converted to finished goods, and imported to the American colonies and other British polities (Ford 1971; Bessey 1995). However, due to the remote nature of the frontier, it was possible (and often necessary) to circumvent this Act. The export of raw materials to Great Britain also aided in the Industrial Revolution, which occurred during the 18th-19th centuries in Europe and was delayed nearly a century in the United States despite an ample supply of raw materials (Landers 2003). The limitations of power that military personnel possessed in enforcing imperial policies and procedures were well documented at Fort Michilimackinac, as described throughout the historic context of the site. These limitations in combination with the limitations on supplies and goods fostered various avenues for cultural and material adaptation at Fort Michilimackinac and other frontier sites.

Blacksmithing at Frontier Fur Trade Posts

Frontier communities, whether trade posts, civilian settlements, or military posts, required the presence of a blacksmith. Since many daily activities required the use of metal objects, the work and services provided by the blacksmith were integral to the maintenance of daily life tasks (Andrews 1977: 2; Ford 1971: 24). Within the context of 18th century fur trade fortifications, blacksmiths and gunsmiths were seen as crucial members of society that aided in the success of the fur trade industry and everyday survival. As a matter of fact, modern scholars recognize this importance and have described the blacksmith as "probably the most important metal worker during the entire span of the fort's [Fort Union] operation" (DeVore 1990:2). Blacksmiths provided necessary services of repair and the manufacture of goods for building materials; guns and ammunition; food production, processing, and consumption; and tools among other things. Moreover, "when things broke, ran out, or were too expensive to import by canoe, residents of Michilimackinac relied on their own wits to survive and improve their quality of life" (Morand 1994:1). The blacksmith would have been one of the most valuable members of the community because of his metal-working skills and ability to repair, manufacture, and generally improve material life at the forts. The task of blacksmithing had both a communal essence and globalized connotation. As site specific, individualized work that took place on a small scale, blacksmithing aided the global interworking of the fur trade and European political and economic expansion in

North America during the 18th century (Andrews 1977: 2; Morand 1994: 17; Watson 2000: 93).[39]

The importance of blacksmithing is not only captured by modern-day scholars, but also becomes evident through historic documents. In a journal entry from one of the first trading parties to enter the Western Great Lakes in 1660, the author, Jesuit Father Louis Hennepin, noted that the canoes carried the implements for constructing a workable forge and smithing shop (Hennepin 1698: 122). Additionally, through archival research, Timothy Kent (2001) located several instances detailing the transport of forges and forge implements from France to various interior regions and forts located in the American territories (Kent 2001:438-465). Blacksmithing was clearly a universally important skill that was necessary to frontier conditions and aided in facilitating political and economic expansion in the Americas.

The importance of a blacksmith at fur trading posts and fortifications can be illustrated in several ways. For instance, both military and civilians owned and relied on their arms and ammunition for a variety of reasons. Not only were firearms used for protection but also assisted in hunting to obtain food. Since military and trade guns during the 18th century were flint-lock mechanisms composed of several interdependent parts, guns were in constant need of repair, especially in the climate of the northern Great Lakes (Hamilton 1976: 8-24). Success of a fur trade post relied on the ability to trap. The most common traps used were for beaver, but larger or smaller traps could also be

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[39] This statement highlights the dialectic nature of blacksmith during the 18th century (McGuire 2000). While daily tasks and personal goals would have centered around the position as a member of the community and laborer who completed jobs and received compensation, the mere presence of the blacksmith and variation in services provided to the diverse communities within the frontier assisted the imperial processes of colonization.

used to procure furs and food from other animals such as bear, fox, rabbit, and mink. Springs, jaws, and catches were some parts often repaired by the blacksmith (Light 1984:27-29; Armour 1976: 27-31). Additionally, tools for a variety of activities ranging from gardening, building repair and construction, hunting, fishing, cutting wood and cooking were often manufactured by the blacksmith. Repairs made with scrap iron were common for these tools and, as an example, can be seen in the axes or kettle lugs found at Fort Michilimackinac (Stone 1974; Armour 1976).

Summary

Blacksmithing on the frontier was a daily practice that was imbued with a variety of relationships and interactions within the immediate and larger fur trade communities. The historical context and the importance of the blacksmith within the frontier setting provide the context from which to better understand adaptive processes that may have been open to the blacksmith and evidenced through his work. Adaptation and change in techniques made by the blacksmith may be reflected in the types of material products he alters or produces for the community at Fort Michilimackinac. The blacksmith had to adapt to this unique social, environmental, and political setting, namely in reference to availability of raw materials and the managerial influence over the labor of the blacksmith, but the members of the diverse community at Fort Michilimackinac also had to adapt to various economic, social, and political exchanges that took place over time at the fort. The fact that European goods were altered prior to European settlement or within frontier environments to better suit needs and desires has been well documented, particularly for personal adornment or commodity goods (Ehrhardt 2005: 105-140; Giordano 2005; Turgeon 1997). Questions that include the European-descendant community, or which centralize an historic figure within the context of the fur trade, have yet to be asked. For instance, in what ways do community members adapt to this dynamic setting and how does the blacksmith facilitate change? The location of the blacksmith within the community would have been important in terms of understanding the interactions and materialist setting which facilitated adaptation to the frontier. The availability and characteristics of raw material, the historical context of frontier blacksmithing, and the spatial dynamics of his workshop are overviewed in the next chapter in order to provide a basis for understanding the material characteristics of 18th century blacksmithing and the setting in which technological innovation may have been cultivated.

Chapter 3: Global to Frontier: the Historical Context of Iron and Modeling its Use on the Frontier in North America

> *"The world of the forge was bound up with the world of wealth and political power. In particular, the technology of iron was a technology of war* [and colonialism]*, and control of the means of coercion depended, above all, on control of the forge and its products."(Landers 2003: 7).*

There are several material requirements for ironworking, including the construction of a solid forge, appropriate tools, and a supply of metal. Often these resources were lacking on the frontier and many times the blacksmith would have to make do with the things available or innovate a method or product to accommodate the constant lack of goods common within isolated fur trade posts. The significance of metal on the frontier is presented here to identify the connections between the history of colonial iron and the methods of producing iron and transporting raw and finished iron products to frontier sites. In the following sections, a brief examination of the history of iron in colonial North America is used to help identify potential sources of raw materials, types of metal, and the tools common to 18th century blacksmithing. A model for identifying frontier blacksmithing workshops is outlined in order to connect global processes of supply to frontier sites.

Iron Working in Colonial North America

The events and actions surrounding the procurement and production of iron in colonial North America do not necessarily reflect the processes of iron use or consumption within various colonial settings. Nonetheless, the components of procurement and production accentuate the wider politico-economic influences upon importing metal as raw materials or finished goods to the remote location of western outposts, like Fort Michilimackinac. While no documents clearly state exactly where the iron objects being brought to Fort Michilimackinac originated (either as raw material, such as bar iron, or as finished products), it is important to understand the global processes shaping the presence of metal at this fur trade outpost.

Iron was a natural resource sought after since the beginning of European expansion into North America (e.g. Ford 1971). At Jamestown in 1608, Charles Newport located and began mining iron ore deposits for export to Great Britain (Grizzard and Smith 2007: 73). The initial exploitive phase[40] of colonization in North America drove the desire to locate raw and rare materials, like gold, silver, and gemstones, but ultimately lead to more mundane, useful natural resources, like wood and iron (Wright 1967; Mulholland 1981; Horn 2005; Grizzard and Smith 2007). In North America, the first successful mining and processing of iron ores into wrought and pig iron[41] occurred in 1645 at Lynn, Massachusetts (Swank 1892: 103; Pearse 1876: 8). Many blast furnaces and fineries in North America were constructed prior to 1700, but most were unsuccessful due to large amount of capital required to construct facilities and import trained labor and a reluctance to invest in such operations (See Figure 3:1 for a timeline

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[40] The exploitative phase as described by Mulholland (1981: 66) refers to a period of colonization that exploration for and extraction of natural resources for the profit and use of European countries was the primary purpose for colonial pursuits. This phase is proceeded by the entrepreneurial phase of colonization in which colonists seek to gain from establishing business ventures on colonial lands in order to profit within the European market. Neither of these phases was supportive of colonists profiting within the colonial market and both phases continue support of the European market. See Wright (1967), Mulholland (1981), and Landers (2003) for further discussion on the phases of colonization.

[41] Wrought iron has less carbon and is more malleable than pig iron, which contains more carbon and slag. The differences between types of iron, wrought, pig, and cast, is discussed further in this chapter in the section titled *Raw Material and Frontier Smithing*.

depicting significant events in the history of iron in North America). Other factors also affected the success and failure of these early iron works, namely poor management, as is indicated by the historic record that details numerous cases of mismanagement of funds, embezzlement, and theft (Donald 1915; Ford 1971; Mulholland 1981; Arthur and Ritchie 1983; Gordon 1996).

Several other factors also contributed to the failure of forges during the early 17th century, including: the lack of a developed agricultural system needed to support industrial communities; limited transportation options due to weather conditions in the north; and, generally, the high cost of transportation in and out of the remote areas of iron ore deposits.[42] These detriments culminated in the continued dependence on foreign markets, as opposed to the growth of a colonial iron industry (Clark 1916: 87-94). Material self-sufficiency in colonial America did not gain significance until the late 1750s following the establishment of numerous iron production sites, particularly in Pennsylvania (Clark 1916: 9-30; Bining 1938; Simmons 1976: 200-203; Mulholland 1981: 62-63).[43] It was during this time that expansion from the coast along the waterways of Pennsylvania encouraged settlement nearer to environs that not only supplied iron in the form of ore deposits, but also allowed for agricultural production

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[42] Colonial policies preventing the production of finished goods for distribution within the colonies also impacted the success of forges but these measures were not put into action until the mid-18th century with the adoption of the British Iron Act in 1750 (see this chapter; Mulholland 1981: 106).

[43] Material independence is emphasized by Mulholland (1981) specifically within the colonial context, and more generally by Landers (2003) in relation to phases of development. This point carries significance, because as noted in Chapter 1, nearly every type of daily activity was inundated with metal objects. If metal objects could be produced in the colonies, dependence upon Great Britain greatly decreased, which threatened imperialistic control over North America. This is highlighted in a brief discussion about several attempts to prevent the success of the iron industry in North America, which became emphasized by the enactment of the British Iron Act of 1750.

1607	Blacksmith at Jamestown
1608	Charles Newport takes iron ore back to England and begins mining to produce pig iron for the English market
1619	England permits colonists to produce iron rather than rely solely on imported goods and raw materials
1622	Falling Creek Ironworks established in Massachusetts
1632	Jesuit priests report finding copper mines in the Lake Superior region
1641	Parliament encourages the construction of ironworks in the American colonies to support the English market
1643	John Winthrop, Jr. created a company in England to support iron production in the Massachusetts Bay Colony
1644	Braintree Furnace in Massachusetts founded by John Winthrop, Jr. who obtains monopoly from Parliament
1645	Hammersmith Ironworks founded by Richard Leader in Saugus, Massachusetts
1685	Tinton Falls ironworks established in New Jersey
1717-1719	England freezes trade with Sweden, straining the iron market
1719-1720	Russia destroys many of Sweden's ironworks and mines
1719	First proposal to Parliament to prohibit iron production in the colonies
1719	Ironworks established in Fredericksburg, VA
1724	Principio, first company founded by English investors to build iron works in North East, Maryland
1728	Principio established Accokeek furnace and was the first company to employ slaves
1730	British Parliament encourages the construction of ironworks in the American colonies by eliminating taxes and awarding time delimited monopolies
1730	Furnace established near the *Trois Rivères* iron ore deposits by French
1731	Baltimore Company establishes Baltimore Ironworks
1732	Germanna is founded in Virginia and is the first 'iron plantation' in the American colonies
1737	St. Maurice Iron Works founded in Montreal by French
1750	Iron Act passes Parliament which prohibits new construction of iron production and refining sites in America
1750-1765	Iron exports to England remain steady and do not decrease despite the Iron Act
1765-1770	Slight recession in the American colonies, iron exports to England increases slightly
1770	Beginning of use of puddling technique in England to produce iron, this allows for an increase in iron production in England
1771	Iron exports to England sharply decrease
1775	American colonies become 3rd largest producer of iron in the world
1780	All colonies, except Georgia, are producing iron
1784	Puddling technique used at St. Maurice forges in Canada
1798	Second blast furnace in Quebec is established on the Batiscan River
1800	Furnace Falls, the first iron manufacturing site in Ontario, Canada is established
1864	John Percy wrote *Iron and Steel*, the first metallurgical volume in English
1850	Catalan Forge in Nova Scotia
1857	Blast Furnace constructed near Ottawa by the Canada Iron and Manufactures Company
1898	Sault Ste. Marie Iron Works, later known as the Algoma Steel Company
1942	Enough iron is being produced west of Lake Superior to reverse the supply-line in Canada

Figure 3:1 Timeline of Significant Events Concerning Metal Production in North America.

sufficient to support communities of industry workers and affordable transportation of iron to major cities.

Just across the St. Lawrence River in New France (present-day Canada), the sense of material independence and the degree of reliance on a mother-country for iron supplies was experienced by colonists in a different way than British colonists. During the early 18th century settlers in New France depended heavily on imported iron goods from France. Unlike their British counterparts to the south, this material dependence was due to the lack of iron production efforts (Donald 1915; Arthur and Ritchie 1982). Great Britain had pushed for the development of iron production in the Americas solely for the purpose of exportation to the British market, while the success of the fishing industry and fur trade had deterred the French government from developing an iron industry in spite of reports describing numerous iron and copper ore deposits in New France as early as 1604 (Waselkov 2009:616; Donald 1915: 55).

The high cost of transportation associated with constructing, operating, and distributing iron in Canada also contributed to a near century long lag behind iron production in the American colonies (Donald 1915: 71; Pentland 1981: 35). Most iron ore production sites that obtained success in America were located within 20-40 miles of a major city: Philadelphia, Boston, Baltimore, or New York, for example (Mulholland 1981:72; Scrivenor 1854; Swank 1892). The successful ironworks in New France were established on waterways that connected to Montreal. However, trade and travel along rivers, even the St. Lawrence River, remained seasonally limited due to the presence of ice or flooding during much of the year. Large-scale agricultural development, which was also reliant upon weather, did not take hold in Ontario until the late 18th century and is another major reason for the delayed development of the iron industry in New France (Donald 1915: 41, 114; Samson 1998:5).

The iron industry in Canada did not take hold until the first successful blast furnace was constructed in 1730 near *Trois-Rivières* (Three Rivers) on the St. Lawrence River. Iron ore had been located and promoted for mining and production as early as 1672 by Count Frontenac. Monsieur Francheville was awarded the rights to work the iron ores in the Three Rivers area in 1730, but due to the procedures for importing skilled laborers and the lengthy permit process, the St. Maurice Forges was not constructed until 1736 (Swank 1892: 348; Donald 1915: 5-6; Arthur and Ritchie 1982: 5; Samson 1998: 18). This forge underwent several improvements during its 153 year lifespan and produced an array of goods such as: pots, kettles, cannons, stoves, farming equipment, and iron bars (Swank 1892: 349 citing Kalm 1749; Donald 1915: 41-42; Pentland 1981: 37; Arthur and Ritchie 1982: 5; Samson 1998: 219-241) but became best known for the production of axes (Arthur and Ritchie 1982: 2). The Saint Maurice Forges produced substantial amounts of pig, cast, and wrought or bar iron: over one-million tons of iron was produced in 1746 alone (Arthur and Ritchie 1982: 5-6; Samson 1998). Between 1736 and 1760, the St. Maurice Ironworks were owned alternately by private entrepreneurs and the French Crown. After the British gained Canada in 1760, the forges at St. Maurice were owned by Great Britain and leased out for profit to various companies until 1846, at which time the forges became privately owned until abandonment in 1883 (Pentland 1981: 44-45). When the St. Maurice Ironworks closed in

1883 it was the oldest active furnace in North America (Donald 1915: 46; Swank 1892: 350-51).

Other iron production sites were constructed in Canada, but the earliest post-dating St. Maurice was not established until 1798 in Quebec on the Batiscan River (Donald 1915: 46; Arthur and Ritchie 1982: 9). It is important to note that no mining or production operations occurred in Ontario, the closest Canadian province to Fort Michilimackinac, until 1800 (Donald 1915: 49). Therefore, any iron brought to the fort between 1715 and 1730 likely arrived via the foreign market. From 1730 to 1760 during French control, iron and iron products arriving at Fort Michilimackinac likely came from the St. Maurice Forges or other forges in New France. After Great Britain gained control of Fort Michilimackinac in 1760, it is likely that most of the iron imported by the military would have come from forges in colonial America. Yet, with the continued occupation of French traders and their families, iron from New France may also have been brought to the fort during this time. Unfortunately, there is virtually no documentation directly tying production sites with the distribution of goods to western outposts. As Samson notes, "Very little business in the way of sales was conducted at the Forges themselves," and "although there is little documentary evidence of sales to merchants…this practice was probably quite common" (Samson 1998: 252). Therefore, while sales were certainly taking place, documentary evidence directly tying forges to Fort Michilimackinac have not been found to date.

The market for iron produced in North America during the 18th century varied. In New France, the forges at St. Maurice were producing finished goods for settlers in New

France with excess iron being exported to France (Samson 1998). Conversely, in British colonial America, the primary purpose of erecting numerous forges and furnaces was for export to Great Britain. Since the 18th century still served as an exploitative phase of colonization for Great Britain, the production of finished goods in the colonies was viewed as detrimental to the iron industry in Great Britain because of the country's reliance on vast quantities of imported iron (Mulholland 1981: 66).

The political relationships between European countries during the 18th century also affected the iron industry in colonial America. For example, England relied heavily on imported iron during the 18th century and most of this iron came from Sweden. According to Mulholland (1981), by 1735 several newspapers and pamphlets estimated that England annually imported 20,000 tons of iron, of which 15,000 came from Sweden, and 5,000 tons from Russia (Mulholland 1981: 104; Scrivenor 1854:72). This dependence upon imported raw materials was due to the fact that Great Britain could not meet the rising demand for iron products from its citizens and colonists, coupled with the deterioration of England's forests[44] due to heavy harvesting of wood for charcoal production to support the iron industry (Gordon 1996: 90-94; Craddock 1995: 189-195). These shortfalls in England's iron industry created dependence on colonial iron in order to alleviate foreign dependence which was constantly affected by problems in relations between Great Britain, Sweden, Russia, and France. For example, in 1717, England's King George I banned trading with Sweden until King Charles XII, of Sweden, died in 1718 and a trade embargo existed preventing iron importation into England from Sweden

[44] Deforestation was also a catalyst for Great Britain's expeditions to find other areas in the North America to exploit furs (Wolf 1982: 152).

until 1719 (Evans and Rydén 2011: 216). Yet, the availability of Swedish iron continued to be inconsistent even after 1719 due to poor political relations and iron competition between Sweden and Russia (Kahan 1985: 210-211; Florén et al 2003: 97-100). In 1720, Russia had destroyed many of the mines, furnaces, and forges in Sweden, an act which adversely affected the iron industry in England and promoted iron production in colonial America (Florén et al 2003: 73). In fact, this led to the establishment in 1724 of the first company in English colonial America founded solely by English investors (as opposed to colonists) named the Principio Company,[45] constructed ironworks in the Chesapeake Bay area. Four years later in 1728, Principio Co. established ironworks at Acookeek. By 1780, twelve of the thirteen colonies (excluding Georgia) had at least one iron production site (Mulholland 1981:100).

Despite England's growing dependence on American iron, several proposals to limit iron production and prohibit the production of finished goods in colonial America were being presented in Parliament by British ironmasters, furnace owners, and forgers beginning in 1719 (Mulholland 1981: 103-106). While most of these proposals were turned down, in 1750, the Iron Act was passed and prohibited the production of finished goods in the colonies. The act, entitled "An act to encourage the Importation of Pig and Bar Iron from His Majesty's Colonies in America; and to prevent the Erection of any Mill or other Engine for slitting or Rolling of Iron; or Plate Forge to work with a Tilt Hammer; or any Furnace for making Steel in any of the said Colonies" was signed by England's King George II on April 23, 1750. This was a desperate attempt to reaffirm

[45] It should be noted that this company was the first to employ slave labor (Lewis 1974; Mulholland 1981: 63). This may have adversely affected the politics in England with regard to efforts preventing ironworks in the colonies since ironworking was a largely guarded, guild profession.

colonial dependence on Great Britain (Mulholland 1981: 106). In spite of this act, the American colonists continued to use existing rolling and slitting mills, tilt hammers, and furnaces to produce steel, even producing cast iron goods at existing furnaces for the colonial market with support from the governors of the colonies who neglected to report these activities to Parliament (Mulholland 1981: 107-110). In essence, the Iron Act of 1750 was nullified without the permission or consequence of Parliament due to overt defiance of the law by bankers, governors, and entrepreneurs who supported material independence from Great Britain.

In general, the broader history of iron in North America indicates that Fort Michilimackinac was receiving iron goods from France from 1715 until shortly after 1736. After this period, iron may have been imported to the fort from either France or the St. Maurice Forges at Montreal. Following British occupation of the fort in 1761, iron goods brought to Fort Michilimackinac were most likely the products of Great Britain and may have been made of iron mined and refined in Sweden, Russia, colonial America, or Great Britain. Until historic documents indicate otherwise, there seems to be no evidence indicating that finished goods imported to Fort Michilimackinac from 1761 to 1781 came from production sites in North America, particularly since the British military oversaw the provisions and supplies. Goods that were produced for consumption in the colonies were most often consumed in nearby proximity to ironworks or were made to support specific colonies (as opposed to marginal political territories/frontier areas) since goods were not being mass produced for trade elsewhere (Mulholland 1981: 58-59, 81). Therefore, the presence of metal within a frontier setting is inundated with complex political and economic processes of mining, producing, refining, forging, and exporting.

Raw Material and Frontier Smithing

During the 18th century, there were three types of iron being produced at North American ironworks: wrought, pig, and cast.[46] Several significant differences exist between these raw iron types, including the carbon content and manufacturing processes involved that resulted in differences in malleability, hardness, strength, and toughness. The manufacturing process affects the carbon content which is directly related to the physical properties of hardness (resistance to penetration), strength (resistance to being pulled apart), and toughness (ability to withstand fracture) (Gordon 1996:14).

The bloomery process, or bloom smelting procedure for producing iron, results in the production of wrought iron. Iron ores are heated within alternating layers of charcoal and ore so that the ores are gradually reduced to iron which seeps down to the bottom of the hearth and collects into a spongy ball or 'bloom' (also known as a 'loup') (Bealer 1969: 33; Mulholland 1981: 32; Arthur and Ritchie 1982: 2; Gordon 1996: 7-8; Watson 2000: 18-19; Miller 2009: 152-156). The bloom is extracted and hammered, which combines the remaining slag into the structural matrix of the iron resulting in a fibrous composite (Andrews 1977: 36; Gordon 1996: 8; Watson 2000: 16). This fibrous characteristic created a desirable combination of strength, hardness, toughness, and malleability. The iron was shaped into bars and sold or exported as wrought iron bars so

[46] Wrought iron, also known as bar iron, was produced for export and was used in the production of goods. Pig iron was a less refined product that had to be re-worked to produce wrought iron, which was then used to make goods. Pig iron was produced primarily for export or transport. Cast iron refers to the produced goods rather than a type of secondary raw material like wrought or pig iron (Gordon 1996, Craddock 1995, Mulholland 1981, Thurston 1883, Hofman and Richards 1904).

that they could be made into finished products by blacksmiths. A single smith could produce wrought iron in a two foot by two foot sized hearth, and depending on the expertise of the smith and available raw materials, including fuel, produce enough wrought iron to supply a small community (Bealer 1969: 113; Andrews 1977: 33; Mulholland 1981: 69; Arthur and Ritchie 1982: 2; Gordon 1996: 14; Watson 2000). There is no evidence that blacksmiths at Fort Michilimackinac were producing iron in any form. Light (1984) does identify the possibility of pig iron production at Fort St. Joseph, Ontario, but this did not take place until after 1815 when iron mining in the Western Great Lakes region began.

Pig iron and cast iron are produced through blast furnace smelting. The blast furnace was a large structure made of stone or brick that contained at least two conical chambers where charcoal, iron ore, and sometimes flux[47] were stacked (Watson 2000: 19). The chambers provided consistency in heating due to a consistent flow of air through the shafts (Gordon 1996:100). The iron was melted out of the ore and drained into runoff molds in the sand near the base of the furnace to produce bars of pig iron. The iron that puddled in the bottom of the furnace in the sand was referred to as 'sow iron' and the runoff puddles outside the furnace resembled suckling pigs and became known as 'pig iron' (Watson 2000: 17; Light 2007: 133). The melted iron could also be poured into molds for finished objects, such as kettles, which resulted in cast iron. The term cast iron refers to the finished product of melted iron and, presumably, would not be

[47] Flux is added to iron in order to slow or reduce oxidization. In the case of smelting, it most often was calcium, but flux in the form of borax or clean sand was added to iron during welding to allow for joining between metals to occur at a relatively low temperature which retained an appropriate amount of slag to ensure appropriate re-hardening (Light 2007: 116; Miller 2009: 150-52; Gordon 1996: 101).

refined into wrought iron as pig iron may have been. Cast iron contains less carbon, is brittle, and cannot be forged without going through further heating and hammering processes (Andrews 1977: 36).

Pig iron was essentially mass produced at furnaces and was exported from the colonies more often than wrought iron. While pig iron does contain high amounts of carbon and slag, undesirable characteristics for blacksmithing, pig iron can be refined into wrought iron. Fineries were established that heated pig iron in charcoal in order to melt the iron and oxidize the carbon and silica. Heating melted the iron into a spongy lump and liquefied the slag so that a spongy lump of iron accumulated at the bottom of the hearth and was then extracted and hammered to combine the remaining slag into the structural matrix (much like the bloomery process) (Bealer 1969: 113; Gordon 1996: 14; Miller 2009: 156-159).

During the 18th century, steel was also being produced and imported from Europe but is not often recovered from archaeological sites on the frontier at sites dating before the 19th century, with the exception of axe bits (Unglik 1984: 107). Steel was more difficult to utilize since more expertise, time, and resources were required to rework steel. Repair using steel would have required more time for reshaping and a delicate annealing and re-hardening process (Andrews 1977: 37; Watson 2000: 16).

Unformed metal was likely a rarity at Fort Michilimackinac. This may have been due to the practicality of importing raw material versus finished goods given the limited space and availability in canoe transport. While many types of metal were imported to Fort Michilimackinac via a trade route from Albany, Fort Stanwix, Fort Niagara, and Fort

Detroit, most metal came in the form of finished products (Hanson and Hsu 1975). Copper or brass was reused or scavenged from both new and used kettles by most trading groups (Turgeon 1997; Ehrhardt 2005; Nassaney et al 2007). Pewter was imported in the form of small goods or, more rarely, tablewares (Ford 1971: 25). Lead could be found in ammunition and other small items, such as lead seals or pencils (Morand 1994: 40-47). Tin and pewter were rarer, but still being imported as tin lighting fixtures, tin boxes, pewter tableware or cookware, and other sundry goods. Excavations at Fort Michilimackinac reveal a variety of metal artifacts that were used at the site and include: lead (n = 6978); brass (n = 6259); iron (n = 6301); copper (n = 911); tin (n = 705); pewter (n = 662); silver (n = 266); gold (n = 134); and steel (n = 63).[48] It is also important to keep in mind that most of these metal types could have been worked by non-specialists within the frontier setting. Copper, brass, lead, and tin are easily malleable and could have been used by individuals other than the blacksmith to repair or alter objects. Further analysis of the characteristics of frontier metal is discussed further in Chapter 5.

A few records indicate that some wrought or pig iron was brought to Fort Michilimackinac and most of the raw iron came in the form of bars. However, given the limited amount of raw materials, blacksmiths often built up inventories of parts for use in repair or manufacture, collecting numerous pieces of the same item, gun cocks for instance, in preparation for various demands for repairs (Armour 1976: 25-31; Hamilton 1976). Even with inventories, blacksmiths often were short on materials. Many times, repairs did not result in a homogenous metal consistency of the item; ferrous metals

[48] These counts for each type of metal include artifacts recovered from archaeological excavations at Fort Michilimackinac as of 2007 (n = object count). Since excavations occur each summer, the number of metal objects recovered has grown.

might be used to patch or repair copper, lead, or pewter items, and vice versa (Light 1984:31). An example of this type of repair was found at Fort St. Joseph where a brass kettle was repaired with ferrous material. As Light noted, such repairs were not necessarily high quality as “the smith seems to have been oblivious to any cathodic reactions that may take place in the presence of an electrolyte such as food in a kettle” (Light 1984:31). Further examples from Fort Michilimackinac are described in detail with regard to repair methods and trends at the site in Chapter 5.

Though there is a lack of historically documented importation of raw materials at Fort Michilimackinac, a large amount of raw iron was imported during the transitional period of relocating the fort onto Mackinac Island. In 1780, a large influx of raw iron was sent to Fort Michilimackinac in the amount of: 125 ½ lbs. of iron, 1 lb. of steel, 27 lbs. of old iron “for making & repairing Fillings and Broad axes & other Tools & making Fish Hooks, and large Spikes for the Block Houses & shoeing his Majesty’s Horses by the Blacksmith” with an additional 3 ½ lbs. of spikes, 2 files, 9 old felling axes, 3 old broad axes, 1 old pick axe, and 8 shovels which were meant to be “Converted into other uses for the Kings Works By the People at work” (MPHC vol. 10, Certificate of Expenditures, 383). However, the large amount of iron and designation of work was due specifically to the efforts to relocate Fort Michilimackinac to nearby Mackinac Island.

The fort’s relocation complicates interpretation with regard to iron use at the fort as it is not clear whether the iron was received at Fort Michilimackinac or if it was received and used at nearby work sites on Mackinac Island.[49] The iron could also have been received at Mill Creek where lumber was being produced for the move to Mackinac Island and where a blacksmith is known to have been (Martin 1985: 121).

Additionally, during this time period, blacksmith work was being contracted to a nearby trader's blacksmith. John Askin was a local affluent trader with a house, farm, and blacksmith located approximately 3 miles southwest of Fort Michilimackinac (Heldman 1983). Historic records detailing expenditures for payment to John Askin's blacksmith indicate that the smith was providing services for both civilians and the military at Fort Michilimackinac. The limited availability of raw materials exacerbates the problems associated with examining blacksmithing at Fort Michilimackinac since the resolution to the material shortage becomes complex with the relocation event (1779-1781) and expansion of blacksmithing resources through John Askin after 1761 (Martin 1985; Heldman 1983). If Askin's blacksmith was being solicited to complete work for the civilian and military populations, one method of payment may have been in raw material (Ford 1971: 21; see also discussion of scrap and payment in Chapter 5).

Modeling Spatial Characteristics of the Frontier Blacksmith Workshop

One way to understand the nuances involved in frontier blacksmithing is to examine the spatial characteristics of the blacksmith workshop which may contain various activity areas related to domestic activities, storage of raw or waste material, and different types of blacksmith related work like filing, hot-working, or cold-hammering.

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[49] Stewart (1998) analyzed blacksmith workshops within Fort Mackinac on Mackinac Island and concluded that three workshops were built and managed by the British, and later, American militaries. The workshops were located outside the fort walls prior to 1805 and again after 1873.

Barker and Majewski (2006) state that basic archaeological information, such as identification, chronology, and typology is an important foundation for further social analyses (see also Galloway 2006). Further identifying the spatial characteristics of the workshops will allow for a better understanding of the chronology of blacksmithing at Fort Michilimackinac. The location of the blacksmith workshop within the fortification may also provide information about who within the community had access to the services of the blacksmith. The availability of materials and types of jobs in demand would have also influenced the ways in which the blacksmith carried out his work. Demand and availability of resources would have influenced the types of technologies and techniques used within the frontier setting. Therefore, the contextual variation between urban, rural, plantation and frontier blacksmithing workshops should be reflected within the archaeological record. The spatial context of the blacksmith at Fort Michilimackinac will bring to light some of the differences between these historical settings.

While it is necessary to contextualize the blacksmith in terms of distinct localized settings, there are some consistencies across fur trade frontier sites that allow for creating an applicable model or framework for analysis. Several archaeological studies of blacksmithing have resulted in illustrations of the spatial layout common among frontier blacksmith workshops. Typically within a workshop, archaeologists can identify at least three activity areas: work, domestic, and storage (Light 1987; Faulkner 1986; De Vore 1990). If properly documented during excavation, a work area, often characterized by the remnants of a forge, anvil base, and possible work bench, can be identified in the archaeological record (Light et al., 1979; Light 1984). Expanding upon previous studies, the following sections describe the archaeological attributes for various components of a frontier blacksmith workshop. This modeling of a frontier blacksmith shop is then tested using archaeological data from Fort Michilimackinac; the details and results of which are described in the following chapter.

Dimensions of the Workshop

Workshops varied in dimension, especially on the frontier. Availability of space, environmental conditions, building materials, demand and frequency of work would have contributed to the size of the workshop. Light states the average size of a frontier blacksmith workshop was no larger than 25 ft. by 25 ft. (Light 2007: 89) in contrast to urban blacksmith workshops which could be up to three times this size (Ford 1971).

Site	Location	Workshop Dimensions (in feet)	Workshop Dimensions (in meters)	Forge Dimensions
Fort Union	North Dakota	25’ x 20.5’	7.62 x 6.25	4‘ x 4’
Fort Pentagoet	Maine	not described		
Fort St. Joseph	Ontario	16’ x 18.7’	4.88 x 5.7	5.5-6’ x 4.5’
Fort Ligonier	Pennsylvania	12' 6" x 14' 6"	3.81 x 4.42	not described
Mount Vernon	Virginia	18’ x 24’	5.5 x 7.32	4’ x 8’

Figure 3:2 Examples of dimensions of blacksmith workshops.

Flooring often consisted of packed dirt but could also be made of wood, although a fireproof floor was most desirable (Wigginton quoting Herbert Kimzey 1979: 112; Wylie 1990: 73). Typically, stone foundations have been discovered that outline the structure of blacksmith related buildings. In some areas, particularly in warmer climates, an open-air forge was common (Brown 1980: 243). Yet, despite the cold, Faulkner describes an open-air forge at Fort Pentagoet, located in Maine, as being common for 17th

century armourers on the frontier in North America (Faulkner 1986:68 citing Brown 1980:243).

Archaeological Signatures of the Forge and Work Areas

A solid, well-built forge for blacksmithing was essential. The historical record indicates that forge materials were transported across vast amounts of land and water to ensure the availability of proper materials to construct a forge. For example, prior to his departure with a trading party traveling to the Straits of Mackinac region, Father Hennepin recorded that "The four bark canoes were loaded with a forge and all its appurtenances" (Kent 2001: 55 citing Hennepin 1698: 122). Additionally, in other areas where the French attempted to establish a trading and military presence, among the list of initial supplies transported include a forge or portions of a forge. As noted by Kent (2001), the sale of a complete forge in 1683 near *Trois-Rivières* included: "one forge, complete with its bellows, anvil, small beak iron, forging hammer, vise, hand vise, one threading die plate, one threading tap, a file, and a nail header" (Kent 2001: 443 citing 'Sale by Mssr. De Lajeunesse to Junio, 3 Janvier, 1683, Notary Adhemar, No. 623, A.N.Q.-M.). This illustrates what may have been included in the transportation of a forge. In later endeavors into the frontier, it was recorded that other elements of a forge were also transported over treacherous terrain, including a French venture in 1722 to establish a trading post at the mouth of the Mississippi which included "a pair of bellows for coal[50] and the tools to set up a forge" (Kent 2001, 441 citing Rowland and Sanders,

[50] This may be referring to a "double" bellows which was often used with coal in order to maintain a required higher temperature in the forge. This type of bellows and the use of coal was not popular on the

Vol. 3, p.338). These accounts reiterate the importance of the blacksmith to the establishment of a trading community on the frontier, and the lengths to which the French military and others would go in order to ensure the establishment of a blacksmith at new trading posts.

Construction of a forge was necessary for creating and maintaining a consistent heating temperature for work with iron and other metals. The forge consisted of a brick or stone chimney with a platformed extension of brick/stonework that formed a "bed" for the hearth, which was approximately waist high (Kent 2001: 443, 446; Dupont 1973:48; Faulkner 1986: 135-137; Watson 2000; Hawley 1976; Andrews 1977; Brown 1980). The box-like structure was then filled two-thirds full of rubble, mostly consisting of bricks or stones, in order to insulate the heat that would be created (See Figure 3:3).

On top of the rubble a layer of sand would be deposited, followed by a smaller bed of slag located closer to the hearth opening of the chimney. Charcoal fuel on top of the slag was used during the 18th century on the frontier since it could be locally manufactured more readily than coal (Birkinbine 1879:149-158; Egleston 1880:373-397; Light 1984, 1987; Zeirer 1987; Wiley 1990).[51] This layering phenomenon is often visible in the archaeological record and careful attention to the stratigraphic nature of deposits

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frontier until the mid-19th century since charcoal could be readily produced within the frontier environment, while coal had to be imported (Light 1984, 1987; Zeier 1987; Wiley 1990; Watson 2000).

[51] Morand (1994) cites a letter from Captain George Turnbull to Sir William Johnson which details evidence that charcoal is produced locally at Fort Michilimackinac by the British military as part of fatigue duties: "I am oblidged to Detach Small Parties of the Garrison to cutt wood and Burn Lime and Charcoal". Charcoal may also have been produced by other, non-military members of the community for community consumption. To date, no evidence for charcoal production has been found archaeologically. This is primarily due to the lack of excavations that have taken place outside the walls of Fort Michilimackinac.

surrounding significant features of brick or stone is the best archaeological indicator of a forge.[52]

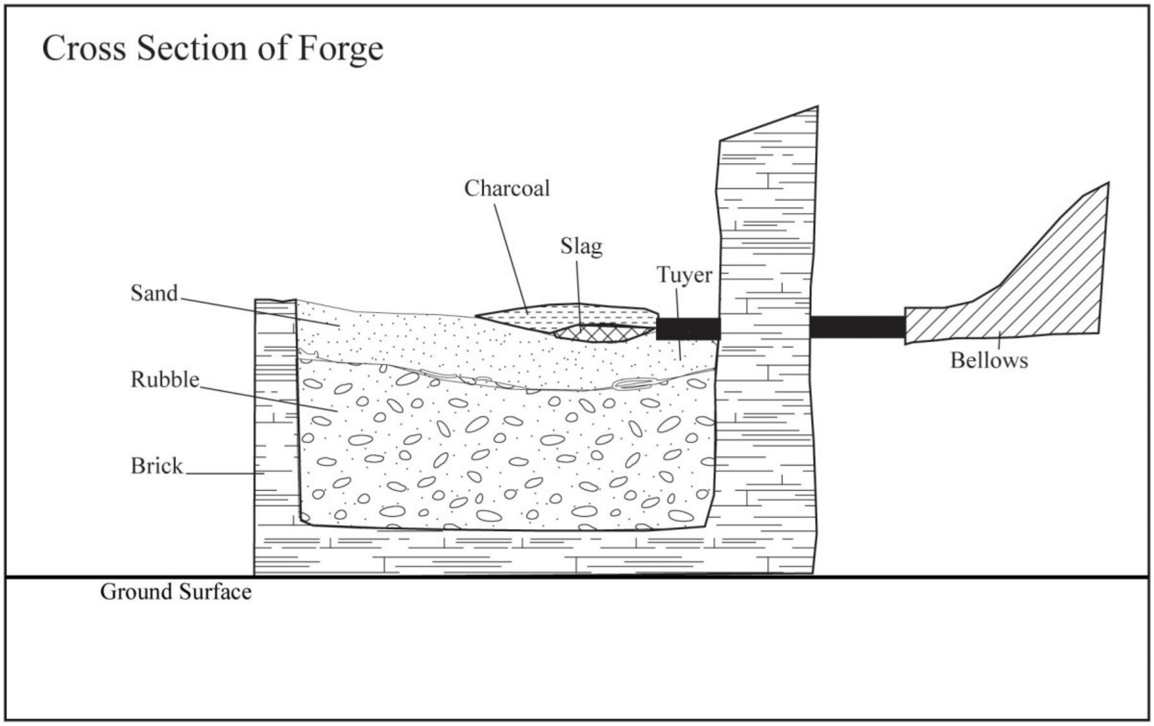

Figure 3:3 Idealized cross section of a forge illustrating the construction layers within the forge's hearth bed and the location of the *tuyère* and bellows. Redrawn after Light 1987.

The bellows is a positive displacement blowing that allows air to enter the accordion-like structure, which was made of leather and acted as a variable capacity chamber, allowing careful control of the amount of air blown into the hearth (Hawley 1976:62). Sometimes called the 'lung' of the forge, the bellows was usually positioned behind or beside the forge with pulley mechanisms accessible near the working area of the blacksmith (Hawley 1976:62; Andrews 1977: 16).

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[52] Although, forges constructed of wooden boxes and dirt have been documented through oral history projects, for example, see Wigginton 1979. No structures like this have been documented through archaeological methods.

A mechanism of pulleys allowed the weighted down bellow (usually with a heavy stone) to be lifted by the blacksmith, without having to leave the iron being worked in the charcoal hearth (Watson 2000:24-25). The bellows could also be constructed in opposite, with the weighted stone holding open the bellows with the lever used by the blacksmith compressing air out of the bellows (see Diderot 1987:174).[53] The archaeological signature of the bellows might be evidenced as postmolds next to the forge since the bellows were elevated. At the French Fort Pentagoet in Maine, the location of the bellows was found in the archaeological record by the presence of several brass tacks; these would have attached the panels of the bellows together (Faulkner 1986:135-137). Light (1987) also states that it is not uncommon to find useable scrap beneath where the bellows would have been elevated; an easily accessible stock pile (Light 1987: 7).

Figure 3:4 Examples of bellows positions. Reenactor from Fort Michilimackinac working with a side mounted bellows system (left) and a reenactor from Colonial Williamsburg working with a rear mounted bellows system (right). Photos taken by the author.

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[53] In the 19th century, a double bellows, with both an upper and lower chamber, was used in coal-fired forges, especially in the manufacture of wrought iron and pig iron (Smith 1966).

In order to regulate heat, a bellows was connected to the forge with a *tuyère* pipe, which allowed the blacksmith to control air blasts to the furnace. The air flowed from the bellows through a metal pipe, called a *tuyère*, and into the charcoal segment of the forge to coke the hot embers or base of the fire in the bed of the forge in order to increase heat. The *tuyère* provided air flow from the bellows, through a hollow in the sand fire bed and into the lower charcoal and slag portion of the forge (see Figure 3:3) (Hawley 1976; Light 1984, 1987; Watson 2000: 23-25). The *tuyère* could enter the hearth bed from either below the fire or from the side (as seen in Figure 3:), dependent upon the location and construction of the bellows. In some instances, the *tuyère* has been found in the archaeological record (Light 1987).

In close proximity to the forge would have been a tub of water, sometimes referred to as a slack tub or quenching tub (Light 1987: 11; Wylie 1990: 73; Watson 2000: 28). This was used to quench the heated metal in the water after heating as part of the tempering process (Wylie 1990: 125; Light 2007: 135; Ford 1971: 24; Watson 2000: 28). The water tub also would have been useful for providing a place to cool fire tongs, rakes, pokers, shovels, and other tools used to manipulate the fire and regulate heat (Hasluck 1904: 31; Wigginton 1979: 171; Wiley 1990: 92). Additionally, water was sometimes sprinkled on the hearth to regulate heat (Ford 1971: 24; Wigginton 1979: 171). The slack tub was usually a barrel or half barrel, which can sometimes be found in the archaeological record, minimally, through the presence of barrel strapping, a barrel hoop, or in rare cases remnants of the wooden barrel (Light 1984: 11). Yet, the presence of barrel remains does not directly indicate the presence of a tub since barrels fulfilled a range of functions, including storage. Furthermore, the proveniences of artifactual remains to stratigraphic remains are crucial to proper interpretation of blacksmithing activities.

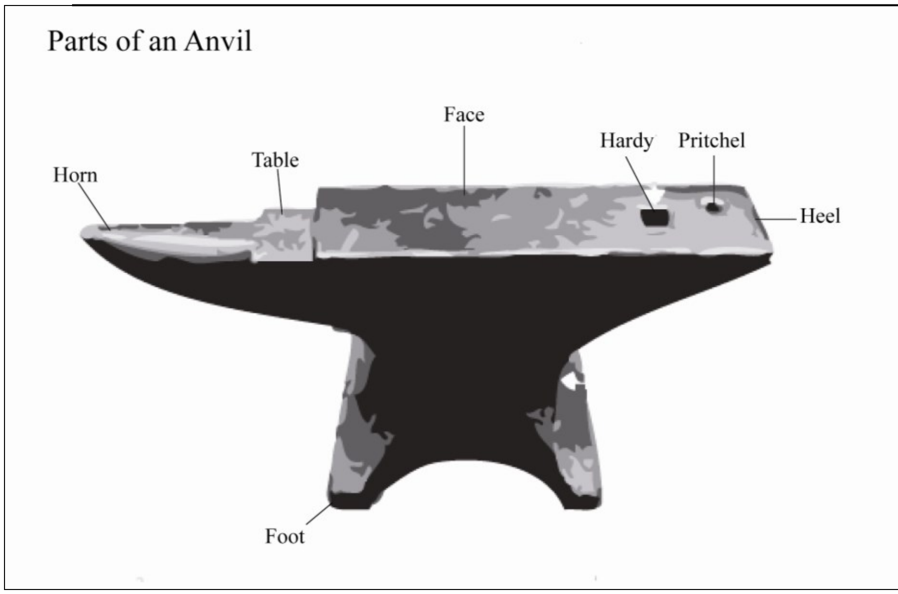

Figure 3:4 Parts of an anvil. Redrawn from Watson 2000, Andrews 1977 and Hawley 1976.

Every blacksmith had at least one anvil. The anvil was probably the most efficient tool of its time since every part of the anvil served a purpose for shaping, cutting, or forging. The horn, heel, and hardy components of an anvil provided multiple platforms and functions for maneuvering hot iron during shaping and finishing processes (Andrews 1977: 17; Watson 2000: 23; Light 2007: 94). Forged anvils (as opposed to cast) were of higher quality and also improved efficiency: "A lively anvil will make your work much easier. A forged anvil will respond well; in contrast, cast iron anvils have a tendency to be dead and full" (Andrews 1977: 17). In other words, a delicate balance existed within an anvil to absorb the striking force, which would allow for some "bounce back" of the striking implement. A dull anvil would absorb more of the striking force, creating a duller sound, and more "dead" striking effect or kick back (Light 2007: 93; Wiley 1990: 93-94; Andrews 1977: 19). Anvils were manufactured in Europe and imported to North America, with England having the upper hand in the market in North America; the London or English style anvil was most popular (Light 2007: 94; Smith 1966: 64; Wiley 1990: 93).[54] While the size and weight of anvils ranged from 100-400 lbs., the most commonly used anvil weighed between 200 and 250 lbs. (Watson 2000: 25; Light 2007: 94; Smith 1966: 66; Wiley 1990: 93).[55]

The anvil provided multiple platforms and functions for maneuvering hot iron during shaping and finishing processes and would have been located near the forge in order to quickly work with an object and reheat as needed (Andrews 1977: 17; Watson 2000: 23; Light 2007: 94). The anvil was ideally located only a "quarter turn away" from the forge so that shaping the metals could be done without significant cooling between processes (Hawley 1976: 57-58; Watson 2000: 25). Positioning the anvil at the appropriate height would allow the blacksmith to work more efficiently. Typically, the ideal height of an anvil, just below the height of the worker's belt, ensured the blacksmith was gaining as much striking force as needed, allowing gravity to aid in the striking process (Andrews 1977: 19; Watson 2000: 25; Light 2007: 94). As an historian of blacksmithing, Smith states:

> Standing next to the anvil, the smith's knuckles should barely touch the face. This is the preferred distance from the floor because it enables him

[54] In addition to England, Sweden, Germany, and Russia also exported anvils to North America (Smith 1966). As mentioned before, wrought iron anvils were more popular, but cast iron anvils were first manufactured in North America in the early 19th century at Les Forges du St. Maurice and in the United States in 1847 (Wiley 1990: 93; Smith 1996: 64).
[55] Lighter anvils were common in shops containing more than one anvil and were common for horseshoeing jobs, while the heaviest anvils (300-400 lbs.) were used for heavy sledge work in forging larger objects.

> to work comfortably without stooping or raising his arm into unnatural or tiring positions. (Smith 1966: 67)

Anvils were usually fixed to a large post that was placed into the ground by digging a post hole.[56] A hole was dug into the ground approximately four to five feet deep and the anvil post was placed into the hole and supported by rocks or stakes (Watson 2000: 25; Light 2007: 94). A piece of strapping (or hoop) was often placed around the top of the stump to stabilize any splitting that might occur with extended use (Light 2007: 94; Watson 2000: 25). It was necessary to have a large stump because the anvil was fixed to the top of the stump by using iron strap across the four feet at the base, which were hammered into the stump. Essentially, the place of an anvil can be determined in the archaeological record by the presence of a wide, potentially deep, post mold, and metal strapping. Additionally, significant amounts of metal often built up around the base of the stump. This metal could be the result of hot-working objects, which would give off scale, or metal flakes. This accumulated metal may also include scrap, from finishing jobs or useable fragments that might be used for finishing jobs. Since even the tidiest blacksmith would be unable to recover every bit of waste, large pieces of scrap and small pieces of metal scale would be present around the post mold, evidencing the presence of an anvil and work area.

Other work areas, particularly the location of the work bench, would also exhibit higher levels of iron within the soil. The work bench would have provided a space for the blacksmith to cold-work (i.e. file or chisel) and/or finish objects (Wiley 1990: 73). Within easy reach, the work bench was most often equipped with one or more vice,

[56] Sometime a squared timber was used, but typically on the frontier, a large, green, tree trunk served as the anvil stump (Light 2007: 94).

grindstone, swage block, mandrill, and a tool rack to hang equipment, such as hammers, swages, fuller, and bits to name a few (Light 1984: 9-10; Wylie 1990: 73; Watson 2000: 28-29). A portable tool rack was also common in many blacksmith shops (Wylie 1990: 74), and tools could be hung on the anvil base, forge, or wall (Wylie, 1990: 73). Even if significant numbers of metal artifacts are not recovered from a potential work bench area, it is still possible to procure evidence of this type of activity area through the measurement of iron levels within soil samples (Light et al., 1979).[57] Light et al (1979: 2) describe how the spatial layout of the blacksmith shop at Fort St. Joseph, Ontario, was inferred based on the measurement of iron using atomic absorption spectrophotometry present in soil samples collected during excavation.[58] Additionally, magnetic fractioning of the soil samples also indicated, in more comparative terms, the amount of ferrous material present in the soil (Light et al, 1979: 3-4).[59] If soil samples are not recovered during excavation, higher concentration of iron may also be indicated by the presence of red staining, a remnant of corroded iron.

Generally, the blacksmith was dependent on a wide variety of specialized tools for the various techniques performed in the repair and manufacture of goods. There were

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[57] The workbench may also have been located near a window to assist in visibility. Since the majority of cold-work could have been done at the workbench, the distance from the forge might not be a factor but instead, the distance to the anvil may have been more important to lessen the need to move around the workshop. Therefore, the combined presence of window glass and high iron concentrations may help to indicate the location of the workbench within the shop. This statement is purely a hypothesis and analysis that includes both archaeological contexts are not found in the existing literature.

[58] "The iron was leached with a hot hydrochloric acid solution (1:1) for 16 hours. The resulting solutions were analyzed for iron by atomic absorption spectrophotometry" (Light et al. 1979:5).

[59] Hand magnets have also been used to indicate the presence/absence of ferrous material in the soil, but the results of this is often unreliable since iron has various properties of magnetization through the stages of corrosion and decay (Light et al. 1979:2). Custer et al. (1986) also conducted soil chemistry testing within an area of a blacksmith workshop but tested the presence of phosphorus, calcium, magnesium, and potassium to identify structural remains. Portable x-ray fluorescence may also be used to help identify the chemical variation in soil samples.

several techniques used during the 18th century for working iron, including cold- and hot-working, forge welding, molding, and brazing (Light 1984: 93), all of which required different types of tools. Tools common to a blacksmith workshop included objects for shaping (hammers, fuller and swages), cutting (chisels, files), creasing or hole punching (punches, reamers), and stabilizing tools (tongs, leg or table vices) (Light 1984; De Vore 1990; Watson 2000). The amount of tools any blacksmith could have used easily numbers in the hundreds since there are so many varieties of the same types of tools. The variety of hammers a blacksmith may have had include a swage-, fuller-, ball-, cross-, ball peen-, long peen-, claw-, flatter-, tack-, and tilt hammer, just to name a few (Arthur and Ritchie 1982: 18; Light 2007; Watson 2000: 33-52; Keller and Keller 1996: 32; Andrews 1977; Bealer 1969). Since tools were valuable items, particularly within the frontier setting, the blacksmith would have taken his tools with him if he moved or temporarily relocated to follow trade and/or demand of his services. Tools, such as hammers, files, and vices, have been recovered archaeologically within blacksmith workshops and often show evidence of severe wear or are fragments (Light 1984; De Vore 1990).

Archaeological Signature of the Domestic Area

The domestic area of a blacksmith workshop would have served to accommodate customers, given the blacksmith a place to rest, and possibly a place to prepare or eat meals. The presence of a stove or other fireplace (besides the forge) would not be uncommon since the forge would not have provided adequate heat during the winter months in cold areas, especially given the dimensions of the fire in the forge hearth and the careful regulation of heat in the forge (Light 1984: 11; Watson 2000: 103). Furthermore, it would be expected that the majority of ceramic and glass (including window glass) would be indicative of a domestic area where a blacksmith could have a break from the hard labor of smithing.

Other uses of a domestic space might include the smith's living quarters. It was not uncommon for a smith's home to be located adjacent to a workshop, especially within the frontier environment (Brown 1980: 242). For example, at Fort Pentagoet, the blacksmith's structure consisted of three rooms within one foundation (Faulkner 1986: 68-69). One of the rooms contained the forge and blacksmith work area, another may have been used for storage, and the third area was used as the blacksmith's living quarters (Faulkner 1986: 66-69).[60]

Archaeological Signature of the Storage Area

Materials built up quickly in a blacksmith shop and despite the often messy depiction of shops in historic photographs, a system of storage, discard, inventory, and refuse was always implemented. Clinkers, slag, fuel, scrap (useable and non-useable), tools, and inventoried parts all had to be dealt with and would pile up quickly. Blacksmiths often reused parts of broken objects, pieces of scrap metal, even slag, especially on the isolated frontier where supplies were not readily accessible. Smiths would collect scrap metal (and sometimes charcoal or fuel) in exchange for services

[60] Living quarters of the blacksmith may also have been housed within the same structure at Mount Vernon (Bessey and Pogue 2006: 178). At other types of sites (i.e. plantations) quartering within the same building structure as the blacksmith workshop is plausible when the smiths were indentured servants or slaves (Wylie 1990; Ford 1971: 11). This structural layout has also been well documented for 19th century cites, including the American Millwright's House at the site of Mill Creek, which lies approximately five miles south and east of Fort Michilimackinac (Martin 1985).

(Ford 1971: 8, 10-11; Light 1984: 9-10; Wylie 1990: 76, 81). Additionally, storage of fuel may have required its own space with certain parameters to ensure preservation; for instance charcoal would have to stay dry and free of mold. Storage areas were, to say the least, not uniform since each smithy dealt with materials in their own way. Sometimes useable scrap was simply piled up near the anvil or beneath the bellows. In other instances, scrap, waste or refuse was quarantined in divided rooms. Because of this diversity, the archaeological evidence of storage areas will also vary but may be indicated by the presence of pits containing an amalgamation of metal artifacts, most often broken. Due to the nature of storage and scrapping, field interpretation of smaller storage areas may misidentify them as refuse pits due to the nature or condition of artifacts present.

Summary

The global context of iron production, the regional history of political and economic exploitation, and the micro-setting of the blacksmith’s workshop and tools provide the foundational context in which to analyze blacksmithing at Fort Michilimackinac. The spatial context of frontier blacksmithing was modeled for application in the next chapter and will provide more information about the setting in which the blacksmith worked within the community at Fort Michilimackinac. The colonial history of iron and the global influences on local production and repair provides another layer of history from which to view the blacksmiths at the fort. Fur trade frontier blacksmithing was unique during the 18th century in part because of the physical, social, and economic contexts that necessitated his presence at sites like Fort Michilimackinac. The next chapter analyzes the spatial and chronological characteristics so that the nuances of technological adaptation through the purview of the blacksmith can be better understood. The location of these workshops and the spatial attributes that can be interpreted from the archaeological archives provide insight to the chronological history of the blacksmiths, the dynamics of access to the blacksmith, and the potential source of resources for the blacksmith at Fort Michilimackinac.

Chapter 4: The Blacksmiths at Fort Michilimackinac

"Week in, week out, from morn till night,
You can hear his bellows blow;
You can hear him swing his heavy sledge,
With measured beat and slow,
Like a sexton ringing the village bell,
When the evening sun is low."
The Village Blacksmith by Henry Wadsworth Longfellow (1842)

In order to better understand the social and physical nuances of interaction and technological adaptation within this setting, the spatial context and historical chronology of the blacksmiths at Fort Michilimackinac must first be understood. This chapter describes the social, political, and economic characteristics, as well as the spatial and material attributes of smithing at the site. The history of blacksmithing at Fort Michilimackinac is described in reference to historic documents and a review of existing archaeological literature about the blacksmiths at the site is presented. This compilation and analysis of specific smithies helps to identify the processes that created the archaeological record as it relates to blacksmithing at Fort Michilimackinac. The work areas and spatial extent of blacksmithing at the site are identified by applying the model outlined in Chapter 3 to identify the archaeological attributes of blacksmithing at a frontier site. The model is applied to four areas within the fort, three of which (Loci A, B, and C) are identified as blacksmith workshops based on reanalysis of previous excavations and interpretations at the site, including two areas previously interpreted as workshops and one area previously unrecognized. The area designated Locus D was previously identified as a blacksmith workshop, but following the application of the model was determined not to be a blacksmith workshop. This spatial and chronological assessment better informs the archaeological and historic context of the 18th century frontier blacksmith at Fort Michilimackinac and will provide insight for further analysis of the products and services the blacksmith provided.

The Blacksmiths at Fort Michilimackinac

The blacksmith was essential to the fur trade at Fort Michilimackinac because of the community's significant dependence on imported goods and supplies, which came from larger socio-economic centers such as Montreal during French occupation (1715-1760) and from Albany through Fort Niagara during British occupation (1761-1781) (Luzander et al 1976; Kent 2001 & 2004). Even though the blacksmith was relied upon to maintain a certain level of integrity of the goods and supplies used within the community, he too suffered from the limited availability of supplies. "Labor consumes products in order to produce products" (McGuire 2000: 104), and the blacksmith and his work are the perfect example of this dynamic. Not only was the blacksmith depended on for production and repair services, he also faced the same shortages in supplies that drove the demand for his work. The availability of materials would have been affected by global politics and economic trends. Supplies came slow to Fort Michilimackinac due to the harsh weather conditions and the remote location of the fort. To compensate for insufficient materials, blacksmiths often built up inventories of parts or scrap material for use in repair or manufacture, collecting numerous pieces of the same item, axe blades for example, in preparation for demands of various repairs (Armour 1976: 25-31; Light 1987: 9; Wylie 1990: 76). It was also common for customers of rural and urban blacksmiths to supply their own metal for repair or construction of items or even to provide scrap metal as payment for services (Ford 1971; Bruegel 2006: 527, 545).

Another important resource that was not imported but dependent upon weather conditions and the availability of quality wood, was charcoal. Charcoal-fueled forges were common during the early 18th century and continued in use within frontier settings until the 19th century.[61] The blacksmith at Fort Michilimackinac relied on charcoal produced locally by military personnel, as evidenced in a letter from Captain George Turnbull to Sir William Johnson, in which he describes fatigue duties, including orders for the "Garrison to cutt wood and Burn Lime and Charcoal" (Morand 1994: 76 citing Johnson 1921-1965, 7: 159).

Within early French missions and fur trade settlements Jesuit priests primarily controlled the work of the blacksmith and the blacksmith's resources (Armour 1976: 25; Boynton 1996: 39; Morand 1994: 22).[62] The varied influence of the Jesuit and French military on individual blacksmiths at Fort Michilimackinac is illustrated by David Armour in his description of blacksmith Jean-Baptiste Amiot (Armour 1976: 25-26). Jean-Baptiste Amiot was first employed at Fort Michilimackinac as a blacksmith by Jesuit priest Father Pierre Du Jaunay around 1724 but was fired after the two had a serious disagreement in 1737 (Armour 1976: 25; Boynton 1996: 39). The French military then employed Amiot, but "the priest, maintaining his monopoly of blacksmithing granted by the King's Memorial, insisted that Amiot pay him one half of

[61] Coal replaced charcoal at a much earlier time within urban and even rural settings (Hyde 1977: 53-116).
[62] It should be noted that this monopoly of blacksmithing that the Jesuits seemed to have is only noted in secondary sources. I have not found direct evidence in primary sources or in discussions of Jesuits at other frontier sites which indicate that Jesuits controlled access to or resources of blacksmithing.

his profits" (Armour 1976: 25). Since the priest's house adjoined the blacksmith workshop, which served as the only forge at the fort, Amiot had no way of avoiding the priest despite being employed by the military.[63] Additionally, after firing Amiot, Father Du Jaunay hired Pascal Soulard to replace Amiot as the community blacksmith, indicating that Amiot not only had to deal with Father Du Jaunay, but also the authority of another blacksmith (Boynton 1996: 39). An inventory of Amiot's work from the time he worked for the French military includes the repair or furnishing of screws, sight beads, sights, cocks, ramrod guides, face plates, a bolt, springs, frizzens and tempering, sears, tumblers, a shoulder strap, and the assembly of fusils; all gun parts or gun related work (Amiot 1747a, 1747b). Other, non-gun related items listed within these work inventories includes picks, axes, tomahawks, daggers, swords, and darts[64] (Amiot 1747a, 1747b). These objects indicate that the blacksmith may have been completing work for military personnel and for the purposes of trade relations between the French military and Native American groups.

The conflicts between France, Great Britain, and the nascent United States of America influenced life at the fort and are illustrated by the complexities associated with the transitions of power and/or influence over civilian laborers, like the blacksmith, who provided services for the community and military. As discussed, French civilians were crucial in maintaining trade activities at the fort, despite the displacement of the French military with the British military following the conclusion of the Seven Years' War.

[63] The workshops identified as Loci A and B in the following sections were located adjacent to the church and may have been workshops in which Amiot worked.
[64] The term 'darts' may refer to arrow points. This is further described in the following chapter in the analysis of projectile points.

French civilians were allowed to maintain the practice of Catholicism and to continue occupation of their homes inside the fort, both of which were mandated by treaty (Widder 1999, 2004; Armour and Widder 1986: 16; Anderson 2000: 16). Craftsmen like blacksmith Jean-Baptiste Amiot were allowed to continue working during this time period and aided in the maintenance of alliances between the French, Native Americans and British. Regardless of the British presence and trade policies, the French and Native Americans continued trade according to previously defined relationships and practices, which included the maintenance of arms and ammunition, something Amiot may have been involved in facilitating. The presence of French civilians inside the British fort, in addition to the reliance upon these civilians to maintain the local economy, created a contentious political climate. As described in Chapter 2, the British trade policies (i.e. requiring a permit and lack of gift giving) did not align with French practices, and vice versa, and created situations that favored French-Native American trading while nurturing resentment for the British presence (Ewen 1990; Stevens 1916; Thomas 1988). Following agreements between the British, French, and Ottawa, who negotiated the trade policies and gift giving to be reinstated in British trade practices after Pontiac's Rebellion, the British military implemented services and routinely provided gun repair and ammunition free of charge to most Native American traders or community members through a partnership with the Department of Indian Affairs (Johnson 1921-1965, 11: 808). On several accounts, Sir William Johnson reimbursed blacksmiths at Fort Michilimackinac for their work repairing arms and other goods for Native Americans

(Johnson 1921-1965, 11: 808).[65] Yet, the relationship between the Department of Indian Affairs and the British military was not always smooth and disputes affected the task of blacksmithing (Morand 1994:19). In one instance, Benjamin Roberts, Indian Commissary in 1767 at Fort Michilimackinac, complained to General Thomas Gage that on one occasion, Major Robert Rogers refused Gage's smith access to the forge used by the blacksmith employed by the British military (Morand 1994: 20 citing Gage 1762-1776 Memorandum of Dispute, enclosed Rogers to Gage, Michilimackinac, Sept. 22, 1767).

With the obvious political unrest and the institutional complexities associated with the act of blacksmithing, it should also be noted that there is a high probability that a blacksmith workshop, possibly owned by an independent blacksmith, existed outside the fortification at Fort Michilimackinac. It is known that in 1737, the French commandant Sieur Pierre Joseph Celoron de Blainville provided Jean-Baptiste Amiot with funds to continue smithing for the community since more than one blacksmith was required to maintain the amount of work in demand from traders, Native Americans, military personnel, and civilians (Armour 1976: 25). During this time period, Pascal Soulard was also working as a blacksmith employed by the Jesuit priest, Father Du Jaunay. Additionally, another blacksmith named Michel Girardin was present at Fort Michilimackinac in 1754. Girardin may have been employed by Father Du Jaunay or may have been allowed to operate on his own within a workshop located outside the

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[65] The blacksmith workshop identified as Locus C in the following sections was most likely associated with the British occupation of the fort and spatially associated with several British military buildings. It is likely that the work described here was taking place within the Locus C workshop.

fortification since his presence is only known due to church records from Fort Michilimackinac which recorded his marriage to Marie Hyppolite Favre in July, 1754 (Kelton 1882: 61; Morand 1994: 18, citing Thwaites 1888-1911, 18: 480).

Given this information, at least two blacksmiths may have conducted business at the fort between 1737 and 1754, and it is likely that at least two blacksmiths worked at the fort until 1761 when Britain gained control. The exact *terminus post quem* of two working smiths is not historically documented and contingent upon inference based on the information provided in historical documents.[66] Armour notes that Amiot provided services for the British military in 1763, and sometime after moved to *La Baye* (Green Bay, WI) where he later died (Armour 1976: 26). Additionally, Father Du Jaunay returned to Quebec in 1765 and Fort Michilimackinac did not have a Jesuit priest until 1775 when Father Pierre Gibault arrived (Armour and Widder 1978: 42) and the employment of Soulard and Girardin by the priest would have ended following his departure in 1765.[67] Based on the documentary records and interpretations, the sequence of blacksmiths at Fort Michilimackinac is:

Jean-Baptiste Amiot[68]	1724 – at least 1763
Pascal Soulard[69]	1737 - 1765
Michel Girardin[70]	at earliest 1754 - 1765

[66] Other blacksmiths worked at the fort after the British occupation but historic documents have not been found to identify the individual blacksmiths at the site (Morand 1994: 19-21).

[67] That is not to say that a blacksmith was not employed at the fort after 1765, nor that the workshop was not being used. It is possible that the blacksmiths remained employed (either independently or by the British military) and may have continued working within the same workshop, but there are no documentary records to substantiate this claim.

[68] Given these dates and the term of his employment with Father Du Jaunay and later the British military, it is likely that Amiot worked within the blacksmith workshops identified in the following sections as Loci A, B, and C.

[69] Given these dates and the employment of Soulard by Father Du Jaunay, it is likely that he worked within the blacksmith workshop identified as Locus A in the following sections.

The high demand of work required of a blacksmith would only increase with time as the community at Fort Michilimackinac grew and would have been particularly appropriate during the later settlement period (1761-1781).[71] Moreover, support of the expanding civilian community outside the fort would have required the presence of more than one blacksmith who facilitated easier access than through institutional avenues.[72]

With the onset of the American Revolutionary War (1775-1783), several successful U.S. campaigns along the St. Lawrence River and in the Mississippi Valley caused unease with the position and defensibility of Fort Michilimackinac (Armour and Widder 1986: 161). Despite several modifications made to the fort, Lieutenant Governor Patrick Sinclair claimed the post indefensible and ordered the movement of the fort and associated village to Mackinac Island (Armour and Widder 1986: 161-162). By 1779, due to the movement of the fort, a large amount of iron, approximately 1254 lbs. of new iron and 24 lbs. of old iron was paid for by the British government for work done at Fort Michilimackinac (Certificate of Expenditures March 1780, MPHC vol. 10, 382-83).

While never explicitly mentioned, but possible due to the paucity of documentary sources, a privately owned forge and workshop may have also existed outside the walls of Fort Michilimackinac. A privately owned forge located outside the fort during British occupation (1761-1781) would have better served the civilian community, which

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[70] Given these dates and the employment of Girardin by Father Du Jaunay, it is likely that he worked within the blacksmith workshop identified as Locus A in the following sections.

[71] The presence of a "suburb" is depicted on the 1765 Magra Map (William L. Clements Library, University of Michigan), and has been described by John Askin in 1778 as consisting of at least 100 houses (See Quaife, Milo (ed. 1928) *The John Askin Papers, Vol. I, 1747-1795*. Detroit: Detroit Library Commission, 69).

[72] This scenario would have been more likely during British occupation (1761-1781), but could have supported the increased population prior to 1761, which consisted of French, French-Canadian, and various Native American groups, including the Ottawa and Ojibwa who lived in established villages near the fort.

potentially included the French, Métis, and Native communities). The location of the blacksmith workshop inside the fort and the potential location for a workshop outside the fortification are further discussed in the following sections.

With the complex social and political history of the site, the presence of craftsmen, particularly the blacksmith, would have aided in sustaining the social order. Conversely, the continued presence of French craftsmen may have supported passive protest and the continuation of French trade relationships established prior to British occupation. Throughout the periods of political instability and military changes, the blacksmith would have remained a constant necessity to all members of the community. Examining the characteristics of blacksmithing within this changing setting provides a better understanding of daily life within the frontier environment. The presence of the blacksmith was due to the fur trade, European expansion, and the European and colonial markets. Understanding the ways in which the blacksmith was influenced by large-scale processes of colonial imperialism and processes of empire building helps provide context to the daily interactions of the blacksmith with the community at Fort Michilimackinac, which may or may not have been directly impacted by these larger, outside forces. This complex understanding of the blacksmith as a producer, maintainer, and consumer of material culture transmits the interconnection of global activities, which would have influenced regional supplies, with the local negotiations of these processes for the maintenance and local production of goods. The spatial characteristics in which this is reflected help to identify the location of the blacksmith and the extent to which his services were utilized by the community within the fort at Fort Michilimackinac. The following sections describe the archaeological attributes of blacksmithing and begin to identify the characteristics of the material culture related to his presence.

Interpreting and Reinterpreting Spatial and Material Attributes of the Blacksmith at Fort Michilimackinac

Archaeological data pertaining to the blacksmith work areas at Fort Michilimackinac were collected during the 1960s. Reanalysis of the stratigraphic and artifactual information resulted in the identification of the core features of blacksmithing workshops (work area, domestic area, and storage area) within three different areas of the site. The chronology of each workshop was also reassessed through reanalysis of the stratigraphy, artifacts, and documentary evidence. The goals of reanalyzing this data were to: 1) confirm the presence of a blacksmith workshop; 2) identify the chronology of blacksmithing; and 3) identify activity areas within the workshops at the site.

Reanalysis of archived archaeological records that detailed the original excavations associated with several areas of potential blacksmithing activities confirmed the location of one blacksmith workshop initially identified during the 1960s and identified two additional areas that exhibited characteristics of blacksmithing. Application of the model for identifying a frontier blacksmith workshop led also to the determination that a blacksmith shop previously interpreted by Maxwell (1960) does not exhibit the characteristics of a blacksmith shop. Each smithing area was associated with a different time period of the fort. The following sections detail the methods and results of applying the model outlined in Chapter 3 for identifying the spatial characteristics specific to frontier blacksmithing contexts. [73]

Loci	Archaeological Excavation	Original Identification	Reinterpreted Identification	Reinterpreted Date Range	Proposed Associated Blacksmith
Locus A	Excavated by Stone 1966 and Brown 1968	Previously Unidentified	Early French Blacksmith/ Gunsmith Workshop	c. 1725 – c. 1740	Possibly used by Amiot, and/or Soulard
Locus B	Excavated by Brown 1967	French Gunsmith Workshop	French Blacksmith Workshop	c. 1740 to 1765	Possibly used by Soulard, and/or Amiot
Locus C	Excavated by Binford 1961	Previously identified as a Brick Kiln	French and British Blacksmith Workshop	1751 – 1765	Possibly used by Girardin, Amiot, and/or Soulard
Locus D	Excavated by Maxwell and Binford 1960	French Guardhouse/British Blacksmith Workshop	Determined not to be a blacksmith workshop	c. 1761 – 1781	

Figure 4:1 Table summarizing the excavation and interpretation of three areas of blacksmithing activities at Fort Michilimackinac.

In applying the model, Locus A was discovered and identified as a pre-1740 French blacksmith workshop associated with the French period and church complex area. Locus B, the post-1740 French blacksmith/gunsmith workshop (1740 – 1748), previously excavated and identified by Brown in 1967 was confirmed and activity areas were identified within the shop. Locus C, a post-1751 expansion blacksmith workshop, previously excavated and identified as a brick kiln by Binford (1961), was reexamined and identified as a probable blacksmithing feature. This area would have been in use during the late French and early British occupations. Finally, Locus D was determined

[73] The 'model' refers to the archaeological signatures described in the previous chapter. This model is drawn from Light (1987) and was added to in order to account for more of the spatial characteristics in each of the three activity areas typical to a blacksmith workshop.

not to be a blacksmith workshop as was originally interpreted by Maxwell and Binford (1961). All three blacksmithing workshops, Loci A, B and C, were in operation during some portion of the French occupation and were located within the fortification. It is highly probable that an additional blacksmith workshop was located outside the fort walls. However, to date, few excavations have been conducted outside the fortification, and none have, thus far, uncovered features related to blacksmithing.

Previous Excavation Methods of the Blacksmithing Areas at Fort Michilimackinac

All of the potential blacksmithing areas within the walls of Fort Michilimackinac were excavated during 1960 by Moreau Maxwell (Locus D), 1961 by Lewis Binford (Locus C), 1966 by Lyle Stone (Locus A), and 1967 by James Brown (Locus A and B). The original site records and artifactual materials from these excavations were used in this study. Methods of excavation included screening soils through 1/4 mesh inch screens with the exception of feature soils which were screened through 3/8 inch mesh screens (Maxwell 1960; Binford 1961; Stone 1966; Brown 1967). Levels were excavated following a combination of natural stratigraphy and arbitrary, three inch intervals, within ten foot by ten foot square units (Maxwell 1960; Stone 1966; Brown 1967). In 1966 soil samples were taken during excavation; this information is not described within the excavation report (Stone 1966), but is based on catalog records.

When excavations took place during the 1960s the stratigraphic characteristics of the site were not completely understood and "The complicated nature of stratigraphy at Fort Michilimackinac has resulted in several misinterpretations of the sequence and dating of deposits" (Whitaker, 1998: 45 citing: Maxwell and Binford 1961: 21-26; Brown 1967: 29).

Stratigraphy of Fort Michilimackinac

Soil Time Period	Texture/Color	Inclusions
Post-1933 Top Soil	Sod/sand	20th century debris
1933 Park Reconstruction	Black sandy loam	Mixture of colonial and post-fort artifacts
1781 Demolition	Brown sandy loam	Clay, chinking, plaster, charcoal, stones and/or wood, colonial artifacts
1761-1781 British Occupation	Brown sandy loam	Features of chinking, clay, stone charcoal, primarily British and some French colonial artifacts
1730-1761 French Era	Grey sand	Features of chinking, clay, stone charcoal, French colonial artifacts
1730s Clearing of Site for Expansion	Charcoal and grey sand	Features of chinking, clay, stone charcoal, lenses of refuse
1715-1730s	Grey sand	Features of chinking, clay, stone charcoal, French colonial artifacts
Some Prehistoric Native American features	Light colored sand	Mostly stone tools, some charcoal
Algoma Beach Sand	Very light yellow sand	Sterile, pebbles and rocks

Figure 4:2 List of strata and associated cultural material and context at Fort Michilimackinac.

Today, the stratigraphic nature of the site is well understood due to changes in the excavation methods,[74] and the culmination of archaeological information from Brown

[74] Excavation techniques at Fort Michilimackinac were modified during the 1980s. Each 10 foot by 10 foot unit is now divided into quadrants in order to better record and control the excavation, and levels are

(1992), Heldman (1984), Heldman and Grange (1981), Halchin (1985), Whitaker (1998), and Reck (2004). One of the benefits of reexamining the stratigraphic nature of previous interpretations is the application of more complete knowledge concerning site formation, which ultimately leads to more accurate analysis of stratigraphy, material culture, and chronology. A series of major stratigraphic features represent distinct temporal periods and formation processes. These are summarized in Figure 4:2.

Reexamining the stratigraphic information from each proposed blacksmith shop included remapping the areas based on the original field plan maps. The software *Adobe Illustrator* was used to compile the drawings from the original plan maps. Several challenges were addressed when creating these maps, including the ambiguity of the original measurements, variation in identifying soil composition and color, and the absence of descriptions of potential features described in the excavation reports. Redrawing the features, post molds, and wall trenches was completed based on relative association of recorded levels. The current understanding of the stratigraphic nature of the site was used to interpret the associations between recorded soil color and composition for all units and levels.[75] From these drawings, comprehensive maps and artifactual information was paired with current stratigraphic information to identify probable areas of blacksmithing, including the archaeological remnants of a forge, anvil base, bellows, and overall architectural characteristics of the blacksmith workshop. The

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excavated in 0.1 inch intervals unless a new soil horizon is discovered, at which point a new level is begun (Heldman and Grange 1981). Strata are also identified using a Munsell color chart and are given an alpha-numeric identifier which indicates continuous strata similar to the Harris Matrices Index (Reck 2004). All excavated soil is now water screened. These modifications to excavation techniques have allowed for more thorough data collection and detailed archaeological assessment.

[75] The current stratigraphic knowledge refers to knowledge gained after the 1960s excavations and that the Munsell color chart was not used during original excavations.

following sections describe each potential blacksmithing area in terms of previous interpretations, artifactual and spatial properties, chronological viability, and summarizes the results by either denying or confirming the area as related to blacksmithing and placing the results within the history of blacksmithing at the site.

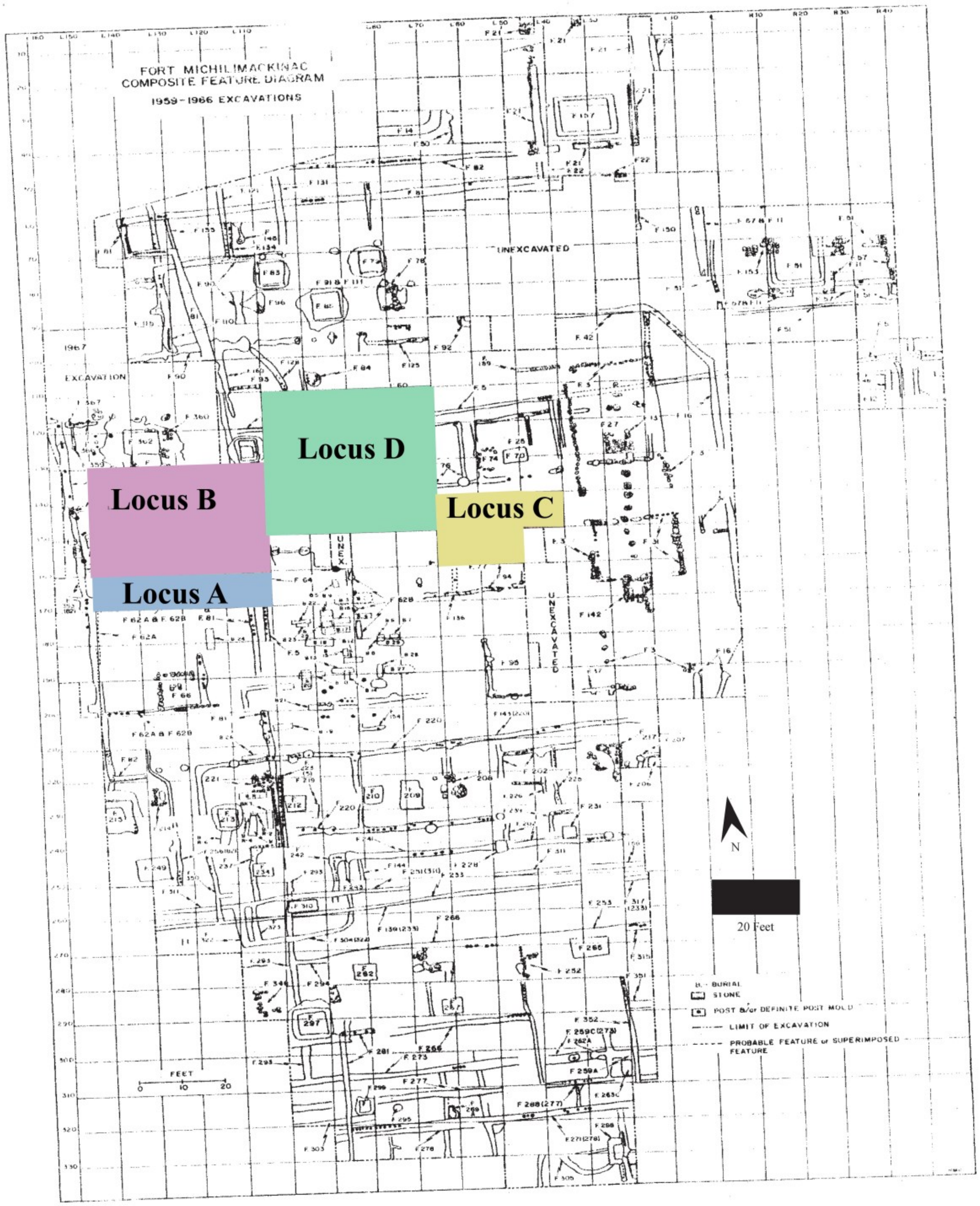

Figure 4:3 Location of each area reanalyzed for the purpose of identifying blacksmith workshops as highlighted on Stone's (1974: 333 Figure 199) plan map of excavations at the site. These areas included locus A, an early French blacksmith workshop (c. 1725-c. 1740), locus B, a French blacksmith workshop (c. 1750-1765); locus C, a late French and early British blacksmith workshop (1751-1765). Locus D was determined not to be a blacksmith workshop.

Locus A: Early French Blacksmith/Gunsmith Workshop, circa 1725 – circa 1740

Locus A was excavated during the 1966 and 1968 field seasons by Lyle Stone and James Brown, respectively. The blacksmith workshop was found within units 160L120, 160L130, 170L120, and 170L130. During the reanalysis of locus B, it became apparent that the area defined as locus A exhibited archaeological attributes consistent with a blacksmith workshop that dated from circa 1725 to circa 1740. It is not impossible, given the data already reviewed, that the presence of a blacksmith workshop may go unnoticed for some time. Reinterpretation and a broad lens of examination provide an opportunity for current researchers to 'see' what was previously unidentified. James Brown commented on this phenomenon in his reinterpretation of data associated with the priest's complex, stating that "None of the features [from the 1966 excavations] were recognized at the time of excavation as belonging to the Priest's House…" (Brown 1992: 5). Yet, Brown is able to interpret an entire "priest complex" by reexamining the archaeological archives, historical records, and comparing data with more recent stratigraphic information. Based on this research, the stratigraphy and archaeological contexts recorded during the 1966 and 1968 excavations were reexamined and another blacksmith/gunsmith's workshop associated with the priest's complex was identified as locus A.

Locus A produced 986 metal artifacts and included 122 gun parts, 466 pieces of scrap, and 22 metal implements.[76] Artifacts specific to gunsmithing and blacksmithing activities found within this area included 1 gunmaker's tool, 1 gunmaker's rasp, 1 wedge,

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[76] Metal implements included strap, staples, spike, shovel, rivets, rasp, punch, projectile point, pipe, gouge, gorge, fishhook, chisel, axe, awl, pail, knife, hook and hammer.

1 punch, 2 chisels, 1 hammer fragment, and 2 rasps. The amount of metal, the variation in types of metal objects, and the large number of gun parts in close provenience to gun repair tools provides the most definitive assemblage of material culture indicative of a gunsmithing workshop. The presence of Micmac pipes, catlinite, Native American pottery, and bone tools indicate the probability that a French or Métis smith worked in the shop. It is likely that Amiot worked within this workshop until he was replaced by Soulard (Armour 1976: 24). Other French associated artifacts recovered from locus B include faience ceramics and tan or beeswax colored gunflints.

Structurally, the locus A workshop would have been rectangular in shape with the south wall abutting the north wall of the church. This is based on the presence of Feature 64 which is reinterpreted here to be the remnants of a forge, feature 337 which is likely the remnants of an anvil base (see Figure 4:8), and the fact that the trench walls are grey in color, something characteristic of French era stratigraphy (see Figure 4:2). Two pieces of a pipe with mortar were recovered in 160L120 with a significant amount of barrel strap. These artifacts support the interpretation of Feature 64 as the remnants of a forge and may be remains of a *tuyère* pipe and slack tub. Additionally, the presence of a charcoal and clay concentration in 160L130, designated as Feature 329, is also characteristic of blacksmithing activities. The work bench area is tentatively labeled in Figure 4:8 based on the large amount of window glass recovered from 160L130 (115 fragments), which is drastically absent in the other relevant units.

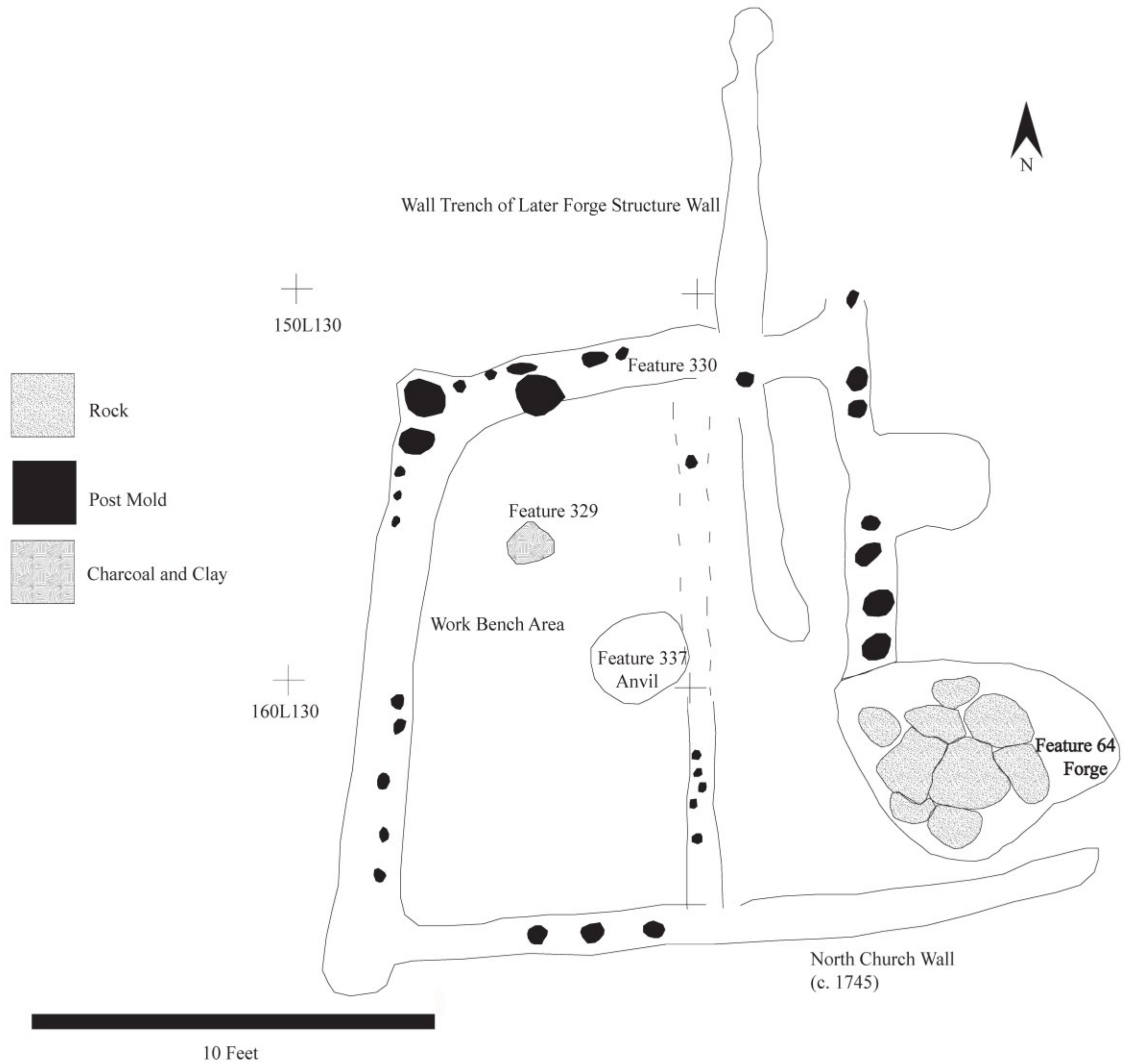

Figure 4:4 Activity areas related to blacksmithing and gunsmithing in locus A were identified following the application of the blacksmith workshop model. Reinterpreted from a compilation of Stone (1966), Brown (1967), and plan maps.

Chronologically, the definite *terminus post-* and *ante- quem* are difficult to interpret because there were multiple phases of renovation and building during the early French period of the fort. The church constructed inside the fort dates to circa 1725-1735 fort stockade (Stone 1974: 313, 315; Heldman 1991: 205; Heldman 1993: 406; Brown 1992: 5-10; Evans 2007: 6). It was then replaced by a larger church in the early 1740's and was located inside the fortification (Stone 1974: 316). Given the location of the church's north wall trench feature identified in the reanalysis of locus A and the documentary evidence that the church was rebuilt about 1740 (Stone 1974: 350) following the construction of the 'ante-penultimate stockade' (Stone 1974: 315), it is likely that the locus A blacksmith workshop was in use prior to 1740 and may have been constructed shortly after the first church was built at Fort Michilimackinac circa 1725 given the close association of the Jesuit priests to the blacksmith as documented during later French occupation (Armour 1976: 24). The artifact assemblage is also consistent with early French occupation. The presence of tin-glazed ceramics and Native American ceramics are common assemblages associated with what Stone (1974: 349-350) refers to as the "Early French Occupation 1715 to 1725 (1735)." Given the circa 1725 – circa1740 date range, it is likely that Amiot and Soulard (after 1737) worked within this workshop under the supervision of Father du Jaunay.

Locus B: French Blacksmith Workshop, circa 1750 to 1765

The blacksmith workshop identified within locus B was originally excavated during the several field seasons in the 1960s: Maxwell in 1960, Binford in 1961, Stone in 1966 and Brown in 1967. Brown (1967) identified it as a gunsmith workshop dating approximately from 1735 (the year that expansions were completed) to 1749 (as it is depicted on 1749 Lotbinière map). Reanalysis suggests a date of 1740 to 1748 based on the stratigraphic context of the trenches associated with the church and other juxtaposed features. In contrast to Brown's conclusion that this area was a gunsmith's workshop, analysis of the artifact assemblage indicates that a variety of items were being repaired and/or produced within this area. Therefore, locus B is referred to as a blacksmith workshop at this point forward in this discussion.

The stratigraphic information concerning the locus B French blacksmith workshop was recorded during excavations conducted in 1961 and in 1966-1967. It is contained within ten foot by ten foot units numbered 150L120, 150L130, 150L140, 160L120, 160L130, and 160L140 (see Figure 4:5 and Figure 4:6). Locus B is contained within what Brown (1992) describes as the priest's complex, and included a portion of the church, priest's house, small cemetery, and blacksmith shop. Reexamination of the original interpretations (Maxwell 1960, Stone 1966), the reinterpretation by Brown (1967, 1992), original plan maps, and artifactual data, provided a clearer, more comprehensive understanding of blacksmithing activities within this area.

Locus B: Previous Excavations and Interpretations

Lyle Stone conducted excavations in 1966 in order to investigate the area of the priest's house north of the reconstructed 1740 church (Stone 1966: 1). The archaeological features that Stone (1966), and later Brown (1992), interpreted as part of a smithing workshop include a North-South, East-West trench feature, designated as Feature 330. The trench runs along the south edge of unit 170L130 into the north edge of unit 160L130. Stone (1966:18) tentatively interpreted this feature as the West wall of an enclosed forge workshop. The fill located to the East and South of this trench was interpreted by Stone (1966:18) as forge fill or rubble that would have made up the base of the forge. The soil composition, which included charcoal, ash, cinders, and pink clay lenses are consistent with the archaeological attributes of a forge as described in Chapter

3. The artifacts recovered from this area are also consistent with blacksmithing activities and include 192 unidentifiable metal fragments, 90 brass sheet fragments, 82 nails, and 14 gun parts (Stone 1966: 18). Unfortunately, a temporal range for this feature is not provided by Stone. He cited the presence of numerous superimposed structures and trench features as the reason why a temporal classification for this area was not feasible. According to Stone, these trench features also distorted the feasibility for identifying the extent and boundaries of the possible workshop area. Given the complex nature of the archaeological record, Stone was unable to identify a temporal range and the limits of the workshop features.

In 1992, James Brown wrote a comprehensive report about the priest's complex. In it, he describes what he terms the 'forge structure' which Stone had identified in his 1966 excavation report. Following a more detailed examination of the associated trench features uncovered by Stone's excavations and the subsequent excavations of the priest's complex in 1967, Brown states that the forge element of the priest complex was constructed about the same time of the priest's house complex; sometime after the first expansion of the fort, which occurred from 1734 to 1735. Since the structure is not depicted on the known historic maps of the site dating after 1765, it was argued that the forge structure was dismantled prior to 1765[77] (Magra 1765, Crown Collection circa 1766-1769, Nordberg circa 1769).

Even though Brown reinterpreted the blacksmith area briefly in his discussion of the priest complex in his 1992 report, which drew on all of the available archaeological

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[77] Brown drew his conclusions based on the accepted date of 1766 for the Magra Map at the time of his anlaysis. Subsequent research has shown that the Magra Map dates to 1765 (Dunnigan 2008).

data, the blacksmithing area was not discussed in detail. The relevant data were summarized within Appendix C (a mere 1 ½ pages), which highlighted the dimensions of the workshop, its age, constructional elements, and features (Brown 1992). Artifacts were not described and activity areas within or outside the workshop were not detailed. Moreover, since artifacts are not analyzed in association with stratigraphic features detailed by Brown (1992), it is not known whether artifact analyses were included in the formation of the chronology of the forge and workshop, or reanalyzed in the same manner as the stratigraphic information from this area. In other words, Brown may have relied upon the positioning of features and Stone's previous interpretation of this area to make his conclusions regarding the "forge structure." Any reanalysis of the features are not presented by Brown (1992); composite plan maps of this area do not appear within the report and remain in the field records.

Stone 1996 (Plate 2)

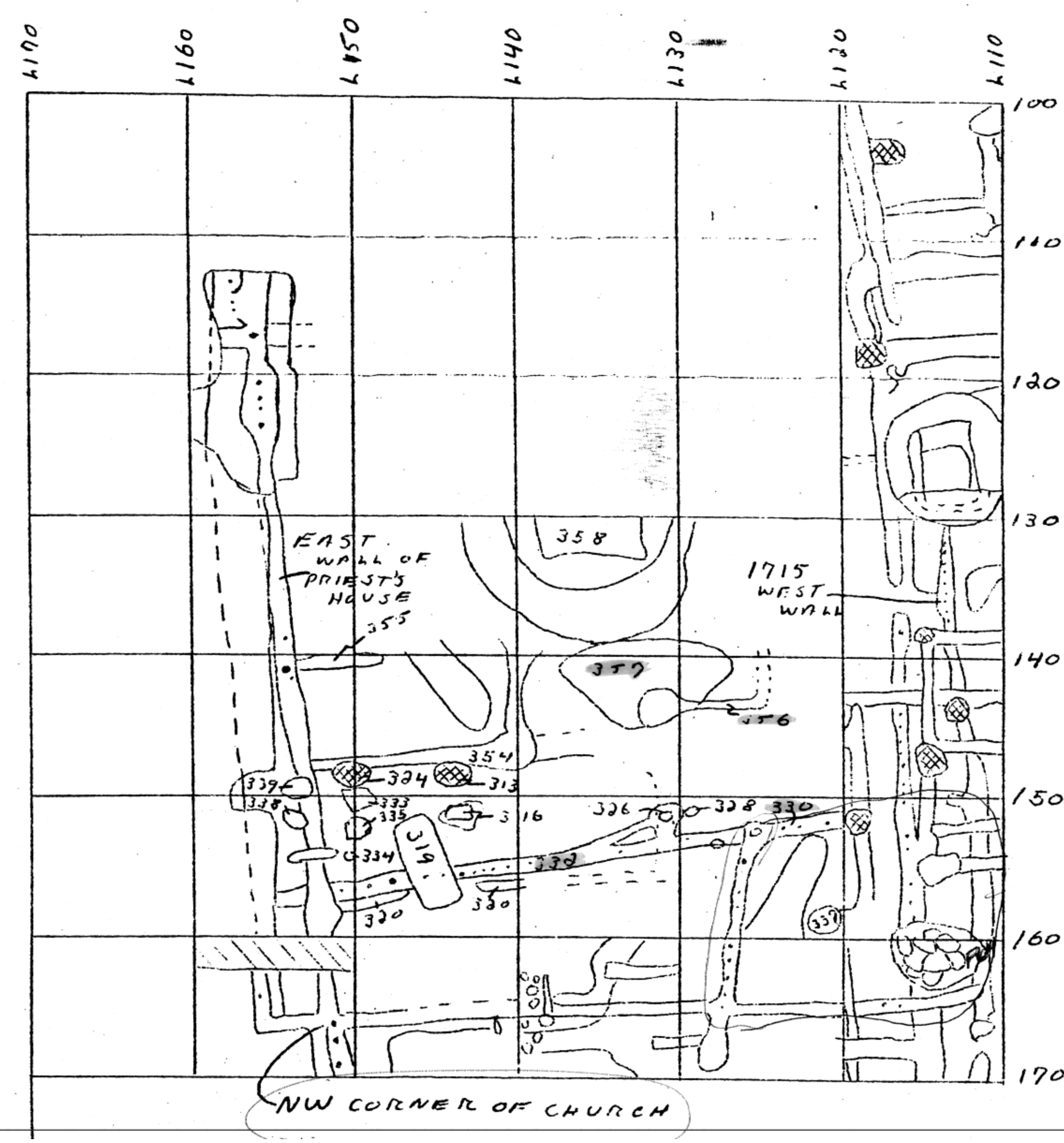

Figure 4:5 Illustration of 1966 excavations showing area of locus B (Stone 1966: Plate 2). Features 330, 357 and 356 are related to the blacksmithing activities of locus B. Feature 332 is the pre-1740 wall trench of the church. Feature 319 is a burial that dates to after 1740 and which aided in reanalyzing the date range for locus B to 1740-1748 (this information is presented in the following subsection).

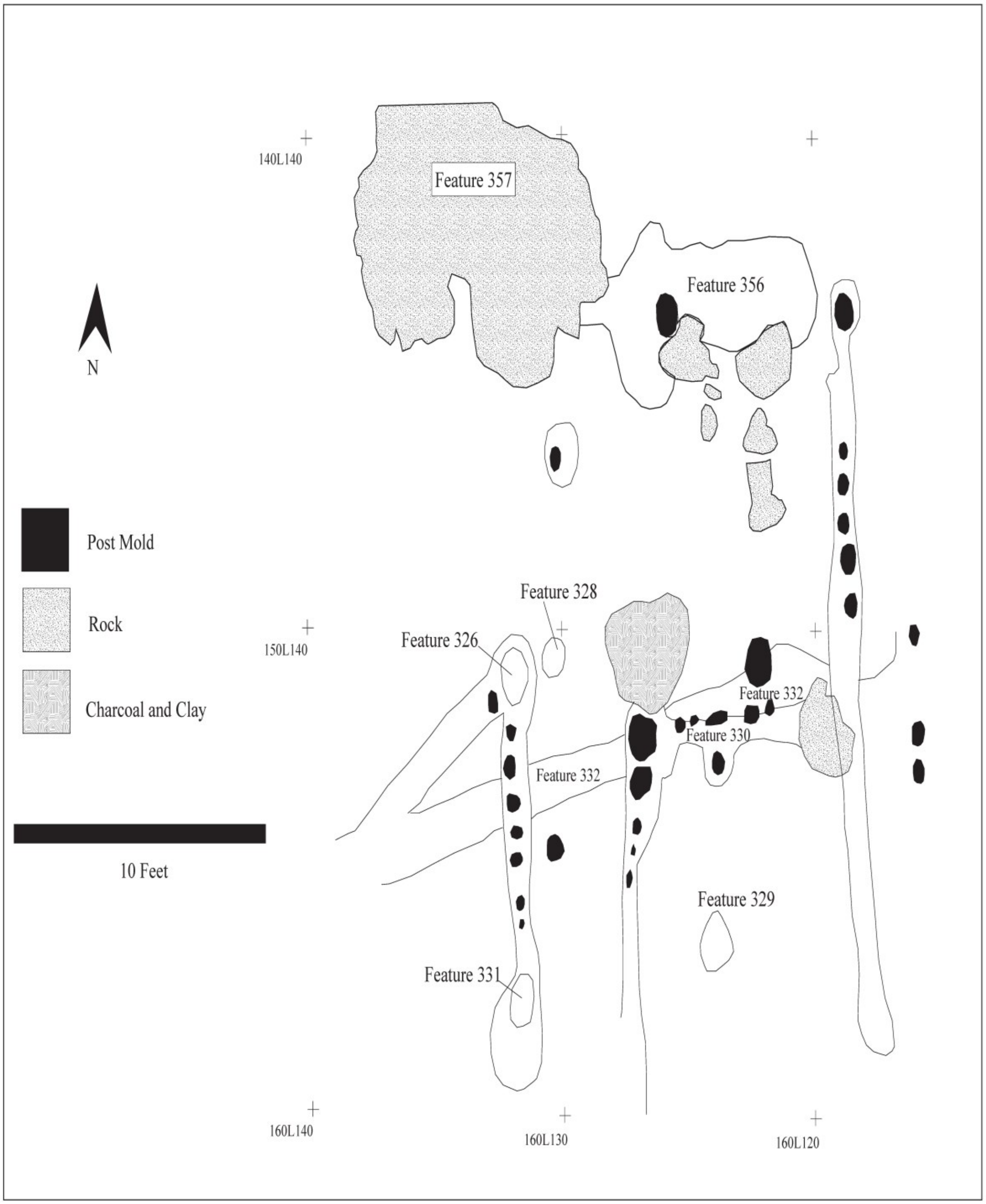

Figure 4:6 Locus B, redrawn from sketch map done by Brown of the 1967 excavations in blacksmith area. Features 330, 356 and 357 were described by Stone (1974) as indicators of a blacksmith workshop and forge.

Combining elements from each of Stone's (1966) and Brown's (1992) analyses provided a more comprehensive understanding of their findings. Brown described the workshop as having been constructed in the French *pied-en-terre* (or vertical post-in-trench) architectural style, 14 feet by 14 feet, and evidence of an east to west ridge pole which indicates the presence of a gabled roof (Brown 1992: 19). This architectural element of blacksmith workshops is typical at other French-era forts, as illustrated by the 17th century armourer workshop at Fort Pentagoet, Maine (Faulkner 1986). Larger post-holes indicate the presence of load bearing posts with smaller posts between them to form the north, west, and east walls of the shop (Brown 1992: 19-20). No wall trench was discovered to signify the presence of a south wall, thus, indicating the possibility of an open-air forge described at other blacksmith sites by Faulkner (1986: 68) and Brown (1980: 243). A doorway was interpreted to be present in the northern portion of the west wall. The location of the forge is a bit confused as the rough sketch maps (Figure 4:4, Stone 1966: Plate 2) indicate it was located along the south-eastern portion of the west wall. However, Brown states that: "A group of large field stones occupied the eastern half of the northeast corner where they were preserved for observation in the 1966 excavations. These stones were probably the foundation of the forge hearth." (Brown 1992: 20). Feature 357, described initially by Stone as a stone masonry fireplace (Stone 1966: 20), and later a circular refuse pit (Stone 1974: 331), was identified by Brown as the remnants of a forge. The feature (357) contained several large boulders and varied metal tools and artifacts that would be indicative of a blacksmith workshop, including:

> 1 iron knife blade, 1 iron awl, 8 iron gun part fragments, 2 lead musket balls, 10 barrel hoop fragments, 59 nails, 3 chinking fragments, 2 brick fragments, 13 cinders, 40 scrap sheet brass fragments, 2 lumps of molten brass, 60 iron fragments, 1 pintle, 9 green glaze earthenware fragments (most likely French), 2 white delftware fragments, 1 Jesuit ring, 7 light green window glass fragments, 4 clear glass fragments, 6 bottle glass fragments, 20 leached window glass fragments, 4 brass wire fragments, 4 silver straight pins, 1 micmac pipe bowl, and 2 gunflints (Stone 1966: 21).

In summary, Stone (1966) and Brown (1992) identified the north wall of the smithing workshop as feature 356 (rock and refuse pit), the west wall included features 326 and 331 (both post holes), and the east wall trench included several 6-8 inch diameter post molds with a corner post in the north wall measuring 9 x 12 inches (Brown 1992: 19-20). Brown inferred the presence of these large post molds to indicate "the presence of an east-west running ridge pole of a gabled roof" (Brown 1992: 19). The forge was identified as feature 357 and contained metal artifacts that are consistent with blacksmithing activities. Chronologically, Brown states that the construction of the workshop coincided with the construction of the priest's house (circa 1750) and was dismantled prior to 1765, with these dates being informed by historic maps (Stone 1974: 337; Brown 1992: 19).[78]

While there is ample evidence for this area inside the fort to be a blacksmith workshop, several questions arise with the overall interpretation of the workshop layout, or spatial characteristics, and chronology. First, if a doorway was located in the western wall, why would it be next to the forge hearth - something that would interfere with the blacksmith's ability to control the heat and air of the fire? Second, if the workshop was

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[78] Brown was using the year 1766 as the date given to the Magra Map at the time. Since then, Dunnigan (2008) conducted further analysis of the Magra Map concluding it likely dates to 1765. This is the accepted date of the Magra Map.

of ‘open-air’ construction, what other constructional elements would be necessary to maintain a work environment during the winter (i.e. is there a way to close off the open wall, furthermore justifying the presence of a door)? Third, how does the artifact distribution within this area support the placement of constructional elements, activity areas, and chronology of the blacksmith workshop? These questions were intrinsically part of the stratigraphic reanalysis of this area and will be answered within the following section about reinterpretation.

Locus B: Applying the Blacksmith Workshop Model and Reanalysis

Reexamination of locus B and the application of the blacksmith workshop model described in Chapter 3, confirmed several of Brown’s (1992) interpretations. Reanalysis also identified archaeological attributes of blacksmithing activities within the workshop area and located the forge, bellows or workbench, and a south wall for the structure. The soil characteristics of the wall trenches and the artifact assemblage that included both French and British material culture confirm the use of this workshop from circa 1750 to 1765.

Most of the artifacts recovered from locus B are associated with French activities but a few artifacts can be associated with the British occupation. It is not surprising that most of the artifacts are French since the proximity of the workshop to the church and documentary records indicate the blacksmith workshop was owned by the Jesuit priest. The blacksmith who worked for the priest within this shop were also French-Canadian (e.g. Amiot, Soulard, and Girardin). Several religious items recovered from this area included Jesuit rings and rosary beads.[79] Artifacts associated with the British occupation of the fort recovered within locus B included kaolin pipes, a cufflink and metallic textile braid typical of British military uniforms, and British creamware. These artifacts were present in upper levels (7-9) of the units within locus B.

Within locus B, two features (357 and 356) exhibited the archaeological attributes of a forge. Feature 357 was identified as forge fill by Brown (1992: 19) and feature 356, located just east of F357, also exhibited the characteristics of a forge (i.e. sand, clay, slag, charcoal, and brick or field stones). Unfortunately, based on information from the 1966 catalog of artifacts, the site's database, and description of these features by Stone (1966 and 1974), no artifacts can be directly tied to feature 356. Generally speaking, however, artifacts from unit 150L130, which contained feature 356, do support the reinterpretation that a forge was contained within the unit. Comparing artifact counts between units 150L130 (containing feature 356) and 150L140 (containing feature 357), the units appear to have very similar artifactual content. Figure 4:6 depicts the raw counts of artifacts from the unit and levels associated with features 356 and 357. The artifactual information indicate that feature 356 also exhibits archaeological attributes associated with a forge.

In terms of archaeological context, Feature 357 is also within close proximity to Feature 358, a hearth area associated with the priest's house (see Figure 4:2, Stone's 1966, Plate 2). It is likely that because the workshop does not appear on historic maps after 1765, the workshop was dismantled or reused. Furthermore, a large number of field

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[79] By the mid-18th century, Jesuit rings had largely lost religious purpose but continued to function as trade items and maintained some popularity (Hauser 1982).

stones, or remnants of a forge, would not be present. The destruction and dismantling of the fort *would* produce significant amounts of chimney fall-over, most likely associated with the priest house hearth (feature 358). Additionally, the location of feature 357 is located outside the walls of the workshop. Yet, due to better artifact provenience information and continuity between Stone's and Brown's interpretation that Feature 357 was remnants of a forge, it cannot be completely disregarded as associated with a forge.[80] In other words, feature 357 is more likely to have been associated with the priest house hearth than with a forge; feature 356 is more likely to have been associated with a blacksmith workshop forge.

	Brick	Charcoal	Chinking	Cinder	Kaolin Pipe	Flint	Projectile Point	Metal	Metal w/o Nails	Slag	Micmac or Catlinite
150L130 (containing Feature 356)	18	20	1	27	5	11	0	217	157	1	3
150L140 (containing Feature 357)	18	34	3	23	6	10	1	135	107	7	1

Figure 4:6 Artifact counts from units containing features 356 and 357.

Brown states that the door to the workshop was located in the northern portion of the west wall, but this may be the location of the bellows and the workbench. With the forge located in the north-eastern area of the workshop (feature 356), the only logical location for bellows would be to the western side of the forge, indicating that the *tuyère*

[80] Feature 357 may also be fall-over from a hearth chimney associated with Feature 356, but as mentioned before, this is unlikely since the stones probably would have been reused or the rubble moved.

pipe entered the forge from the side. The workbench may be indicated by the three post molds in the western portion of the structure. These post molds are closely affiliated with the forge remains and the potential location of the anvil. It remains unclear where the entryway to the workshop was located, but the possibility remains that it may have been located in the northern portion of the west wall.[81]

Brown reported that no south wall was discovered, but there may be a south wall present based on the composite drawings from the archives. Feature 332 is identified as an east-west trench and, upon reanalysis, appears to be a portion of the north wall of the church (Stone 1974:331; Stone 1966:17). Since historic documents stated that a gunsmith workshop was adjacent to the priest's house, it would make sense that the south wall of the blacksmith shop abutted or consisted of the north wall of the church. The church was originally constructed circa 1725 outside the west wall of the fort stockade (Stone 1974: 313). It was then replaced by a larger church in the early 1740's and was located inside the fortification (Stone 1974: 316). If feature 332 is the south wall of the blacksmithing workshop and the north wall of the Jesuit church, the date for the *terminus-ante quem* would follow the 1740-1745 date of the church construction inside the fort, and would have likely coincided with the circa 1750 construction of the priest's house. Additionally, Brown cites the *terminus post-quem* for the workshop as 1765 because it does not appear on the Magra Map. This date is further complemented by the departure of Father du Jaunay from Fort Michilimackinac in 1765 (Armour and Widder

[81] This would address the question pertaining to the closeness of a door to the forge. If Feature 356 was the forge, the location of a door in the west wall would not interfere with temperature control as I had expressed concerns of in the previous section of this chapter.

1978: 42). Therefore, a conservative date for the locus B blacksmith workshop is from circa 1750 to 1765. Given this date range, it is likely that Amiot, Soulard, and/or Girardin worked within this workshop.

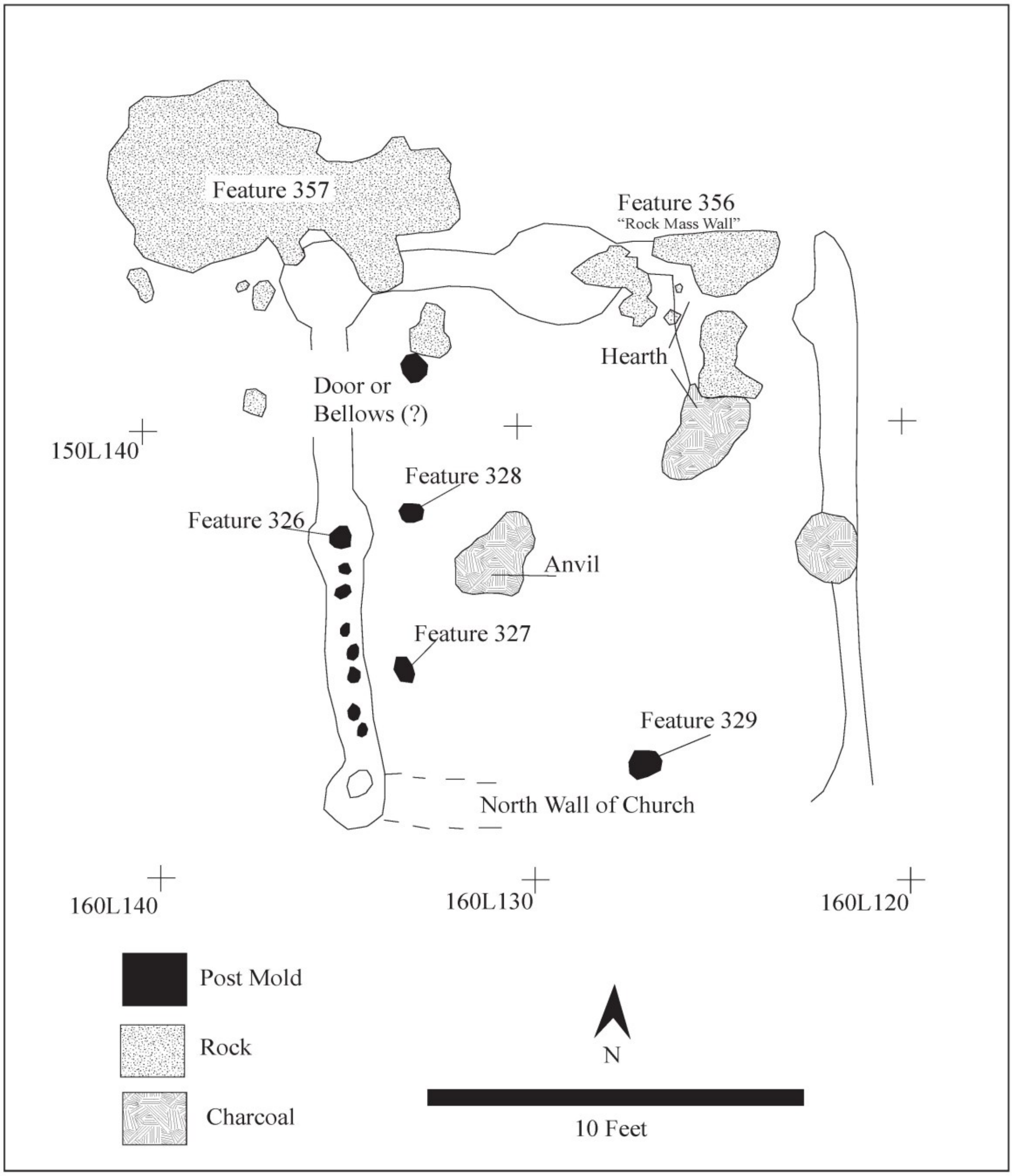

Figure 4:7 Reinterpretation of Stone's (1966) and Brown's (1967) sketch maps and plan maps with the blacksmithing workshop model applied in order to identify activity areas. Note the location of the door, bellows, anvil, forge, and work bench areas.

Locus C: French and British Blacksmith Workshop, 1751-1765

Locus C was excavated in 1961 by Lewis Binford and is contained within units 150L50, 150L60, 150L70, 160L60, and 160L70.[82] Within these units, Binford excavated feature 77, which he identified as a brick kiln dating from circa 1751 (the late French occupation) to 1765 (determined by the absence of the structure on the 1765 Magra Map). There are, however, several problems with the identification of this feature as a brick kiln. The most profound argument against this feature having served as a brick kiln is the fact that local production of bricks and/or ceramics did not take place at Fort Michilimackinac due to the lack of significant clay resources in the area that would support brick making (Morand 1994: 76; Sorensen 1970).[83] Reanalysis and application of the blacksmith workshop model revealed that this feature exhibits the archaeological characteristics consistent with a forge dating from 1751 to 1765.

This feature was originally described as "a long narrow oval depression eighteen feet long, approximately five feet wide with the long dimension orientated almost perfectly with the grid system in an east-west direction" (Binford 1961:27-28). This orientation gives the feature a parallel association with the post-1740 church and near perfect perpendicular orientation with the British Barracks which were constructed from

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[82] Unit 160L50 was not excavated and remains unexcavated as an effort to preserve portions of the archaeological site. Plan maps of the area indicate that the southeastern corner of this feature would be located within unit 160L50.

[83] Another type of kiln used during the 18th century was charcoal kilns, used for the production of charcoal (Zeier 1987: 83-86; Rolando 1991: 18-19). It is not likely that this kiln was used to produce charcoal given the large amount of smoke that charcoal kilns produce. Additionally, Rolando's (1991: 18-19) description of charcoal kilns, which includes several attributes that are not present within this feature, namely that charcoal kilns typically measure 20 feet by 30 feet does not lend weight to an interpretation of this kiln as tool for charcoal production. Charcoal production was taking place at Fort Michilimackinac (Morand 1994: 76) but was likely taking place outside the fort in order to access the appropriate space and resources.

1769 to 1770 (Stone 1974: 332). In his interpretation, Binford described the brick kiln as:

> …below the gravel fill was a dense layer of charcoal, ash pink clay and partially fired hunks of clay. This layer began 24 inches below the present surface and was continuous over the entire length of the feature. Included in this layer were occasional fragments of fired brick and mortar, but yielded in general a relatively sparse sample of cultural material (Binford 1961:28).

In spite of Binford's interpretations, feature 77 exhibited many of the characteristics of a frontier blacksmith forge. It consisted of a layer of brown sand overlain on the western end by black ash and mustard colored clay, and on the eastern end overlain by unfired brick, pink clay, and charcoal. These stratigraphic characteristics are similar to forge attributes described by Light (1984) (see also Figure 3:3) and is similar to Light's (1987) analysis of the forge at British Fort St. Joseph (1796-1812), Fort St. Joseph Island, Ontario. Charcoal would have been the fuel used by blacksmiths at Fort Michilimackinac since coal was not readily available. The mustard colored clay may be local daub used by the French at the site. The ash and sand are attributes of the hearth bed and the brick fragments were likely fill material used to support the forge structure and hearth bed. Other archaeological attributes found in locus C correspond to other frontier forge structural characteristics: "Associated with this structure were 4 post molds, 2 at each western end of the long 'trench' and 2 more opposite each other midway the long dimension" (Binford 1961:29). As previously described, the bellow supports may have been next to the forge structure in order to support a suspended bellow (as shown in Figure 3:3). These post molds may also indicate the supportive remains for a roof structure over the end of the forge. The majority of window glass from this area was recovered from unit 150L60, which may indicate the presence of a window area and could have been related to a workbench.

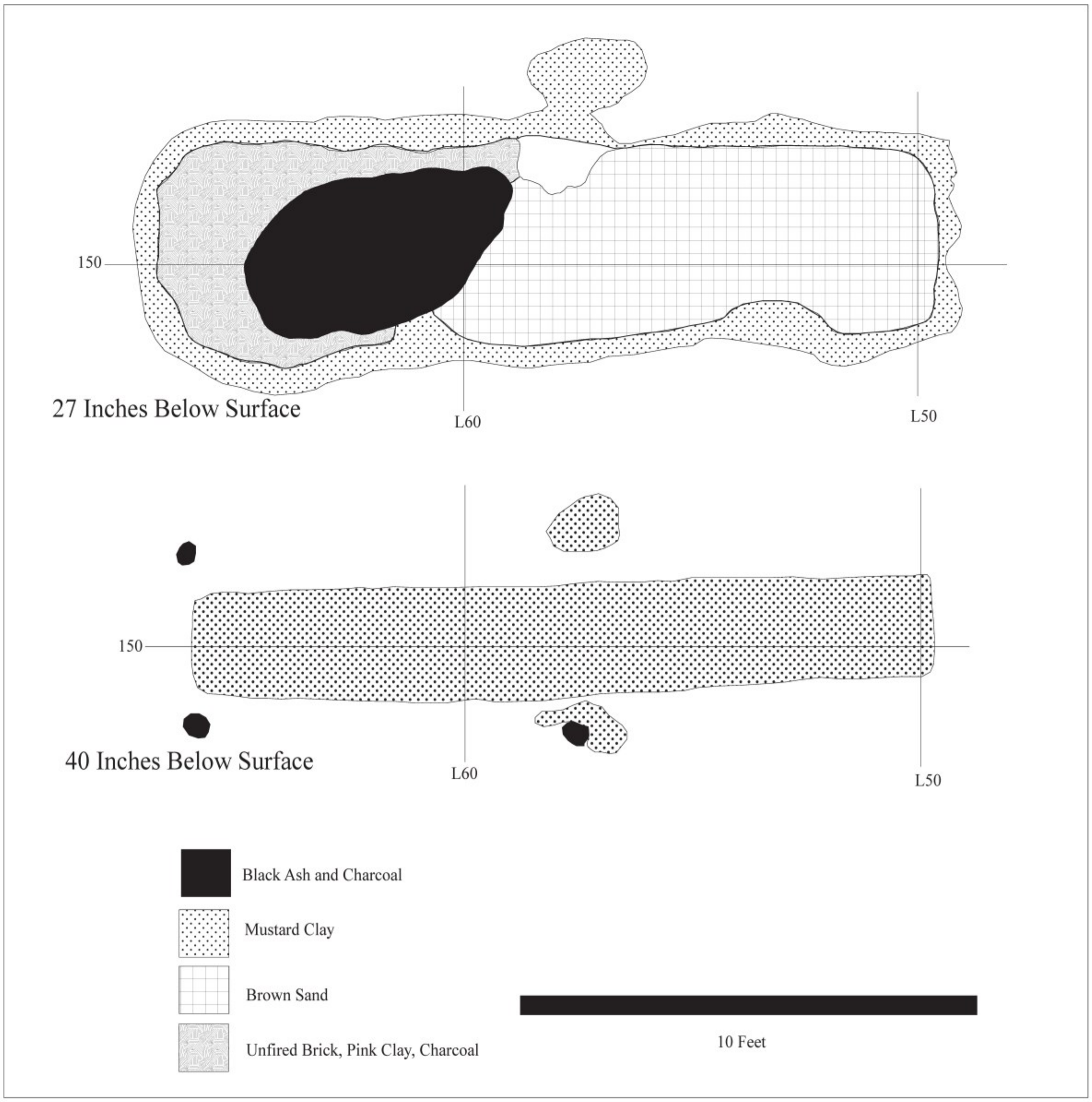

Figure 4:9 Plan map of Feature 77, locus C, redrawn from Binford (1961).

The artifactual material associated with locus C also supports the use of this area as a forge. Only portions of Binford's description of material culture associated with this feature were detailed in the original report. However, while described by Binford (1961:24-25) as a "sparse sample of cultural material," in reality, a number of metal artifacts, scrap metal, tools, gun parts, ceramics, glass, and faunal remains were recovered from locus C. A total of 4,745 artifacts were recovered from the units containing feature 77, consisting of 3,783 non-metal artifacts and 962 metal artifacts (approximately 20% of the artifact assemblage from this area consisted of metal artifacts). Furthermore, only 37 bricks or brick fragments were recorded in the catalog following the excavation, which may be attributed to field collection methods, the reuse of brick material during movement of the fort to Mackinac Island between 1780 and 1782, or simply that there were few bricks at the site. A significant number of diagnostic artifacts found within locus C indicate both French and British period use, and included 34 tan or beeswax colored gunflints, 6 grey or black colored gunflints, 9 flakes of undisclosed color or material, and 2 projectile points. Other gun-related artifacts included: 1 escutcheon, 1 lead flint patch, 1 glazier's point, 3 gun worms, 28 musket balls, 1 ram rod pipe, and 3 gun springs. A diverse metal assemblage found within locus C consisted of:

1 awl	2 whizzers 2 lead/iron discs	1 piece of jewelry (frog shaped pin)
1 rectangular band of iron	1 file tip	1 keyhole plate
3 brass hawk bells	3 fishhooks	4 clasp knives (French)
2 buckles	1 pewter handled tableware	1 brass projectile point
1 military gold textile braid (British)	1 fish gorge	1 Jesuit ring

Chronologically the artifact assemblage and stratigraphic nature of the feature indicate that this feature was in use during the late French period through the early British occupation. The gravel fill layer described by Binford (1961: 24-25) was originally interpreted to be fill from construction activities associated with the British barracks in 1769, but the depth of 24 inches corresponds to the 1781 demolition layer in this area. This depth places the probable age of the feature during the British occupation. Additionally, the current understanding of the stratigraphic nature of the site indicates that the gravel fill located in the strata above the feature may be associated with a landscaping project conducted during the 1930s (Whitaker 1998). Moreover, two French military buttons indicate pre-1761 use of the feature, and one British pewter (pre-1768) infantry button, four other British infantry buttons, and three King's 8th buttons (post 1774) indicate use of the feature during British occupation. It is possible that this feature was constructed between 1751 and 1755 during the second expansion of the French period stockade on the northern portion of the fort (Thwaites 1908(18): 82). Material culture recovered from this area indicates that the structure was built, and in use, during the late French period. Binford infers that the structure was destroyed prior to 1765 since it is not depicted on the Magra Map. It is possible that after the reoccupation of the fort in 1764 following Pontiac's Rebellion the structure was moved outside the fort walls as part of construction efforts to increase the militarized function of the fortification (Morand 1994:7-8; Armour and Widder 1986:11-12). This would account for the absence of the structure on the 1765 map.

In summary, Feature 77 is not a brick kiln but exhibits the archaeological attributes of a forge structure that may have been used for blacksmithing activities at the fort. The structure was built during the late French occupation (circa 1750-1760) and may have been constructed during the last French expansion between 1751 and 1755

(Stone 1974: 316). The need for a blacksmith shop would have been realized when the earlier gunsmith workshop associated with the church was dismantled. It is possible that t\hat structure was dismantled and relocated for use outside the fortification prior to the creation of the 1765 Magra Map. This relocation of a blacksmith workshop outside the fort likely coincided with reoccupation of the fort following Pontiac's Rebellion and with the efforts of Captain Howard to make the fortification more military in function, limiting the need for Native Americans to enter the fort (Armour and Widder 1976: 11-12). Constructing the blacksmith workshop outside the fort walls would have also been safer in terms of fire hazards.[84] As seen in Figure 4:10, the artifact ratios for this area does not conclude metal working activities when compared to the other blacksmith workshop areas. These calculations may be biased since the metal assemblage is primarily composed of nails: 636 of the 962 metal artifacts are nails, or 66% of the metal assemblage. One of the primary purposes of this workshop may have been nail production, particularly if the blacksmith workshop was associated with the last French expansion (1751-1755). Another possible reason for the metal artifact to assemblage ratio lies in the fact that metal was scarce, particularly as demand increased, and if a blacksmith workshop was dismantled and moved outside the fort, the blacksmith would have tried to relocate as much raw and inventoried material as possible. Further excavations of the area surrounding the feature may confirm the use of this structure as a blacksmithing forge.

Locus A: French Blacksmith/Gunsmith Workshop, c. 1725 - c. 1740

[84] This was likely the motive for constructing the bake houses outside the fort as shown on the Lotbiniere Map.

Square	Metal	Non-Metal	TOTAL	NAILS	Percent of Assemblage is Metal, excluding nails
170L120	75	142	217	no nails	35%
170L130	60	143	203	no nails	30%
160L120	181	518	699	72	16%
160L130	670	332	1002	219	45%
TOTAL	986	1135	2121	291	33%

47% of assemblage is metal (including nails)

Locus B: French Blacksmith Workshop, 1750-1765

Square	Metal	Non-Metal	TOTAL	NAILs	Percent of Assemblage is Metal, excluding nails
150L120	88	487	575	no nails	15%
150L130	330	499	829	94	28%
150L140	367	348	715	129	33%
150L150	199	374	573	125	13%
160L120	181	518	699	72	16%
160L130	670	332	1002	219	45%
160L140	413	323	736	105	42%
160L150	331	461	792	214	2%
TOTAL	2579	3342	5921	958	27%

44% of assemblage is metal (including nails)

Locus C: French and British Blacksmith Workshop, 1751-1765

Square	Metal	Non-Metal	TOTAL	Nails	Percent of Assemblage is Metal, excluding nails
150L70	61	356	417	29	7%
160L70	157	1120	1277	101	4%
160L60	214	890	1104	133	7%
150L60	467	1035	1502	337	9%
150L50	63	414	477	43	4%
TOTAL	962	3815	4777	643	7%

20% of assemblage is metal (including nails)

Locus D: French Guardhouse-British Blacksmith Area

Square	Metal	Non-Metal	TOTAL		Percent of Assemblage is Metal, excluding nails
120L100	28	88	116		24%
120L90	20	77	97		21%
120L80	42	183	225		19%

130L100	60	399	459	13%
130L90	58	196	254	23%
130L80	50	112	162	31%
140L100	245	754	999	25%
140L90	35	189	224	16%
140L80	17	139	156	11%
150L90	16	136	152	11%
150L80	6	75	81	7%
TOTAL	577	2348	2925	20%
	20% of assemblage is metal			**(Note: Nails were not recorded for this unit)**

Figure 4:10 Metal and non-metal artifacts recovered from units of potential blacksmithing areas.

Locus D: Reinterpretations of the French Guard House – British Blacksmith Shop

In 1960, Moreau Maxwell conducted excavations in locus D that led to the interpretation that a British era blacksmith shop was constructed directly over the foundations of an earlier, French era guardhouse (Maxwell 1961). Reinterpretations of locus D suggest that this structure was in fact, not a blacksmith workshop, but rather a French house dating from circa 1725 to circa 1740. Locus D lies within units 120L80-100, 130L80-100, 140L80-100, and 150L80-100 (Maxwell 1960:1-2, 11-12). The following sections describe the excavations and interpretations of Maxwell (1961) and Stone (1966) and then reanalysis of locus D after applying the blacksmith workshop model.

Locus D: Previous Excavations and Interpretations

Plan maps of the fort indicate that the French guardhouse was constructed during the "First Expansion" period, 1734-1735 (Maxwell 1960: 2, 10). According to Maxwell, the building continued in operation until at least 1767 (Maxwell 1960: 10).[85] The remains of vertical posts and chinking support indicate French era architectural style. Maxwell proposed that sometime after 1767, the guardhouse was demolished and a new structure was built directly over the old foundation, giving it the dimensions of 32’2” north to south, and 20’10” east to west (Maxwell 1960: 11-12). Evidence of this newer structure was interpreted by Maxwell as a British blacksmith shop (Maxwell 1960: 12). The distinguishing feature for this explanation is designated feature 61, which was a trench feature (See Figure 4:). He proposed that the smithing shop was directly on top of the guardhouse walls (feature 61) (Maxwell 1960: 11-12). The foundation of the blacksmith shop is not clearly defined since it was built directly over the remnant walls of the guardhouse, yet, Maxwell was able to distinguish construction characteristics that indicated both French style (post in trench) and British style (horizontal log) construction (Maxwell 1960:11-12). Maxwell states that further chronological interpretation is problematic, partly due to what he refers to as numerous disturbances from relic hunters in the workshop area (Maxwell 1960: 2). Despite this, Maxwell designated 1774 as the *terminus post quem* for the workshop (Maxwell 1960: 2). This date is informed by an artifact assemblage consisting of creamware, rounded leached glass bottles, and British King’s 8th buttons (circa 1774) recovered from a cellar feature within the building. In summary, Maxwell states that the blacksmith shop was in operation from sometime after 1769 to at least 1774.

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[85] Maxwell determines this date based on the presence of the structure on “maps of that period” but does not refer to a specific map. It is likely that Maxwell is referring to the 1769 Nordberg map, but it remains unclear.

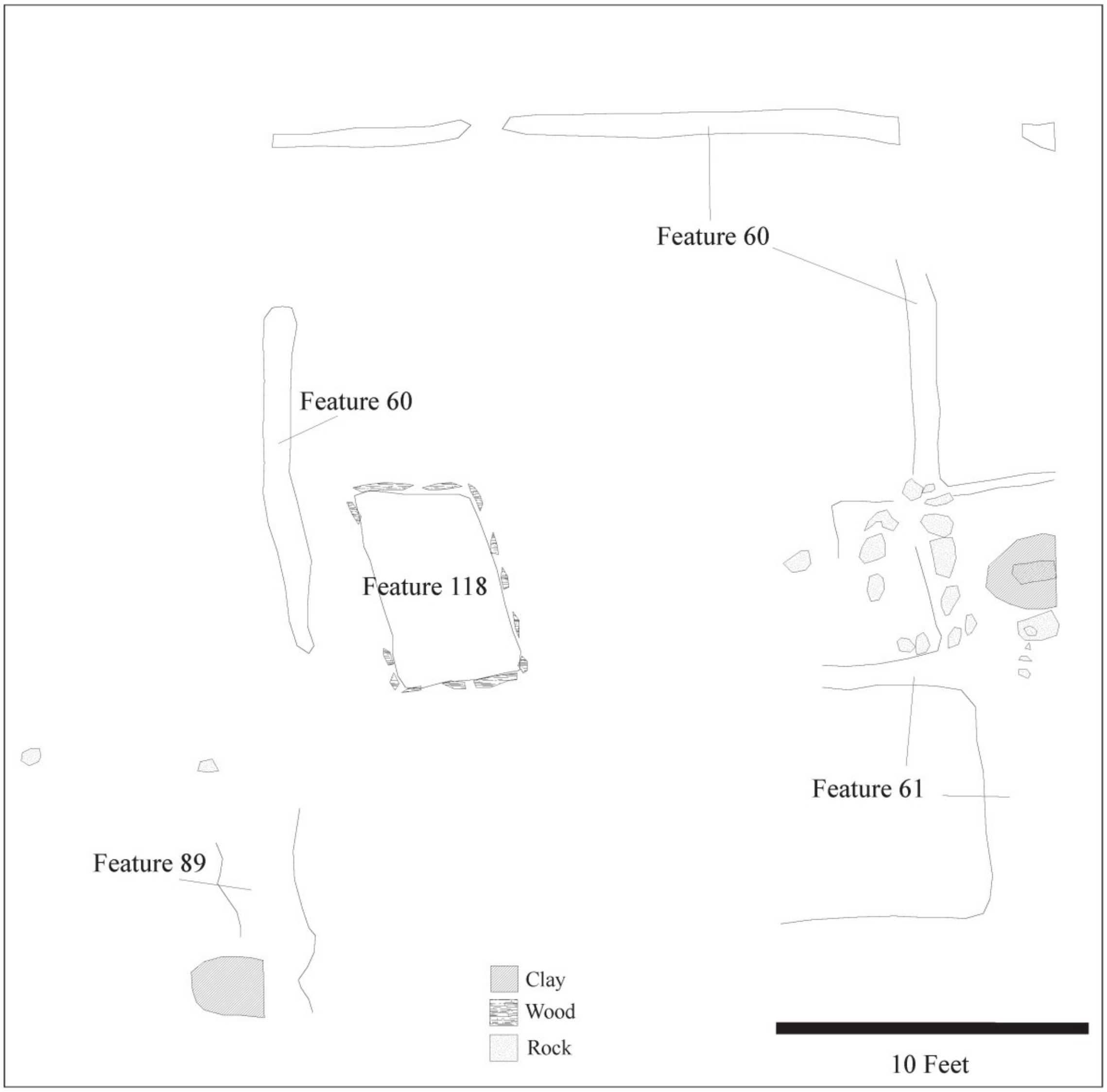

Figure 4:11 Plan map of the French guardhouse and British blacksmith shop as interpreted by Maxwell (1960) and Stone (1974). Feature 60 represents the French Guardhouse and feature 61 represents the British Blacksmith Shop as interpreted by Maxwell. This figure is redrawn from Stone (1974: 338).

Evidence of blacksmithing activities within this area was based on what Maxwell interpreted to be the remnants of a forge and the presence of numerous gun parts and metal artifacts. A seven foot by eight foot rectangle made of fire-baked clay and rocks delineates the forge and is located opposite a stick and clay chimney. Maxwell described the area as follows:

> The fireplace of the earlier structure was demolished and some of the stones used for wall construction in the later structure. The fireplace for the later structure was moved to the west wall. Here there is a heavy clay and rock hearth foundation surrounded by large vertical posts, with a clay and post chimney exterior to the wall. The size and configuration of this hearth leads us to interpret it as a forge, and the unusually large number of gun parts and iron scrap in the midden of the structure suggests that it was used as a blacksmith shop. (Maxwell 1960:2)

Unfortunately, there are no illustrations of the chimney/hearth feature on the west wall within the report and the chronological association of the stick and clay chimney is also unclear. Additionally, following the reexamination of the original plan maps, it became apparent that a feature this large consisting of clay and large rocks was not recorded in the field.[86] Another feature[87] Maxwell identified to support his interpretations is a circular hearth area filled with charred earth and charcoal within close proximity to the proposed forge (Maxwell 1960:11). Again, due to the lack of a full description and illustration or drawings of this feature, there is no indication that this feature is the remnants of a forge.

Locus D: Reanalysis and Conclusions

Several questions concerning the location of trenches and features related to blacksmithing were central to reanalysis. The excavation methods used in 1960 did not allow for the recovery of information in a way that would have made it possible to better

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[86] One possibility for interpretation may also be that the chimney feature may have appeared larger than it actually was in the field due to construction and demolition activities. Again, reexamination of the plan maps of this area does not reveal a 7 foot by 8 foot chimney feature.
[87] No feature number was assigned.

distinguish between the guardhouse and blacksmith areas and may have hindered interpretations of the historically disturbed areas. To compensate for this problem, all plan maps from the original excavations were analyzed and new maps were created from the original field plan maps in order to provide a visual illustration of what had been written within the 1960 report. In creating these composite plan maps it became clear that better stratigraphic control and a more complete knowledge of the stratigraphic nature of the site (available only via hindsight) may have facilitated the identification of more features and particularly, the chronology of structural features. In reexamining the plan maps of the original excavations it was determined that the field recordings lacked information on features and soil characteristics (e.g. color and texture). Furthermore, this type of remapping proved beneficial since soil descriptions not detailed within field notes nor within Maxwell's report were sometimes drawn onto the field plan maps. Despite a lack of description of color or composition, contextual associations helped to identify significant areas previously overlooked.

Not only were features better identified in terms of their associations and significance, but structural information and chronology became clearer following this reexamination of stratigraphy in locus D. Originally, Maxwell claimed that inferring the exact location and the temporal range of the blacksmith shop in this area was difficult due to the demolition and construction phases that occurred within locus D. Yet, he was able to conclude that stylistic differences were present and could distinguish between French construction (i.e. post-in-trench) and British construction (horizontal logs). Within his report, Maxwell did not describe which trenches exhibited each type of construction.

Without this information, retroactively analyzing the characteristics of the construction phases and chronological visibility within the stratigraphy proved difficult. Additionally, a description of the demolition activities as evidenced in the archaeological record was also lacking and it remained unknown whether existing structures were modified in ways similar to other structures within the fort during the transitional period (1760-1761) (Heldman and Grange 1981; Heldman 1984; Whitaker 1994).

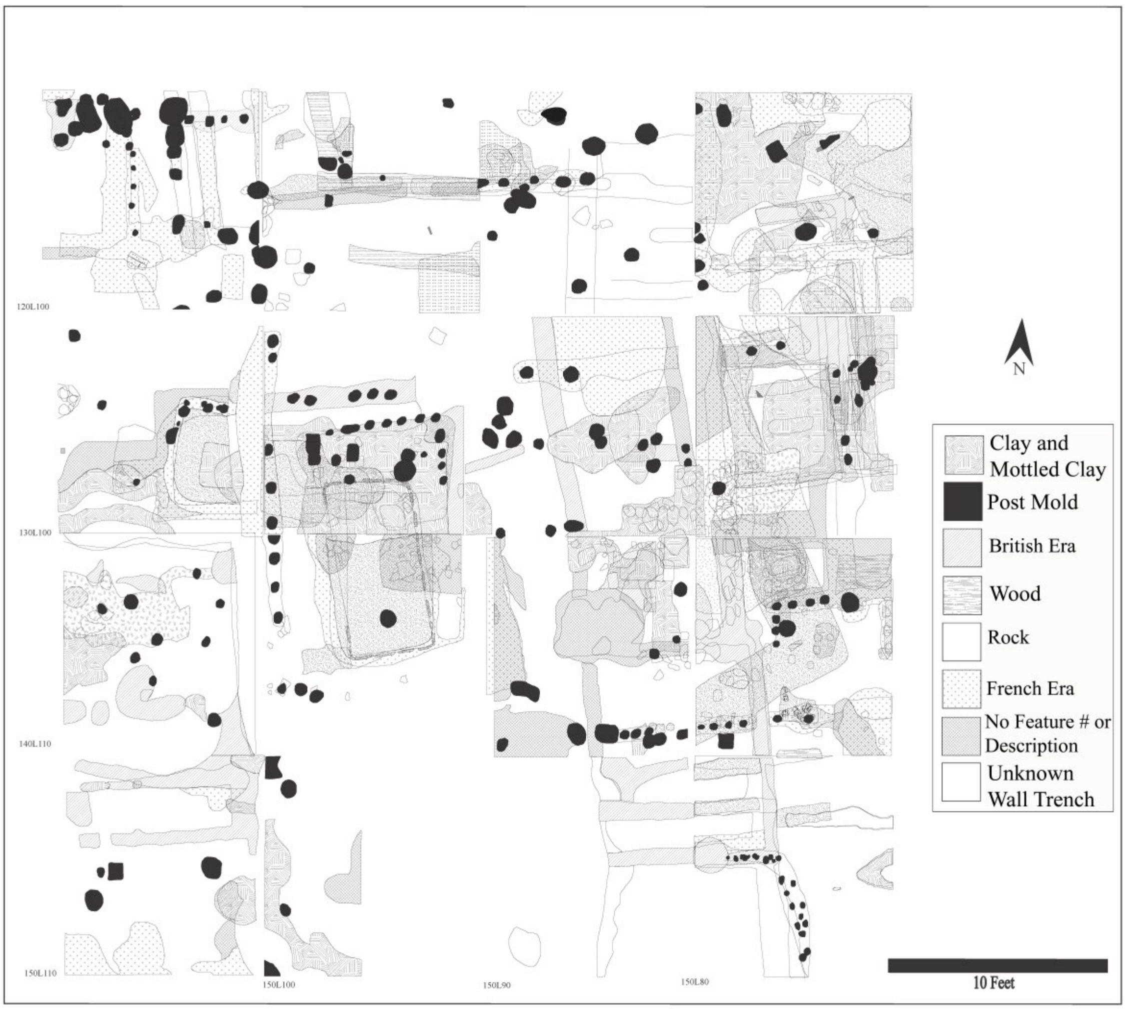

Figure 4:12 Remapped stratigraphy within locus D based on plan maps from the 1961 excavations.

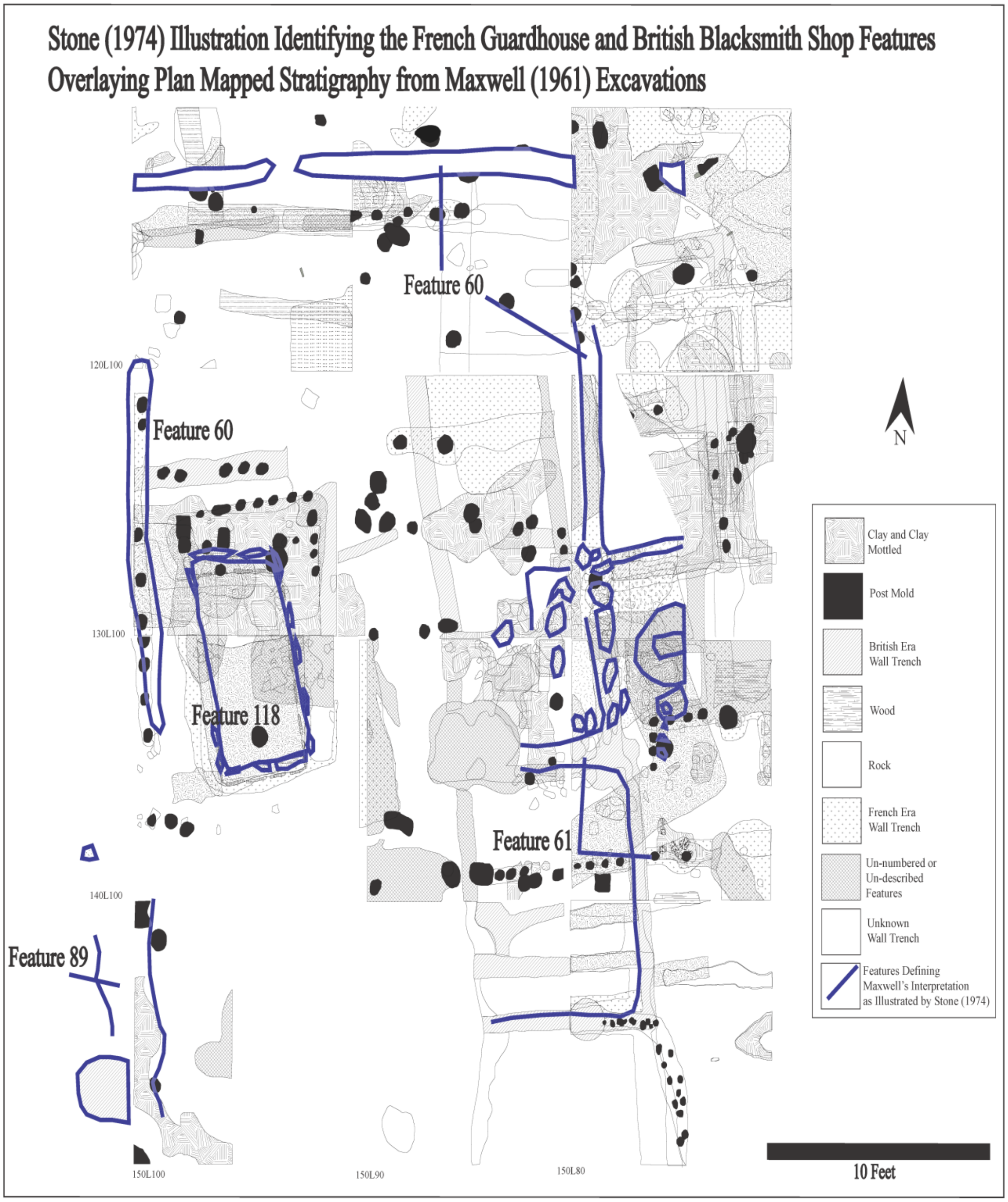

Figure 4:13 Plan view of locus D showing the remapped stratigraphy overlaid with Maxwell's (1961) and Stone's (1974) illustrations of the French Guardhouse (feature 60) and British Blacksmith Shop (feature 61).

There were also several features described within the report that were not drawn on plan maps or described in field notes. One significant example of this was found in unit 140L100. The majority of metal artifacts from locus D were recovered from this square within a chimney pit (1960 artifact inventory records). Regrettably, the chimney pit was not documented in any field drawings and it is unclear where these artifacts were found within the 10 ft. by 10 ft. unit. The artifact assemblage from this unit indicated that much of these artifacts were associated with early French activities and are similar to assemblages found in French dwellings at the site (Stone 1974: 349). Furthermore, locus D did not contain an artifact assemblage consistent with blacksmithing activities: slag, scrap, and repaired or partially finished goods.[88]

Remapping and reanalysis of the stratigraphy of this area combined with the application of the model for identifying blacksmith activities in the archaeological record revealed little support for the interpretation of locus D as a blacksmith workshop. First, the archaeological characteristics of a work area, including a forge, do not seem to be present. The stratigraphic characteristics of clay, rock, and charcoal as depicted on field maps and in Maxwell's report are not consistent with a forge (Maxwell 1960:2). Rather, these features are more likely the remains of a household hearth. The soil characteristics of the features in locus D relatively date (see Figure 4:2) to the circa 1715 early French period. The artifacts recovered from this area also support this claim.

[88] While slag was found during excavations of locus D, it is unclear the amount. It is noted in the report that slag was present but within the catalog record, no slag was curated from the 1960 excavations. Slag is commonly misidentified and may be in the collection as clinker, coal, or burned metal.

While one unit in particular produced a number of metal artifacts, the assemblage was associated with the cellar feature of the building. The cellar was probably filled-in with debris during expansion or demolition efforts. Compared to other potential blacksmith areas within Fort Michilimackinac, this area produced relatively few metal artifacts. Of the entire assemblage of artifacts from locus D, approximately 17% of the assemblage consisted of metal artifacts, as compared to the artifact assemblage from the Priest's Complex Blacksmith Shop which consisted of approximately 41% metal (see Figure 4:).

Since locus D does not contain a forge, it is not surprising that post molds indicative of bellows were not found in the archaeological record. As previously described, ironworking waste and debris (such as scale) may be recognized by the presence of iron concentrations in the soil: identified by red, brownish-red, or rust colored soil. This was not recorded on any plan maps nor described in Maxwell's report. Furthermore, in terms of identifying the remnants of an anvil base, while several large post molds were recorded on plan maps, they are mostly in-line with other post molds or trench features. These post molds are not large enough, nor deep enough to have supported the weight and work involved in using an anvil. Aside from the work area, a storage area could not be identified from the original plan maps or descriptions of the stratigraphy within locus D. Storage areas typically contain large amounts of scrap material, but only 24 pieces of iron scrap were recovered from locus D.

Reanalysis indicates that locus D contains the remnants of a French house dating to the early French occupation of the site (circa 1715). One feature associated with this house is a circular hearth and chimney feature, identified in Stone's (1974) report as Feature 76. The artifact assemblage in locus D consists of trade goods and other French associated artifacts, including:

> 28 knives, 54 tinkling cones, 8 Jesuit rings, 2 hawk bells, 17 rosary beads, 1 tomahawk, 1 scale balance arm, 271 glass beads, 4 jaw harps, 6 sherds of Native American pottery, 25 fishhooks and fish gorges, 1 brass thunderbird figurine, 17 silver pins, and 64 pieces of worked catlinite or Micmac pipes, and 3 pieces of vermillion (MSHP catalog record from 150L90).

Stone states that feature 76 was part of the original houses constructed with the 1715 fort, but at the time of his interpretation, the internal partitions and the fireplace were not yet identified (Binford 1961: 12; Stone 1974: 313). The trenches and features from locus D that were remapped, including feature 76, were compared with the nearby row house complex, namely structural features 27 and 25 which date to circa 1715 (Stone 1974: 334, Figure 200). The reanalysis of locus D indicates that the features originally attributed to the blacksmith workshop are actually structural features, more specifically, the internal partition and fireplace associated with the French row house feature 76. The dimensions of a fireplace in the center row house (Feature 25), located on the west wall near the southwest corner, are similar to the fireplace that Maxwell described as a blacksmith forge, which would have been located in the same relative position within feature 76 (fireplace: 6' N-S x 4' E-W, hearth: 4' N-S x 2'6" E-W). Additionally, the doorway to feature 27 (the eastern most row house) was located on the south wall and measured approximately 3 ft. 6 inches. Finally, the eastern partition that Maxwell associated with feature 61, is similar to internal partitions interpreted to be within features

25 and 27. In terms of chronology, Stone states that feature 76 was in use until sometime between 1730 and 1740, which coincides with the First Expansion period of the fort (circa 1734-35) (Stone 1974:313, Figures 198 & 200).

The artifact assemblage recovered from this area also contributes to the reinterpretation of locus D as a French row house component. It is well known that French inhabitants fashioned their diet to what was available within the surrounding environment much more frequently than British inhabitants (e.g. Shapiro 1978; Scott 1991; Needs-Howarth and Gromoff 2009). Within locus D, numerous fishhooks were recovered. As mentioned before, several items that can be associated with trading or Native American relationships were also recovered, including Native American style pottery, trade beads, tinkling cones, rosary beads, Jesuit rings, and French style knives. Micmac pipes were also found within this area and are known to be used primarily by the Ojibwa, Ottawa, and other local Native American tribes, Métis, and French (Waselkov 2009:11; Gundersen et al 2002). Since it is also well documented that French peoples were more likely to engage in marriage and other social relationships with Native peoples more readily than British peoples, these items would not be uncommon within a French household.

Features from this area associated with later occupation, and more specifically, British occupation were also reinterpreted in order to obtain a clearer chronology of the stratigraphic events uncovered during initial excavations. After 1740, the row house was demolished and a French Guardhouse was constructed over the former building site. Based on the presence of a structure on the Nordberg Map (circa1769), Maxwell reasons that this building was still in use in 1769. Documentary evidence also suggests that this structure was still in use during British occupation in 1768 (Maxwell 1960:10-12; Armour and Widder 1986:11). No known documentary sources indicate the construction of a new British guardhouse, but given the archaeological evidence of two different architectural styles within locus D, it is likely that the British renovated the building for continued use. The vertical post-in-ground method used to build the original French era structure could have been added onto using the horizontal log construction associated with the British, possibly providing a new storage room, porch, or military space. The practice of renovating existing structures has also been well documented in the archaeological record (Armour and Widder 1986: 11)

The presence of several artifacts within locus D indicates that this building was in use until the 1770s. For instance, the presence of the British King's 8^{th} buttons may be accounted for since it has been documented that a cellar or a 'black hole' was used at Fort Michilimackinac for holding or punishing soldiers. The use of this building by the British military is also supported by the types of artifacts recovered from this area, including British creamware, King's 8^{th} button, kaolin pipes, gun parts, and gold textile braid common to British military uniforms (MSHP catalog records).

Following the reanalysis of locus D, several conclusions and reinterpretations were made. Several phases of construction, reconstruction, and demolition took place within locus D and occurred during both French and British occupational periods. Reanalysis of locus D also determined that a blacksmith workshop is not present within this area. Instead, further archaeological features related to an early French house were identified and dated from circa 1715 to circa 1740.

Summary of the Blacksmith Shops at Fort Michilimackinac

Reinterpreting the location of the blacksmith workshops at Fort Michilimackinac provided information that was essential to understanding the chronological history of the blacksmiths at the site. Several characteristics associated with frontier blacksmithing were identified in the archaeological record. The presence of a forge, anvil base, bellows, workbench, and domestic areas were identified in several loci. Drawing from previous studies of frontier blacksmithing (Light 1984, 1987; Wylie 1990; Bessey 1995), this research tested the hypothesis that frontier blacksmith shops have distinguishing functional features that, even retroactively, are identifiable within the archaeological record.

Reanalysis of archaeological archives confirmed the location of one blacksmith workshop and resulted in the identification two other blacksmithing areas at Fort Michilimackinac. Each metalworking area was associated with a different time period of the fort and supports the presence of all three smithing areas, each having been used at different times:

- ❖ Locus A: French Gunsmith/Blacksmith Workshop, c. 1725 – c. 1740
- ❖ Locus B: French and British Blacksmith Workshop, c. 1750 - 1765
- ❖ Locus C: French and British Blacksmith Workshop, 1751 – 1765

A blacksmith workshop, previously overlooked, was identified and described as being associated with the French period and church complex area (Locus A). The blacksmith shop originally interpreted by Brown (1992) was supported and further described (Locus B). Finally, a previously identified brick kiln was reexamined and proposed to be a third blacksmithing area within the fort walls that would have been in use during the late French and Early British occupations (Locus C). It should be noted however, there is great probability that a blacksmithing site exists outside the fort walls, where, to date, few excavations have been conducted.

Applying the model for identifying the stratigraphy and artifact assemblages related to 18th century blacksmith workshops in each of these areas resulted in a more descriptive understanding of the spatial attributes of blacksmithing at Fort Michilimackinac. The reanalysis of the blacksmith workshops also illustrated the potential of reexamining archaeological data and the extent to which new research questions can be answered through information that exists in archaeological archives. In addition to archaeological archives, previously collected material culture and museum collections also provided the opportunity to examine the activities of the blacksmith *across* the site of Fort Michilimackinac. The number of artifacts recovered during numerous excavations at Fort Michilimackinac allow for further analysis of the material characteristics of 18th century blacksmithing activities across. This analysis provides a better understanding of the dynamic environment in which the blacksmith was working at Fort Michilimackinac. The next chapter examines the material culture associated with the repair and manufacture processes of metal objects at Fort Michilimackinac.

Chapter 5: Frontier Metal and Blacksmith Products

> *"Clearly everyone in town had to patronize the blacksmith sooner or later. He was, in a very real sense, a craftsman for all seasons." (Ford 1971: 26)*

In the previous chapter, a model for identifying 18th century frontier blacksmith workshops was used to identify smithing areas at Fort Michilimackinac. This chapter moves the study of the blacksmith beyond the production areas. Workshop areas provide spatial information and evidence for the production of materials, yet the best place to view the products of a blacksmith is not within the workshop. This chapter examines the general characteristics of frontier metal goods and identifies attributes related to local production and repair. Analyzing processes of repair and manufacture as exhibited through metal artifacts also helped to identify the interactive processes of production and consumption involved with altering materials in order to adapt to the conditions of the frontier.

The Material Context of Metal on the Frontier

Metal objects were infused in every aspect of daily life within the frontier setting: from cooking, gardening, cutting wood and other domestic activities, to hunting, fishing, trapping, and architectural and military requirements. Nearly every occupation or trade required the use of metal, which inevitably would have required the intervention of a blacksmith to maintain, repair, and manufacture goods to support the activities of these individuals. Blacksmithing facilitated survival in the isolated environment of the frontier because "when things broke, ran out, or were too expensive to import by canoe, residents of Michilimackinac relied on their own wits [and craftsmen like the blacksmith] to survive and improve their quality of life" (Morand 1994: 1). Because of his skill, the blacksmith would have been one of the most valuable members of the community.

Perhaps one of the most important roles of the blacksmith was in maintaining the fur trade; the primary purpose of Fort Michilimackinac. The use and maintenance of traps would have been fundamental to the economic base of the community. The most common traps used were for beaver since beaver pelts were the primary fur traded in North America (Wolf 1982: 151). Larger or smaller traps were also used to procure furs and meat from other animals such as bear, fox, rabbit, and mink (Gerstell 1985: 64). Trapping was not only a way to obtain furs, but also a method to procure food.[89] It has been well documented at Fort Michilimackinac, and other fortifications such as Crown Pointe, that the French military and civilian populations utilized the surrounding resources, like eating wild game, more often than the British military and civilians who tended to hunt and trap only as a supplement to provisions or when they were unable to trade for foodstuffs (Cleland 1970; Scott 1985, 1991; Feister 1984: 127-128; Needs-Howarth and Gromoff 2009). Before 1850, nearly all traps used in North America were imported from Europe and were made entirely by hand (Gerstell 1985: 32). Exposure to wide ranging environmental conditions meant that traps often broke and required repair within the frontier context. Springs, jaws, and catches were parts on the traps that were often repaired by the blacksmith (Light 1984: 27-29; Armour 1976: 27-31; Gerstell 1985: 64).

[89] Spears, snares, and shooting were other methods used to procure furs and food (Gerstell 1985: 33).

139

In addition to trapping, metal tools and wares fulfilled innumerable other functions. Food procurement and consumption, for example, depended heavily upon the use of metal wares. An abundant source of food came from the availability of fish at Fort Michilimackinac.[90] Fishing required harpoons, fishing spears, fish gouges, sinkers, fleshers (or defleshers) and other metal artifacts, which may have been produced locally. Cooking and other domestic activities, such as gardening and cutting wood, would have required a variety of metal tools, including kettles (iron and copper), axes, hoes, and cooking utensils. Repairs made with scrap iron and brass were common for these tools and, as will be discussed further in the following sections, can be seen in the kettle lugs found at Fort Michilimackinac and other militarized fur trade posts (Stone 1974; Armour 1976; Unglik 1984).

Finally, all members of the community who lived at Fort Michilimackinac would have faced the constant task of home maintenance, particularly within the harsh, four-season, coastal environment of northern Michigan. Metal flashing on roofs, nails, and hinges are among some of the metal building materials that were used to construct the homes, military buildings, and businesses at Fort Michilimackinac (Stone 1974). There were also constant efforts to expand, maintain, and renovate military buildings throughout the fort's history. During British occupation, for instance, Captain William Howard authorized several changes to the fort in an attempt to make it more militarized

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[90] Chapter 1 briefly describes the importance and success of the fishing industry in New France during the 18th century. Several accounts in the Jesuit Relations and in the Cadillac Papers also mention the importance of fishing to survival within the frontier setting. Many of these examples can be found in the Michigan Historical Collections, (1904) *Michigan Pioneer and Historical Society,* vol. 33.

in function (Armour and Widder 1986: 12).[91] The blacksmith would have aided in providing or producing materials related to construction or maintenance of the structures within Fort Michilimackinac.

The variety of metal objects that the blacksmith could have been involved in repairing or producing also provides insight to the challenges Europeans faced in adapting to the frontier environment. Analysis of the repair and production methods utilized by the blacksmith at Fort Michilimackinac demonstrates, to varying degrees, the processes by which Europeans adapted to the frontier. These same repairs and products also exhibit the processes by which the blacksmith was applying his knowledge and adapting his skills to better facilitate his success in the frontier community at Fort Michilimackinac. These analyses also indicate the degree to which the frontier community used more malleable metal like copper, brass and lead, to conduct their own repairs or production of goods.

Methods of Analysis and Sample Selection

Three sources of data were used to identify and analyze repaired and locally produced objects found at Fort Michilimackinac. Documentary sources, including trade records, inventories, and military correspondence related to metal at the fort were used to identify the groups of artifacts that had either undergone repair by the blacksmith or were likely to have been made by the blacksmith at the fort. Archaeological archives and physical characteristics of repair or local production were also used to identify groups of

[91] These changes are reflected in the 1765 Magra Map. It is possible that during this time Michel Girardin may have been the blacksmith at the fort (see Chapter 3 for discussion).

artifacts relevant to this study. pXRF analysis on objects from the site was another source of data that contributed to identifying characteristics of repair and local production. Combined, these data created a methodology that allowed for the identification of: 1) repaired objects and possible locally manufactured objects at Fort Michilimackinac, 2) the physical characteristics of repair and local production unique to the frontier setting, and 3) the potential for future research analyzing the material attributes of frontier blacksmithing. The methods used to assist in the selection process included information gathered from historic documents, archaeological archives, visual observation, and the ability to conduct pXRF analysis. The methods of sample selection and data collection are briefly described in the following subsections.

Historic documents

Trade records, inventories, and military correspondence were used to identify categories of materials that were likely repaired or produced locally. These documentary sources provided broad contextual information concerning the metal objects recovered from across the site, including where metal implements were being imported from and what types of work was being demanded of the blacksmith by different communities. The blacksmith served various groups within the settlement. As an example, Sir William Johnson's papers identify several occasions that the British Indian Department provided services of gun and tool repair for various Native American groups (Johnson 1921-1965). Trade records provided information regarding what types of metal objects were being imported to the frontier and essentially provided insight into what types of objects would require repair after their arrival and use at Fort Michilimackinac. Phyn and Ellis (1767-

1776) describe several types of metal objects that were exported to Fort Michilimackinac, including kettles, axes, traps, and sears. Inventories of Amiot (1747a, 1747b), Lefeuure (1746), and Askin (1776-1779) provided information about the types of work frontier blacksmiths were performing in general and specifically at Fort Michilimackinac. Within these documents included several references to axes, hoes, darts, gun parts, tomahawks, a pick, and sword parts. These documents informed analyses of activities specific to blacksmiths at Fort Michilimackinac which was critical to the investigation of metal working on the frontier since goods were constantly being traded between individuals with varying metal working skill who may have moved between frontier sites. Based on this survey of documents, a list of items recorded as having been repaired by blacksmiths at Fort Michilimackinac was created and is shown in Figure 5:1.[92]

Assembly of fusils	Ice Cutters	Sears
Bolts	Kettles	Shoulder Straps
Breech	Kettle Parts	Sight Beads
Breech Plug	Knife	Sights
Cock	Lance (Bayonet)	Spring
Dagger	Mainsprings	Swords
Darts	Musket Barrel	Tomahawks
Frizzen	Pan	Traps
Fuzees	Pick	Trap Parts
Gun Parts	Plate	Trigger Guard
Hatchet	Rampipes (Ramrod Piping)	Tumblers
Hoes	Screw	Vice Jaw

Figure 5:1 List of objects repaired at Fort Michilimackinac based on historic documentation.

[92] The following references were used to help compile the list of repaired and/or manufactured items: Rogers (1775-1776); Haldimand (1780-82); Gage (1762-1776); Phyn and Ellis (1767-1776); Fleming (1932); Macomb (1774-1775); Amherst (1760-1773); Edgar (1760-1769); and Amiot (1747).

Archaeological archives and collections

The archaeological archives were used to identify the contextual information associated with several metal objects and to identify specific types of objects that were relevant for analysis. Archaeological plan maps, field notes, artifact inventories and catalog records, and reports provided information on the spatial and contextual relationships between the artifacts examined and informed the application of pXRF analysis. Information from the archaeological archives was used to create a database specifically designed for this research using Microsoft *Excel.* This software was chosen because of the flexibility afforded to the researcher to organize, sort, and export data into other software programs.

There were multiple challenges in working with the Fort Michilimackinac archaeological archives, existing databases, catalog records, and collections. Most metal alloys do not preserve well within the archaeological record. Many objects were not conserved and due to their condition, some artifacts were left unidentified or mis-identified.[93] The state of metal artifacts contributed to differences between field notes, reports, and catalog records. Reports also described artifacts based on field notes but some objects were not curated based on their physical state, collection strategy, or the re-identification of the object as something else. The dire physical and chemical state of metal artifacts, in general, is usually the foremost barrier for the inclusion of metal in material culture studies. There are exceptions to this statement, but the fact remains that overall, metal is understudied through the lens of cultural or social context when

[93] This statement should not be read as a critique of those who did/did not identify these objects but is meant to highlight one of the challenges in working with metal artifacts.

compared to other types of materials, such as ceramics or glass. While these conditions may be a challenge, it is also one of the main objects for undertaking this research: to shed light on the social context of metal within the fur trade frontier environment during the 18th century. Unlimited access to the records and collection provided by the Mackinac State Historic Parks was instrumental in overcoming these disparities.

Assessment of Physical Attributes

The Fort Michilimackinac databases and collections were used to identify artifacts for visual examination. Given that repair and local production of numerous items may not have been recorded in documentary records for a variety of reasons, nearly all types of metal artifacts from the fort were examined. Because this research examined evidence of blacksmithing and the utilization of metal artifacts throughout the fort, including habitation and other activity areas, the initial survey of artifacts included the entire assemblage of metal objects, which consisted of over 300,000 metal artifacts.[94] While this represents a large collection, many artifacts were excluded from the selection process. As such, objects not related to the 1715-1781 occupation of the fort were excluded from this study. Iron objects were singled out for further analysis because of the nature of the blacksmith's specialization with ferrous materials. Approximately 1,400 iron objects from Fort Michilimackinac were recorded in the catalog system. Corrosion also excluded numerous artifacts since the presence of severe corrosion interfered with either the identification of repair characteristics and/or the capabilities of pXRF analysis.

[94] This number was accurate at the time of this research. Since excavations take place each year, more metal artifacts have been added to the collection since the information for this research was gathered.

Indicators of possible repair and local manufacture are subjective and included irregularity versus homogeneity in object form or material. Evidence of welding, cut marks, brazing, and the presence of rivets, patches, or folds are other physical signs of local production or repair activities and are described in the following pages. The final sample consisted of 104 artifacts from various contexts (Appendix 1).

The physical characteristics that indicate repair or local production techniques include welding, brazing, rivets, and patching. For the purposes of this study, welding refers to the process of heating two pieces of iron and then forging them together via hammering (Faulkner 1986: 78; Unglik 1984: 89). When a blacksmith welded objects together, he continually heated and hammered the pieces of the object until the weld formed and joined the two pieces together (Ford 1971: 26; Kauffman 1994: 22). As an example, the bit, or steel strip, that was welded during production to connect the body and blade of an ax, or the arm and eye of a trap would wear and break with use. This process was also termed "laying" since a new piece of steel would be "laid" or inserted into place and welded (Ford 1971: 25; Tylecote and Gilmour 1986: 202, 210; Kauffman 1994: 22). Cutting the ax or trap pieces and rejoining them via welding, was a common repair made for both of these object types. Salvaging pieces of traps or axes from broken objects for the purposes of reusing for repair is likely to have happened within the frontier context, given the fluxes of supplies and goods to the remote outpost. Furthermore, artifacts that appear to have been cut may indicate the intent to reuse the object for a welding repair.

Brazing is a common technique used by blacksmiths to join two pieces of iron using copper alloy filler (Unglik 1984: 126). The blacksmith often used brazing as a repair technique when welding was not a feasible repair method and it was a common method of repair given the abundance of brass scrap from kettles (Armour 1976: 28; Faulkner 1986: 79; Light 1987: 126). To join two pieces of iron with a copper alloy, the blacksmith would place the broken pieces in the forge to heat them to the appropriate temperature. Once hot enough, the blacksmith would add a flux, such as sand or borax, to the broken surfaces that were to be brazed together (Unglik 1984: 127). After adding the flux, several small pieces of brass or copper would then be sandwiched between the broken surfaces of the object. The object would remain in the forge so that the "filler flowed into the whole joint after melting" (Unglik 1984: 127). After the object cooled, the smith would trim the remaining brass off the edges. One interesting note made by Unglik (1984) is the fact that the smith "could easily spill molten brass which would mix with the slag or iron fragments" in the forge (Unglik 1984: 127). This is especially interesting because an axe and trap part, both recovered from French contexts at the fort, exhibited the presence of cupreous material which may be indicative of this phenomenon; both are described in more detail in the following section. Brazing was a technique commonly used on gun parts as is described in the following section. Brazed repairs were not common on other objects within the sample that were observed for repair at Fort Michilimackinac.

Rivets were a common hardware used to repair objects with handles or for applying patches to objects. Brass rivets were made by cutting brass kettles into small diamond or trapezoid-shaped sheets which were then folded into a cylinder, inserted through the objects to be joined, and hammered down flat against the sides of the object (Stone 1974: 189). Iron rivets were usually made from wrought iron rods with one end hammered to a head (similar to nail production), inserted through the objects to be joined, and then hammered flat. Iron rivets were sometimes used with washers and then cold-hammered to a rounded head (Hanson and Hsu 1975: 55). Smaller iron rivets used for the purpose of repairing hand tools were found at Fort Michilimackinac. Patches could also be riveted or brazed to the body of the object. These are found in the shape of squares, rectangles, or irregularly shaped cupreous or iron pieces with holes around the edges where the rivets connected the patch to the main body (Faulkner 1986:86-87). Rivets and patches made of cupreous material may be indicative of the lack of access to a blacksmith and the fact that brass was easily worked and did not require such specialized knowledge. Cupreous material also wears faster and may require more frequent patching. This may also be a result of the accessibility of brass as opposed to iron, which may have been reserved for more elaborate repairs.

Portable X-Ray Fluorescence

Portable x-ray fluorescence (pXRF) was used to help identify characteristics of repair and locally produced metal objects at Fort Michilimackinac.[95] Spectroscopic

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[95] The full potential of the pXRF data was not utilized in this research. Rather, pXRF data was used as a tool to help inform basic analysis and observation of repair and local production of metal artifacts from Fort Michilimackinac by providing another type of comparative qualitative data. Further quantitative questions regarding the chemical analysis of these objects may be asked in regards to this research but are not addressed here. Further testing and more data are needed to identify the statistical significance of chemical occurrences within and between objects. For the purposes of identifying variation and presence/absence,

analysis was completed for a sample of 104 iron, brass, and copper objects from Fort Michilimackinac that exhibited repair characteristics or those that were included in documentary sources as being locally produced by the blacksmith.

Portable x-ray fluorescence was employed to identify chemicals present within the study collection because it does not require destruction of the object in order to gain an accurate reading. Readings were gained by holding the pXRF device (Bruker Tracer System™) to the surface of the object. In order to control for variation that might occur when a reading was taken on the surface of the object, multiple readings were taken at different locations on the same object. Longer readings, which lasted 800 seconds (approximately 5 minutes), were also taken in order to obtain more accurate raw data with less "noise" or interference visible on the raw data spectrum. *Tracer World* and *ARTAX* software was then used to identify the significant elements present on a logarithmic table of the raw data for each object. A titanium aluminum filter was used to increase accuracy of readings for heavier elements. These longer readings and the use of a titanium aluminum filter reduced the refracted radiation (i.e. noise) and created smoother peaks visible in the raw data which allowed for better interpretation of the presence/absence and calculated levels of fluoresced elements.

Presence/absence analysis was the primary mode of quantitative analysis for this research.[96] Visible examination of the raw spectroscopic data provided presence/absence

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the full potential of the pXRF data was not utilized, instead, the analysis relied upon the identification of variation and presence/absence of specified chemical readings.

[96] This method of qualitative analysis has not been used in other studies. There are several reasons for this. First, most XRF or pXRF studies of archaeological metal objects are done on well preserved, unique objects, such as coins (e.g. Yao and Stross 1965) or to determine metallurgical origins (e.g. Roberts and

information for chemical signatures and basic variability between objects. This data was used as a tool for interpretation in combination with the documentary information and visual observation. This basic data was sufficient, in most cases, in providing supporting or additional information regarding processes of repair or the interpretation of locally produced items.

Iron projectile points were further analyzed using ratio analysis. Projectile points were selected for this type of analysis based on the limited amount of information garnered from the documentary record and hypotheses that are presented in later sections. The raw data readings were input into an *Excel* file. Multiple readings were taken on each point and these readings were averaged together in the database. In order to compare readings and elements between points, ratios of elements compared to iron were calculated.[97] Calculating the ratios of various chemical elements as compared to iron allowed for a generalized qualitative analysis of the chemicals present within each object and provided a method of comparison between artifacts. For instance, arsenic levels found in a projectile point was compared to the iron readings from the same object. The ratio calculated of arsenic to iron (As:Fe) could then be compared to the ratio of arsenic in other objects, allowing for a qualitative comparison based on quantitative data.

Thornton 2009; Killick and Fenn 2012; Schmidt 1997). Ehrhardt (2005) conducted analysis on brass and copper but not on iron objects. Consultation with Dr. Kathleen Ehrhardt at the Illinois State Museum, in reference to her study of brass and copper objects combined with consultation with Dr. Bruce Kaiser of Bruker AXS resulted in the methodology for this study. Other pXRF, XRF, and chemical sciences experts were also consulted at Syracuse University including Dr. James Spencer (personal communication January 2008) and Dr. Patrick Bickford and Dr. Michael Chatham (personal communication February 2008).

[97] Parts per million were not calculated since the sample is of an unknown origin and the baseline data, such as a raw material reading from the source, cannot be known.

Metal Artifacts from Fort Michilimackinac

A total of 104 artifacts were selected for analysis. The majority of these artifacts were related to French contexts, but were associated with a variety of structural contexts, including row houses, the parade ground, church area, and British guardhouse areas. This may be attributed to the fact that the fort was occupied continuously by French individuals.[98] Observed repair and local manufacturing attributes, historic documentation, information from archaeological contexts, and pXRF data are presented here for each of the following artifact groups: gun parts, axes, trap parts, hoes, kettle parts, saws, strike-a-lites, projectile points, and harpoons/spears.[99] The characteristics of repair and local production unique to the frontier setting are summarized following the presentation of data for each group of artifacts.

Gun Parts

The environment of the frontier and the frequency in use of the flintlock mechanism on frontier muskets and pistols would have contributed to the wear and breakage of the multiple moving parts of the flintlock mechanism. Due to the multiple working parts and the environment in which the flintlock was used, the repair of various

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[98] Further analysis of contexts from which these objects were found would provide a unique perspective to the varied uses of metal by different populations at the fort. Analysis of the metal recovered from specific contexts, compared across the site, may provide better insight into the socio-economic relationships between the blacksmith and various individuals at the site. The contexts are not fully analyzed within this research, instead a basic understanding of the contexts is presented in order to provide a baseline for comparison of repaired and locally produced objects at Fort Michilimackinac. The catalog numbers of the artifacts analyzed in this sample are provided in Appendix 1.

[99] The original sample observed included 1498 artifacts in the following categories: gun parts, axes, harpoons, hoes, ice choppers, fleshers, kettle parts, knives, metal wire, saws, strike-a-lites, trap parts, projectile points. Based on condition of the artifacts, provenience, and information taken from historic documents, 121 objects were selected for further study from these categories. The final sample excluded ice choppers, fleshers, metal wire, and knives due to the lack of relevant or decisive information gathered from these objects, leaving 104 objects that were analyzed in this study.

gun parts would have been a common job the fort blacksmith performed. The British Indian Department often provided gun repair service for Native Americans who frequently visited or resided near Fort Michilimackinac.[100] Traders and military personnel were also in need of the blacksmith's services of gun repair as is apparent in Gage's papers which revealed the fact that Gage had a blacksmith under his own supervision in addition to the blacksmith employed by the British military at Fort Michilimackinac in 1767 (Gage, Michilimackinac, Sept. 22, 1767). In Chapter 4, a gunsmith workshop associated with the Jesuit priest and church within the fort was further analyzed and it was concluded that this workshop was actually being used by a blacksmith. Given the lack of resources, it would have been necessary to have skills beyond gun repair in order to accommodate the demands of the community in performing a variety of repairs to metal objects. The blacksmith at Fort Michilimackinac was undoubtedly engaged in repairing numerous parts of 18th century flintlock fire arms. Gun repairs may, in fact, have been the most common blacksmithing service within the 18th century frontier environment.

Methods of repair on gun parts at Fort Michilimackinac have been previously described by Hamilton (1976). Hamilton identifies several gun parts that were repaired at the site and gives examples briefly describing the method of repair (Hamilton 1976: 28-29). Many of the gun parts show evidence of brazing as a method of repair. Brazing would have been the preferred method of repair because in many cases forge-welding would not have been possible or practical on the smaller, thinner gun parts. Brass was

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[100] The paper s of Sir William Johnson detail numerous occasions that the British Indian Department was providing gun repair services to various Native American communities (Johnson 1921-1965).

used to braze iron gun parts, such as frizzens, breech plugs, cocks, and locks. This process included: 1) heating the iron object being repaired, 2) laying the brass into the area requiring the repair, 3) heating the object with the brass until it melted and coagulated into the broken areas, and 4) filing the surface flush with the rest of the iron gun part.

Hamilton (1976) provides three examples of brazed gun repairs from Fort Michilimackinac. While Hamilton describes the repair of numerous gun parts, he does not indicate from which type of flintlock musket the parts derived, but all three presented here were found in French contexts. Two breech plugs and a frizzen found at Fort Michilimackinac were repaired using the brazing technique of repair (Figure 5:2). On the first breech plug, Hamilton (1976: 29) states “The tang on this breech plug was broken through the screw hole, so an extension was brazed on and a new hole drilled.” Portable XRF indicates this repair was made with brass given the presence of both copper (Cu) and zinc (Zn). Hamilton also details how a broken tang on a different breech plug was repaired: “the tang on this breech plug was broken through the screw hole, so an extension was brazed on and a new hole drilled. For some reason the work was not completed, for the brass appears only at the start of the break” (Hamilton 1976: 29). The pXRF readings on this object reveal that this repair was made with copper instead of brass. Hamilton also revealed that brazing was also a method used to reface a frizzen describing the process as “neatly brazing a new steel facing over the old one” (Hamilton 1976: 29). Since this braze lies between two pieces of ferrous material, it was not possible to obtain a pXRF reading for the cupreous material.

Figure 5:2: Breech plugs brazed with brass and copper (photograph by author).

Axes

There were several types of 18th century axes, including pick axes, felling axes, broadaxes, and belt axes. The most common type of ax recovered from Fort Michilimackinac was trade axes (Stone 1974: 297).[101] Trade axes are similar to felling axes and differ slightly in size (Kauffman 1994: 12). Trade axes recovered from Fort Michilimackinac were typical of French and Dutch style axes which included "round holes with a strap around the handle forming a big round eye" (Kauffman 1994: 12). Unglik (1984) describes later, early-19th century trade axes found at British Fort St.

[101] The museum collection database used by the Mackinac State Historic Parks indicates that there are 32 axes within the collection. This number may be skewed if axe parts have been not been identified, or if different nomenclature was used to describe the various fragments of axes. It is extremely difficult to maintain the use of specific nomenclature terms over 50 years of excavations and curation.

Joseph on St. Joseph Island in Ontario, as having the same characteristics and being made by "folding a single strap of iron around a mandrill, forge-welding the two ends, insetting a previously carburized and hardened steel bit, forging and broad blade, and finally grinding the cutting edge" (Unglik 1984: 84). These axes have a blade that is flared downward. The blade, eye, and butt of the axe fall in a straight line across the top of the axe.

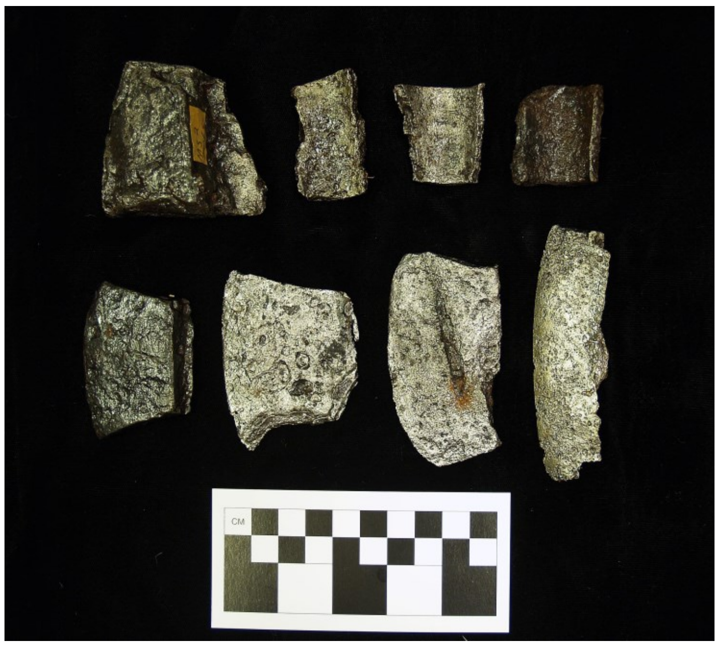

Figure 5:3 Axe blades from Fort Michilimackinac (photographed by the author).

Repairing axes was a common activity of the frontier blacksmith. Axes were made and repaired by hot-working, welding and hammering iron to steel. The connection of the steel bit that joined the body of the axe with the blade of the axe weakened and sometimes broke. Replacing the steel portion of the axe was fairly common, as was scrapping the other portions of the axe (Morand 1994: 22). Sixteen axe fragments (50% of the axes from the collection) recovered from various contexts were analyzed using pXRF. Two came from known British military contexts, seven from known French contexts, and seven from other contexts within the fort, such as trader's houses or from contexts with indeterminately French or British association.[102] The analysis shows evidence of cut edges on several of the axe pieces which may have been scrapped for later use to repair axes (Figure 5:3). Unglik (1984) noted that several axes recovered from the blacksmith shop at Fort St. Joseph had been pieced together using several parts that were welded to form one axe (Unglik 1984: 87-88). The same process may have been taking place at Fort Michilimackinac. Portable x-ray fluorescence analysis reveals some variation between the axes, particularly with regard to the presence of copper (Cu) and zinc (Zn) in two specimens. As shown in Figure 5.4, several yellow areas on the axe reveal the presence of cupreous material within the axe. The presence of the copper alloy on the axe can be attributed to the axe touching the cupreous material in the forge during a heating episode. A frontier blacksmith would have used a variety of methods, including brazing, to repair various objects. As previously described, the process of brazing may result in the unintended spillage of cupreous material onto the slag or forge material which would later adhere to objects placed in the forge; for instance, to heat an axe in preparation for welding. The presence of the copper alloy on this axe is evidence of local repair or possible manufacture of this axe within the frontier setting where brazing was a common occurrence since it is not probable that mass production sites of iron implements were participating in repairing objects by the method of brazing.

[102] The date of occupation is not definitive, nor is the cultural association of from which these ax fragments were found.

Figure 5:4 Trade ax from Fort Michilimackinac exhibiting copper inclusions (photographed by author).

Trap Parts

Traps were essential to the success of Fort Michilimackinac. Trap parts were imported to North America, mostly from London, England until the 1850s when Newhouse traps became widely distributed from Oneida, New York to New York City and Chicago, two of the largest fur trade centers in America (Noyes 1865; Gerstell 1985: 32, 75, 89-90). The few traps that were made in North America during the 18th century were made by blacksmiths, gunsmiths, and machinists for local trappers or for fur company employees who were stationed at frontier fur trade posts (Gerstell 1985: 129). Surprisingly, few trade inventories list traps as an item being imported or traded and it is likely that traps were included with entries like “sundries”, “casks of hardware”, or “iron works" (Gerstell 1985: 64). Gerstell (1985: 72, 74-75) notes that traps were being imported to Michilimackinac from London via Albany. It is also known that traps were imported to Fort Michilimackinac because of reported loss. In 1763, William Edgar, a successful Great Lakes trader, reported the loss of 21 traps, among other supplies, that were being transported to the fort (Edgar 1760-1769).

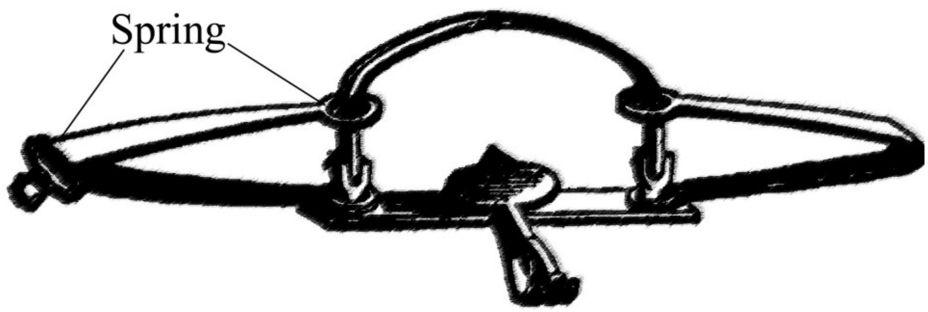

Figure 5:5 Typical 18th century animal trap (redrawn from Gerstell (1985: 33) and Noyes (1865).

The variety of conditions the traps were exposed to for extended times contributed to their fragility and they often broke. Trappers often placed the ferrous metal traps beneath moss or roots and even submerged the traps in shallow water as a strategy to trap beavers (Gerstell 1985: 40). For example, according to accounts from Alexander Henry who was taken prisoner following the raid of Fort Michilimackinac during Pontiac's Rebellion in 1763, Ojibwa strategically used traps to catch "bachelor beavers living in holes in the river banks" (Henry 1969: 127). According to Amiot's 1747 inventory he was repairing traps and trap parts (Amiot 1747). It is not known for whom Amiot made the repairs, although it is likely that traps were being repaired for traders and Native Americans.

As with most ferrous metal objects made during the 18th century, there are no detailed records that explain how traps were made or repaired (Gerstell 1985: 158). Among the most commonly found pieces of traps are the springs. All of the trap parts (n=7) within the sample examined for repair were portions of the spring and four had cut edges that indicate that they had been scrapped.[103] The trap parts in Figure 5:6 have cut edges below the eye portion of the spring arm and may have been retained for reuse.

Figure 5:6 Trap parts recovered from French contexts at Fort Michilimackinac. The middle and right exhibit cut edges (photographed by the author).

Other evidence that repairs were being made to traps at Fort Michilimackinac included one spring that appeared to have active corrosion in several pits on the surface

[103] The collection database at the Mackinac State Historic Parks indicates that 7 trap parts have been recovered at Fort Michilimackinac. This count is not accurate because of the varied use of nomenclature terms for various categories in the catalog records. For instance, in the database, the catalog record for a trap spring may not contain the term 'trap' but may be referred to as a 'spring'. Other objects also contained springs within their mechanics, for example flintlocks. Furthermore, it was not possible to get an accurate count for all the various fragments of trap parts.

of the object. pXRF analysis revealed that these imperfections were actually inclusions of copper within the primary iron matrix that made up the spring (Figure 5:7 & Figure 5:8). While chemical variation exists between traps, this trap exhibited significantly more copper than any of the other trap parts. This is another example of repair within the frontier environment. This trap part would not have been originally manufactured to contain brass impurities. The presence of brass on this trap part is clear evidence that it was placed into a forge that contained brass which was most likely present due to brazing activities of a blacksmith which is likely to produce brass run-off onto the forge slag or coals (Unglik 1984: 127). This contamination would most likely have taken place within the frontier environment in which the trap was imported and utilized.

Figure 5:7: Trap spring with copper inclusions (photo taken by the author).

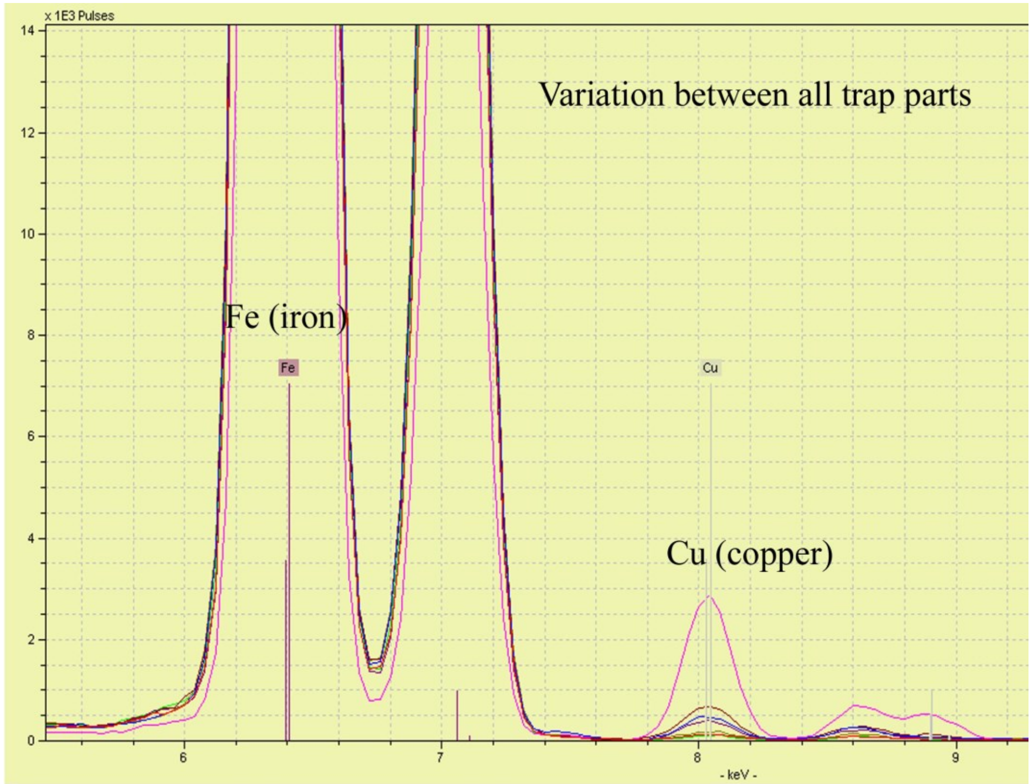

Figure 5:8 pXRF reading showing the variation between all trap parts analyzed in this sample.

Hoes

Hoes are not commonly found at 18th century fur trade posts but become more common in the 19th century (Hanson 2004: 4; Birk 2004: 82).[104] Hoes may have been locally produced at Fort Michilimackinac, but were most likely imported with other tools. Hoes were documented to have been repaired at the site and show up on French trader's inventory lists as *pioches* (LeFeuure 1746; Amiot 1774). All of the hoes examined were made of wrought iron, found within British contexts, and were likely used by various individuals at the fort to cultivate gardens, located both inside and outside the

[104] According to the artifact catalog database maintained by the Mackinac State Historic Parks, eight hoes have been found at Fort Michilimackinac.

fortification (see Magra Map 1765). The most common repair exhibited on the hoes was the reattachment of the metal body of the tool to a wooden handle using rivets. These rivets were mostly iron, but some brass rivets are also present. Interestingly, this form of hoe, which required the use of rivets to attach the blade to the handle, is atypical of other 18th century hoes that attached the blade to the handle through a wrought iron eye that paralleled the body of the hoe (Hanson 2004: 2-3).

The blade on one of the hoes examined from Fort Michilimackinac was folded over and hammered into a flat surface; clear evidence of reuse and modification to the existing body. These cold-working methods of repair did not require a blacksmith's skill but highlight the importance of repair, reuse, and adaptability of metal objects within the frontier setting.

Kettle Parts

Kettles were a staple commodity at frontier fur trade sites in North America. The utility of the kettle, as not only functional as a vessel but also as a source of raw material, particularly copper or brass kettles, meant that kettles were widely distributed across the fur trade frontier.[105] Iron and copper or brass kettle fragments were found in abundance at Fort Michilimackinac.[106] Iron kettles were made of cast iron and were imported from

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[105]Many references to the different "lives" of the kettle have been thoroughly documented and craft industries dependent upon the reuse of brass or copper kettles has also been detailed through various studies of brass materials, such as tinkling cones, rivets, or other small artifacts (for examples see: Morand 1994; van Dongen 1996; Turgeon 1997; Nassaney et al 2007; Ehrhardt 2005).

[106] The catalog record database maintained by the Mackinac State Historic Parks indicates that there are 235 kettle parts within the collection. This count is probably less than the actual number of kettle parts recovered from the site. The term 'kettle' may not be used in several catalog records. For instance, 39 patches are included in the database but the catalog record does not include the term 'kettle' so it is unclear whether these patches were used on kettles or other types of goods that were repaired.

production sites like *Trois Riviéres* or Montreal during French occupation and during British occupation may have come from places like Saugus, Massachusetts or could have been imported from London, England with other iron implements.[107]

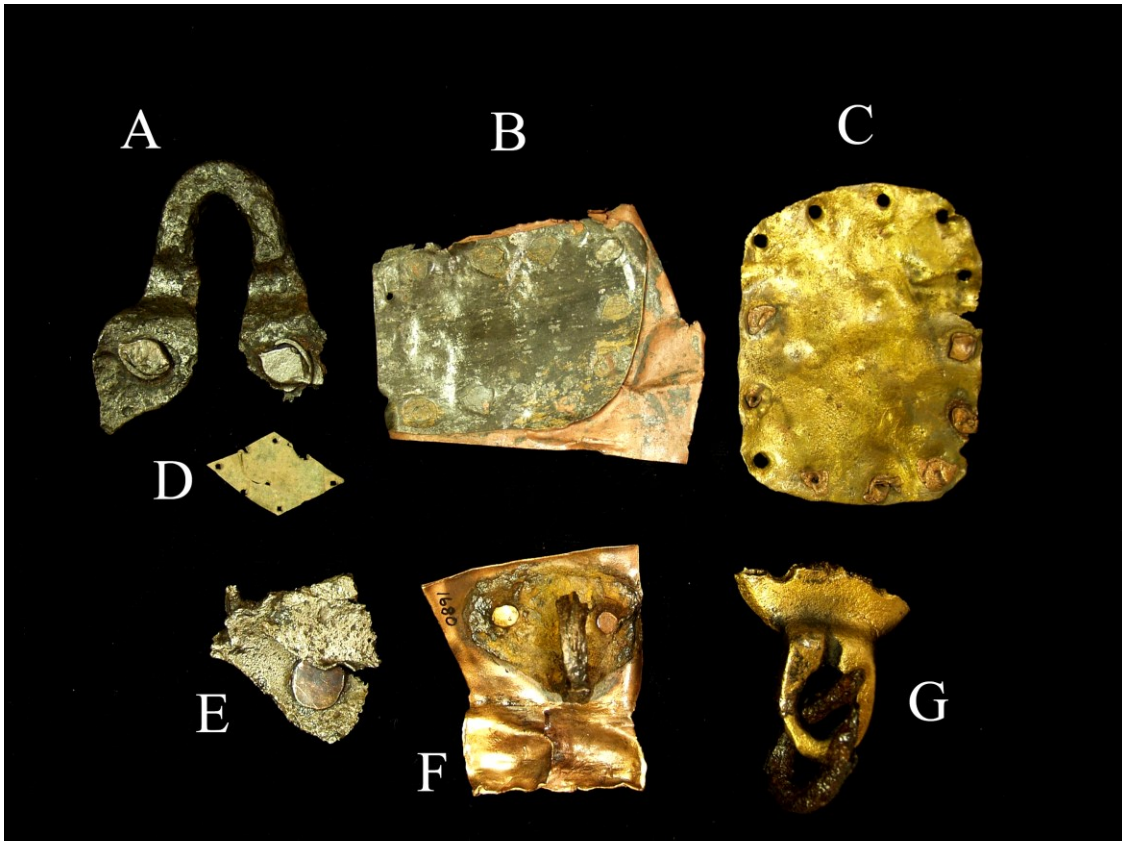

Figure 5:9 Kettle parts found at Fort Michilimackinac (photographed by the author).

Three main types of repairs were made to kettles depending on the portion of the kettle that broke. Patches were riveted to the body of the kettle if there was a leak or hole. Rivets were used to reattach lugs to the body of kettles. Kettle bales were also

[107] As noted previously, Gerstell indicates that traps were being imported to Michilimackinac from London (Gerstell 1985: 72, 74-75). This route of importation from London through urban centers, such as Albany, may have also been the pathway of providing other iron implements like cast iron kettles. It is also likely that the kettles may have been imported this way since they could have been used as a container for carrying other types of goods.

either riveted or connected via a chain link or hook. All three of these types of repairs for kettles were found at Fort Michilimackinac.

Figure 5:10 Kettle patch that was sewn as opposed to being riveted (photographed by the author).

Figure 5:9 pictures a variety of kettle parts found at Fort Michilimackinac, including kettle lugs (A, E, F and G), patches (B, C, D) and portion of a bale or handle (G). Portable XRF analysis indicates that both copper and brass are being used as rivets. Kettle patch B (Figure 5:9, B) exhibited unusual color attributes that consisted of a grey patch with yellow rivets connected to a red body. Portable XRF analysis revealed the presence of copper, antimony, lead, and bismuth, indicating that the gray piece is not tin, as was originally interpreted, but is instead, a piece of pewter. The red metal on the patch is copper, while the yellow rivets contained both copper and zinc, indicating they were made of brass. Another unique kettle patch also recovered at Fort Michilimackinac exhibits characteristics that show it was sewn with cupreous wire as opposed to be riveted to the body of a kettle (Figure 5:10).

Saws

There has been relatively little written about saws at frontier fur trade posts in terms of where they were produced, how they were made or repaired, and who used them. Other fur trade sites that included saws are typically French and mention the presence of both ferrous and cupreous saws (Birk 2004; Faulkner 1986; De Vore 1990). Several fragments of small saws were recovered from Fort Michilimackinac and were included in this analysis because of unique characteristics (Stone 1974: 298).[108]

Cupreous saws are relatively common to frontier sites and many have been recovered from French trade posts (Birk 2004: 62; Faulkner 1986: 90; De Vore 1990: 19). These saws could easily have been made at Fort Michilimackinac for the same reasons and by the same methods as other small brass or copper objects that were made from brass or copper kettles: it was abundant and easily manipulated. The size, thickness, hardness and durability of these cupreous saws limit their possible uses since they would be too fragile for use on wood or large objects (Wood 1993: 555). The purpose of the small, thin, cupreous saws is ambiguous. One interpretation is that these saws may have been used by blacksmiths as a pattern for making ferrous saws. Brass saws recovered

[108] The catalog database maintained by the Mackinac State Historic Parks indicates that 24 saws or saw parts have been recovered from Fort Michilimackinac.

from blacksmithing contexts at Fort Pentagoet were interpreted as patterns that may have been used to make iron saw blades, awls, butt plates for muskets, or thread gauges (Faulkner 1986:90). However, it is not clear how the supposed brass saw patterns were used to create the objects described by Faulkner (1986: 90).

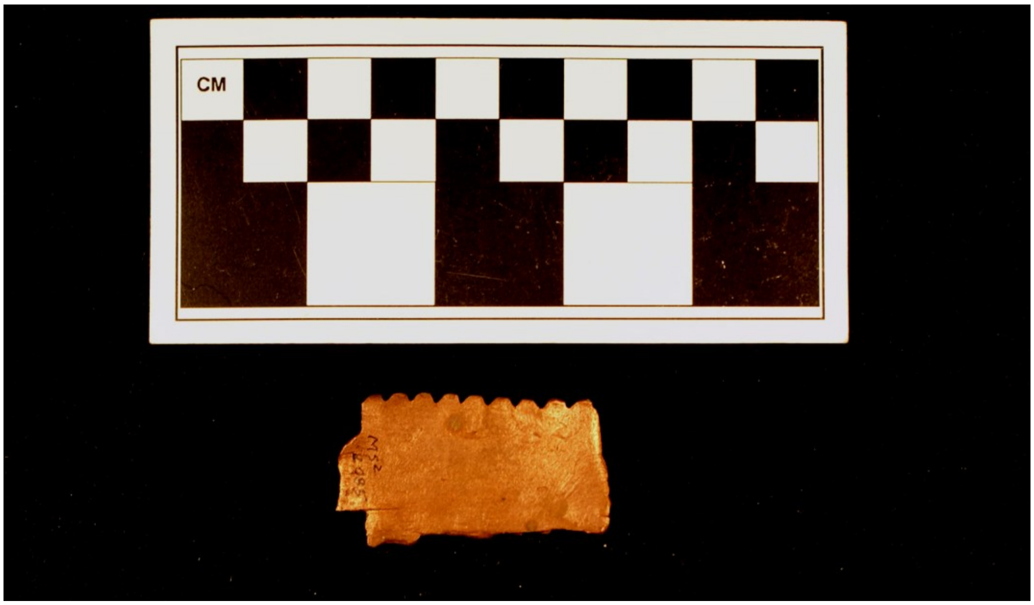

Figure 5:11 Copper saw blade with rounded teeth and uneven, cut surfaces (photographed by the author).

Another, more likely, explanation is that the brass/copper saws were used to shape and cut soft stone. Brown (1918) describes the function of brass/copper saws recovered from French trade sites as implements used to carve and cut soft stone, such as soapstone or catlinite, into Micmac pipes, beads, or effigies (Brown 1918: 76; Cleland 1971: 28; Birk 2004: 62). Birk also notes that several other French trade sites located in Voyagers National Park in northern Minnesota also produced brass saws (Birk 2004: 62; Richner 2002: 59, Table 4; Bray 1978: Figures 6, 7, and 8). The specimen from Fort Michilimackinac shown in Figure 5:11 and Figure 5:12, B has rounded teeth, as opposed to the sharp jagged teeth on iron saws. This characteristic, in combination with the French contexts in which they were found, also lend weight to their use in stone cutting since Micmac pipes were produced by the French for participation in Native American smoking practices and, more specifically, were being produced at Fort Michilimackinac (Brown 1973: 28; Hauser 1982; 28; Morand 1994: 48). More specifically, Micmac pipes were being produced at Fort Michilimackinac and Brown (1973) identified a probable manufacturing location in the south-southwest row houses which contained several fragmented and complete pipes along with waste material. This location also contained the copper saw pictured in Figure 5:12, E. The small brass/copper saws were likely produced at Fort Michilimackinac for the purposes of producing carved or cut stone objects. If this is the case, the blacksmith would likely not have been the one producing or using these saws. Expanding analysis to compare residue analysis or cut marks on bone or other materials from the site might provide more information about the uses of various types of saws.

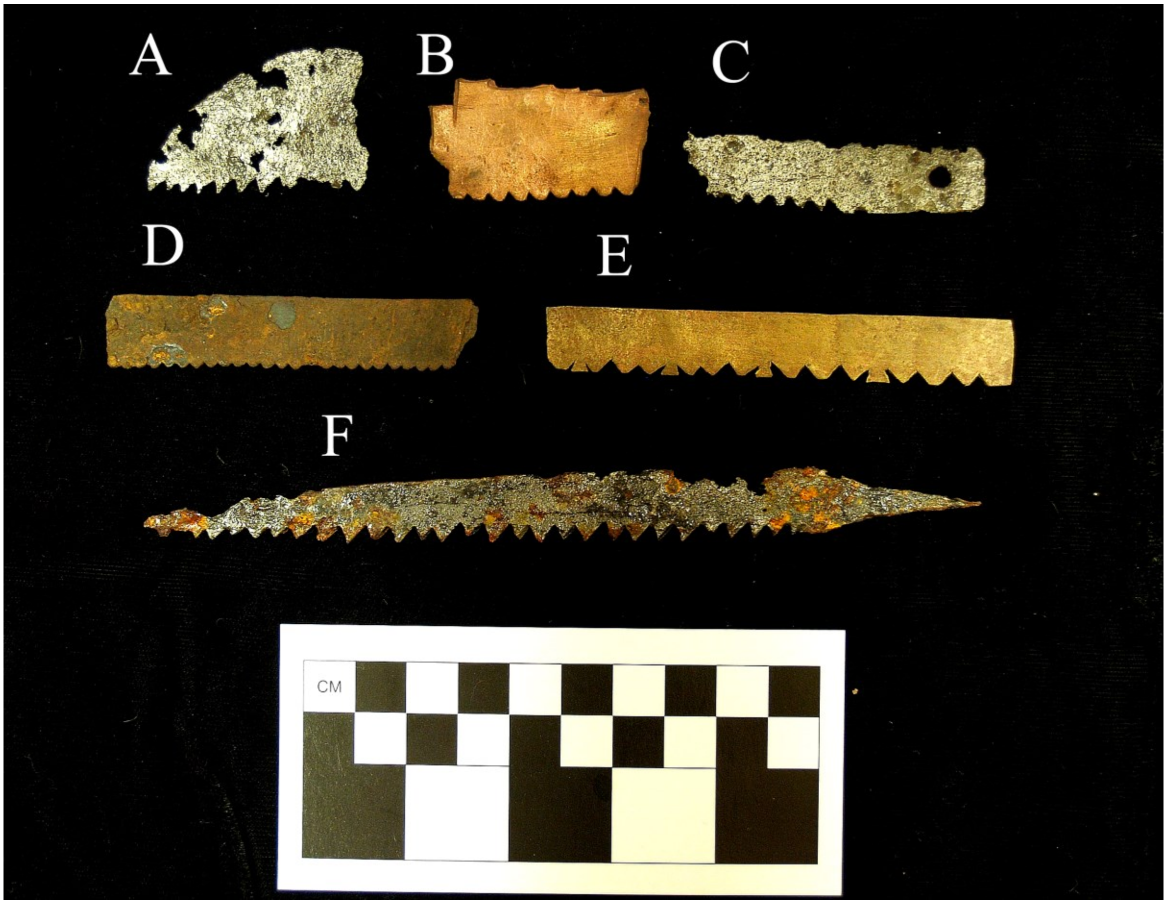

Figure 5:12 Saw Blades from Fort Michilimackinac (photographed by the author).

Ferrous saw blades recovered from Fort Michilimackinac may also have been locally manufactured. As shown in Figure 5:12, several different types of saws were present at Fort Michilimackinac. All the saws were likely various types of hand saws given their small size. Saws C, D, E and F were likely web saws or cross-cut saws with U-shaped handles extending over the back side of the blade (Disston 1921: 12). Saw A was a hand saw that cuts on the pull while the other blades were designed to cut on the push and the pull motion of the user (Disston 1921: 12). Portable x-ray fluorescence revealed high variability between the ferrous saw blades recovered from the site. The presence of lead (Pb) in two ferrous saws indicates that someone may have tried to repair the saw blades using lead material. The lead readings did not come from the blade area and therefore do not indicate that the saw was being used to cut lead objects. Even in the iron saw blades the presence of brass seems to indicate that the blades were somehow exposed to cupreous material. The degree of variability and the presence of brass on the saw blades may be indicative that the blacksmith was manufacturing the saws locally at Fort Michilimackinac.

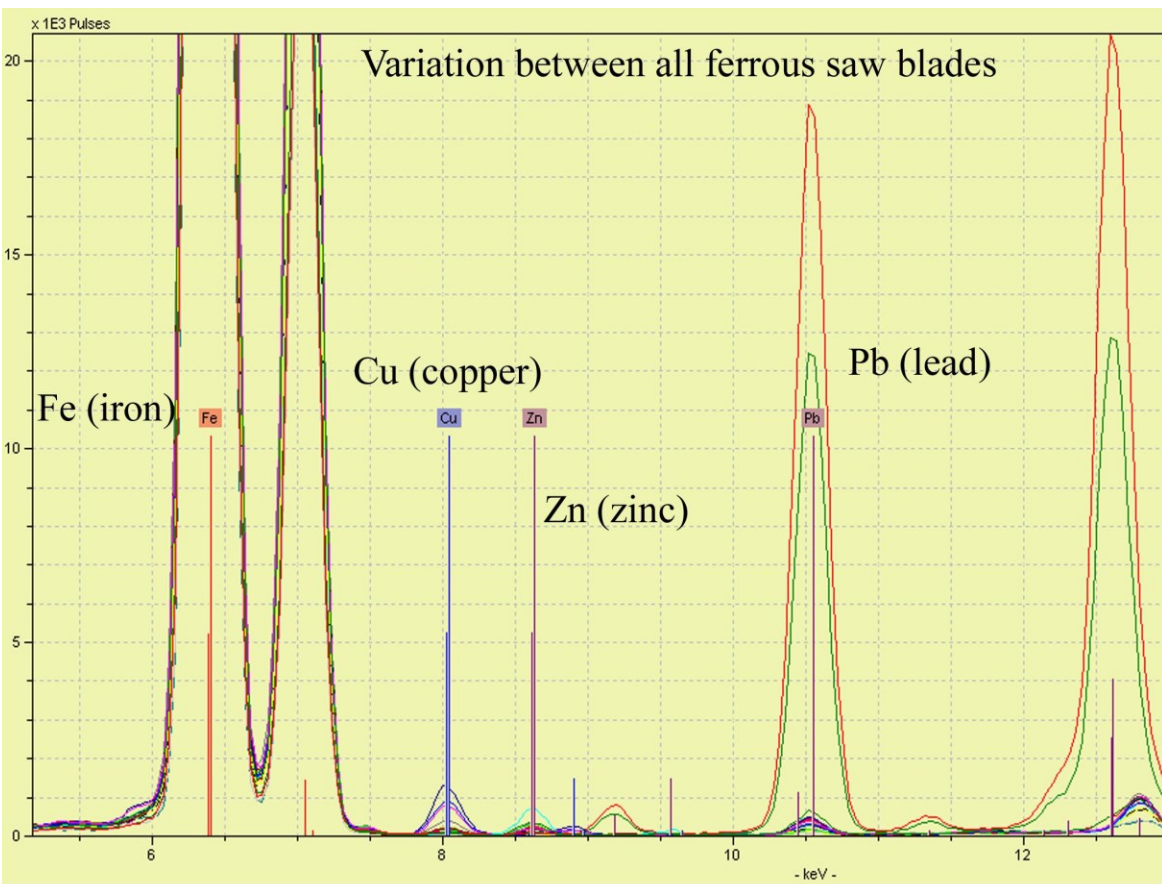

Figure 5:13 Raw data variation between ferrous saws. Note the presence of copper, zinc, and lead in various saw blades.

Strike-a-lites

Strike-a-lites, *steeles*, or firesteels, as referred to in historic documents, was another type of object that was documented to have been produced by the blacksmith at Fort Michilimackinac (Amiot 1774). Strike-a-lites were widely dispersed and everyone within the community would have owned one or more. Two types of strike-a-lites were found at Fort Michilimackinac, six of which were analyzed.[109]

Figure 5:14 Strike-a-lites Recovered at Fort Michilimackinac (photographed by the author).

The first type is a closed oval (Figure 5:14 A, B, and C) that was hand forged from steel rod (Stone 1974: 187; Hanson 2001: 5). This type of strike-a-lite is commonly

[109] The catalog database maintained by the Mackinac State Historic Parks indicates that only two strike-a-lites are in the Fort Michilimackinac collection. However, Stone (1974: 187) includes 40 in his count. The count from the database is not accurate as different nomenclature terms may have been used to identify the objects in the database.

found at fur trade sites and were "mass-produced" for export to fur trade posts (Hanson 2001: 5).[110] The longer edges could serve as either a handle or blade, depending on the grasp of the user. Stone (1974) divides this type in two based on shape, identifying some strike-a-lites as more oval in shape and others as more rectangular (Stone 1974: 187). According to Hanson (2001) there was no difference in the production or distribution in the oval versus rectangular shapes. Hanson states that traders "complained if the striking surfaces were too curved rather than being straight" indicating that the small differences in shape may have affected the preference choice of traders (Hanson 2001: 5). Strike-a-lite B (Figure 5:14) is most notable because there is a letter "A" stamped into the side; possibly a maker's mark.[111] This would have been done after the object was made while it was still warm.

The second type of strike-a-lite found at Fort Michilimackinac has finger loops on either end with one striking blade opposite the grip (Figure 5:14 D, E and F). Stone (1974) describes these as "two-part" strike-a-lites, but these would have been made using one piece of steel that would have been hand worked, stretched and tapered to form the finger loops. Some of these strike-a-lites have curled ends as seen in Figure 5:14 F. This type of strike-a-lite is typical of French associated fur trade sites (Cleland 1971: 22; Hanson 2001: 3; Birk and Richner 2004: 107-108). This type is also most likely to have

[110] Hanson (2001: 5) notes that the strike-a-lites were "mass-produced" since "fur company orders often reached 100 dozen at a time. They were often shipped in paper packages of a dozen steels". Hanson does not indicate where the steels were being exported from.

[111] Maker's marks on strike-a-lites are relatively rare but have been documented and are described in part by Birk and Richner (2004: 107-08). The only maker's mark identified by these authors containing the letter "A" would have been from the word "WALDON" but little is known of this maker's mark and there does not appear to be any evidence of other letters on this strike-a-lite from Fort Michilimackinac. Therefore, it is assumed that this stamp is not from a known maker's mark.

been produced at Fort Michilimackinac. According to Amiot's 1747 inventory, he made "steeles", which most likely looked like forms D, E and F in Figure 5:14 given the French affiliation of that type. Variation among the type is clearly visible between the three examples pictured in Figure 5:14. Strike-a-lite E appears more rectangular in form, while D and F are more rounded along the edges. Strike-a-lite F is even curved along the bottom and has serrated teeth. This variation may also indicate that they were produced during separate events, as opposed to being mass produced, and were likely produced by blacksmiths at fur trade sites.

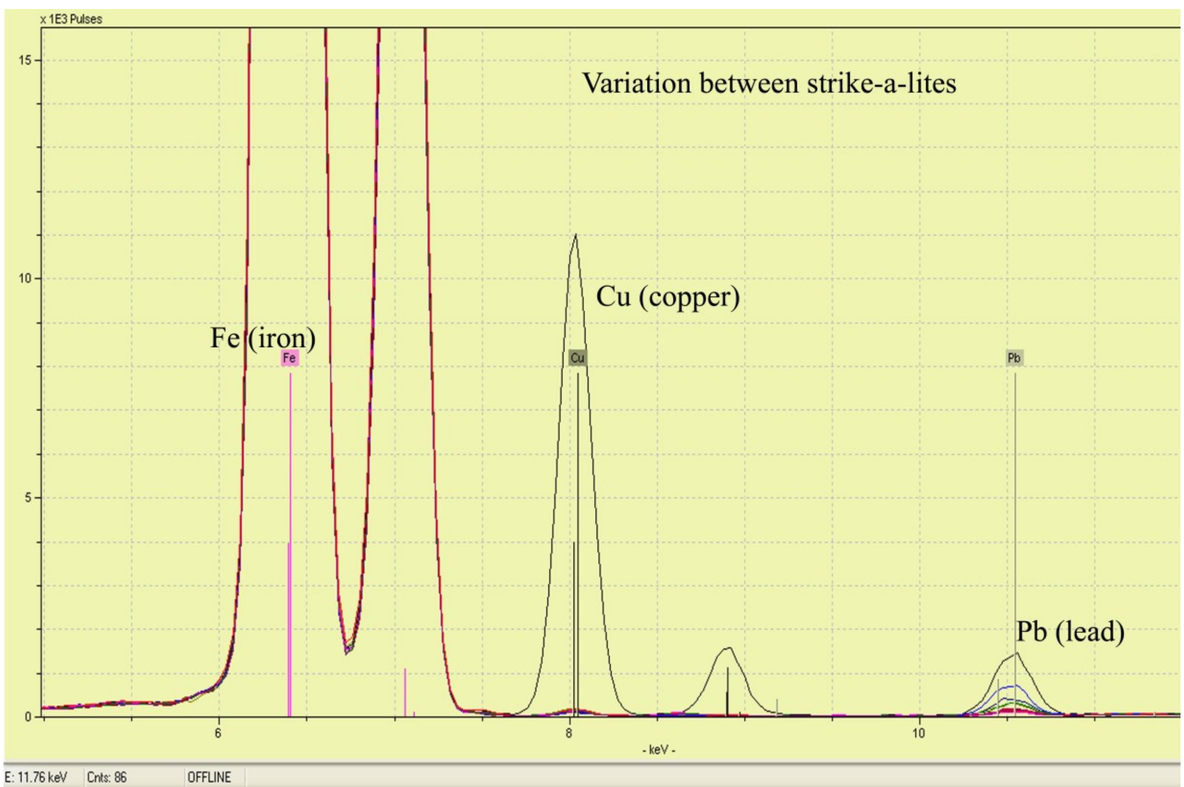

Figure 5:15 Raw data pXRF showing variation between strike-a-lites from Fort Michilimackinac.

The pXRF data indicates some variation in the chemical composition between the strike-a-lites with the most significant differences exhibited by strike-a-lite D pictured in

Figure 5:14. As see in Figure 5:15, most of the variation exists in the amount of lead (Pb) present. All strike-a-lites lack a presence of lighter elements which indicates that they are made of wrought iron. This variation indicates that strike-a-lite D (Figure 5:14) may have gone through a repair attempt but evidence beyond the significant variation in the presence of copper is not apparent.

Projectile Points

Metal projectile points have been recovered from several trade posts and are overwhelmingly associated with French contexts. A total of nine projectile points found within French contexts were analyzed using pXRF.[112]

Most metal points are cupreous and have been interpreted as non-utilitarian trade objects that were produced by cutting kettles (Cleland 1971: 28; Stone 1974: 277; Morand 1994: 28; Halsey 1996: 9, 18). In terms of production, cupreous projectile points were easily cut from kettle scrap by individuals without working knowledge of metallurgical processes. Cupreous projectiles could also have been cut using a pattern, similar to the way in which tinkling cones were produced (Nassaney et al 2007; Giordano 2005), which helps to explain consistency in form between specimens.[113] It is also possible that the ferrous points were cut or ground from other iron objects, such as iron

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[112] The exact number of projectile points found at Fort Michilimackinac is not known. Further analysis into the points found at the site is needed to distinguish between actual projectile points and triangles. The catalog database maintained by the Mackinac State Historic Parks indicates that 14 projectile points have been recovered from Fort Michilimackinac but this number is not accurate since Stone (1974: 277) notes that 48 had been recovered through 1966. Various terms are used to describe the projectile points, such as triangle, point, arrow, and arrowhead. Some of these terms, like point, are used to describe other fragmented objects, such as glazier points.

[113] In order to confirm the idea that cupreous projectile points were cut using patterns, further measurement analysis would be required.

strap from barrels. Yet, the degree of variation in both form and material composition reveals the need for further metallurgical analysis to better explain the production process. The elements identified via pXRF analysis varied greatly between iron projectile points and levels of chromium, manganese, antimony and lighter elements like calcium indicate that two of these were cut from cast iron objects (Figure 5:16 & 5:17 A & D).

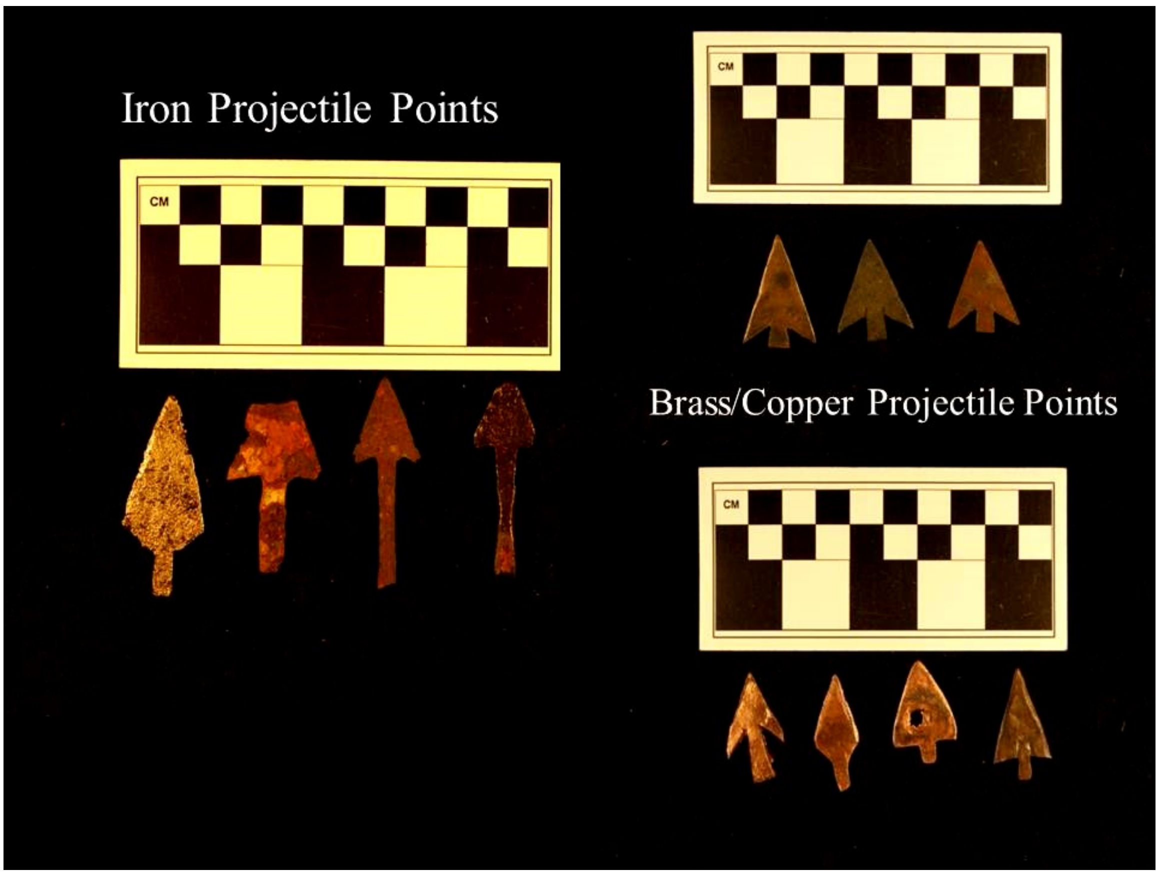

Figure 5:16 Iron and copper alloy projectile points recovered at Fort Michilimackinac (photographed by the author).

Ferrous projectile points have been a topic of discussion since the 1930s, yet still little is known about their production, use, and distribution. Iron projectile points are also thought to have been cut from European goods, such as barrel hoops (Morand 1994: 29), hoes (Smith 1950: 3), or other iron scrap. Ferrous projectile points have been interpreted to have been produced primarily for trade with Native Americans who presumably used them in the same manner as traditional arrowheads (Quimby 1966: 72; Kidd 1970: 76-78; Stone 1974: 298; Morand 1994: 29; Pyszczyk 1999: 163-167; Birk 2004: 62). Ferrous metal projectile points discussed by Quimby (1966), Kidd (1970), Stone (1974), Morand (1994), Pyszczyk (1999), and Birk (2004) are interpreted as being used by Europeans for trade with Native Americans with the assumption that Native Americans used the iron points in substitute for stone arrowheads and are evidence of continuous use of traditional cultural practices using European materials. However, unlike tinkling cones which were a prevalent locally manufactured commodity at fur trade sites, iron projectile points are not common at fur trade sites. Most metal projectile points during this time period are made of cupreous material and iron projectile points seem to outnumber these types only at later fur trade sites in western North America, as found at Fort George in Alberta, Canada (Quimby 1966: 72; Kidd 1970: 76-78; Pyszczyk 1999: 163-167; Birk 2004: 62). Both cupreous and ferrous projectile points could have been made by individuals other than the blacksmith within the frontier setting.

The relative rarity of iron projectile points indicates that they were not necessarily produced for trade, but instead may have been used by traders, civilians, and other French-associated individuals. If iron projectile points were being used as a material substitute for traditional arrowheads, it would be likely that larger numbers of projectile points would be recovered from trade post sites and also from 18th century Native

American village sites.[114] It would also be likely that these projectile points would have appeared in historic documents, either in formal inventory lists of trade supplies or informal lists of objects traded with Native Americans, such as notes from Sir William Johnson or other prevalent traders.[115] The fact that the metal projectile points are found in small numbers, within residences inside Fort Michilimackinac, and lack a presence in written European documents that describe items traded or gifted to Native Americans, supports a hypothesis that these points were used by Europeans and European-descendants. While this hypothesis cannot be further evaluated here, it is reasonable to consider it viable and furthermore a potential avenue of material adaptation of Europeans to the frontier environment.

Comparative pXRF analysis of the nine ferrous projectile points indicate that seven points were likely made from wrought iron, while two were made from cast iron. As previously mentioned in Chapter 4, cast iron has increased lighter chemical elements, like calcium, because of the smelting process. The production of wrought iron involves hammering out the lighter elements and reducing the raw iron to more pure iron (Fe). Cast iron is also weaker and would be easier to cut by repeatedly folding, hammering, bending, and cold hammering. Figure 5:17 illustrates the variation between all the

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[114] In his research on Native American sites that were contemporaneous to Fort Michilimackinac, Anderson (1992) does not indicate whether or not iron projectile points were prevalent within Native American sites. In a similar study focused on Native American use of metal, Halsey (1996) reports the presence of metal projectile points as included in grave assemblages, many of which were cupreous (Halsey 1996: 9, 11).
[115] The terms 'dart' or 'dart point' have been used to by some lithic specialists to describe smaller projectile points (Hildebrandt and King 2012). Based on their function, projectile points may be referred to as 'darts' within documentary sources like trade lists, inventories, or correspondences. Furthermore, darts listed on Amiot's 1747a inventory may be indicative of iron projectile points. Exploration into the consistency of the use of the term 'dart' within documentary sources at sites where metal project points have been recovered is needed before this claim can be substantiated.

ferrous projectile points analyzed for this research. A total of 9 iron projectile points were analyzed. The lighter elements of calcium (Ca), manganese (Mn), and chromium (Cr) indicate that those projectile points are made from cast iron. Other variation seen in the form of copper (Cu), zinc (Zn) and lead (Pb) indicate that iron (Fe) may have been smelted with brass (Cu and Zn) or lead.

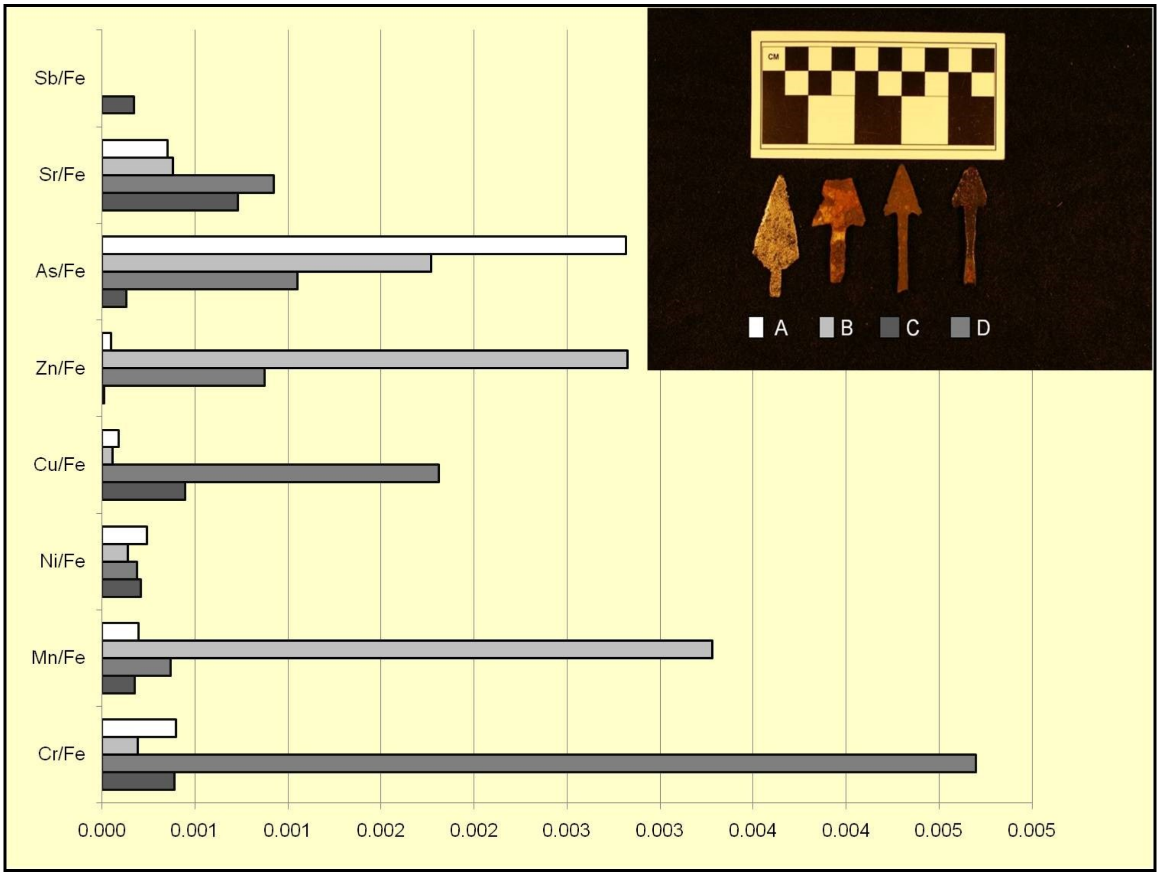

Figure 5:17 Comparison of elements present in ratio to iron in the projectile points analyzed.

Harpoons or Spear Points

Relatively little is known about the use and manufacture of harpoons found at 18th century fur trade sites. Three harpoons recovered at Fort Michilimackinac from French contexts were analyzed for this research and exhibit incongruities that are indicative of local production.[116] For example, one characteristic that is typically found on harpoons is the presence of an eye, or hole, through which a rope would have been threaded to aid in retrieving the harpoon and prey (Cleland 1971: 22). The harpoons pictured in Figure 5:18 do not exhibit this characteristic but are more characteristic of spear points. Spear C (Figure 5:18) comes closest to exhibiting this feature, but the inflexible ferrous wire that loops through the point likely extended to a spear handle since there does not appear to be a place for the attachment of a rope or line. This spear point was manufactured by creating an iron triangle to serve as the projectile point, a hole was then punched through the triangle, and an iron wire was threaded and twisted to secure and tighten the make-shift shaft to the point.

Spear B (Figure 5:18) is similar in form to other harpoons found at fur trade sites during the 18th century. Cleland (1971) noted the presence of an iron harpoon of similar form that measured approximately 222 cm that was found in a burial pit at the nearby Lasanen site (late 16th century). This harpoon from Fort Michilimackinac was made by folding and hammering a piece of iron, probably originally a file. The lack of an eye and the vertical line in the middle of the body may indicate that this point was fixed to a spear handle but this observation remains a hypothesis.

Spear point A in Figure 5:18, appears to have dual purpose with a barb on one end and a flattened serrated edge on the other end. The small barb and thin shaft would have been most effective on small fish or animals. The opposite end with flattened serrated

[116] The catalog database maintained by the Mackinac State Historic Parks indicates that 17 harpoons (12 metal and 5 bone) have been recovered from Fort Michilimackinac.

edge is characteristic of iron fleshers, yet smaller in size. It may have been a dual purpose tool used to catch small fish and then gut them.

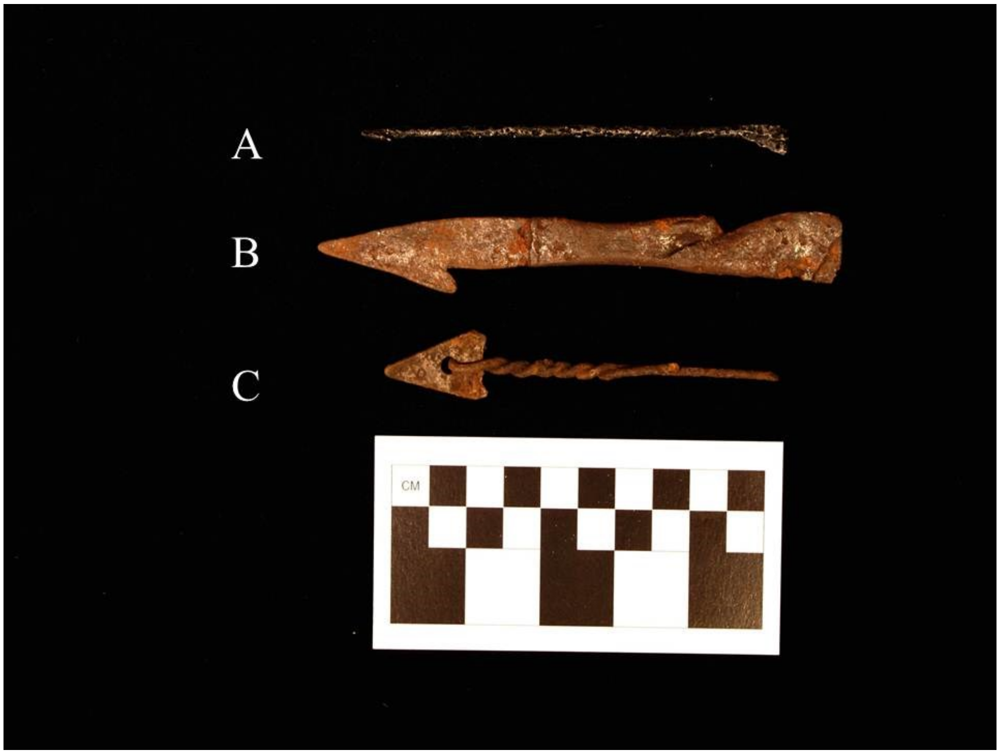

Figure 5:18 Harpoons from Fort Michilimackinac (photographed by the author).

The pXRF indicates that Harpoon B contained slight amounts of copper (Cu), the significance of which is not identifiable. The lack of lighter elements (i.e. Ca) indicates that these harpoons were made of wrought iron as opposed to cast iron. Therefore, it is likely that these harpoons or spear points were locally made at Fort Michilimackinac during French occupation.

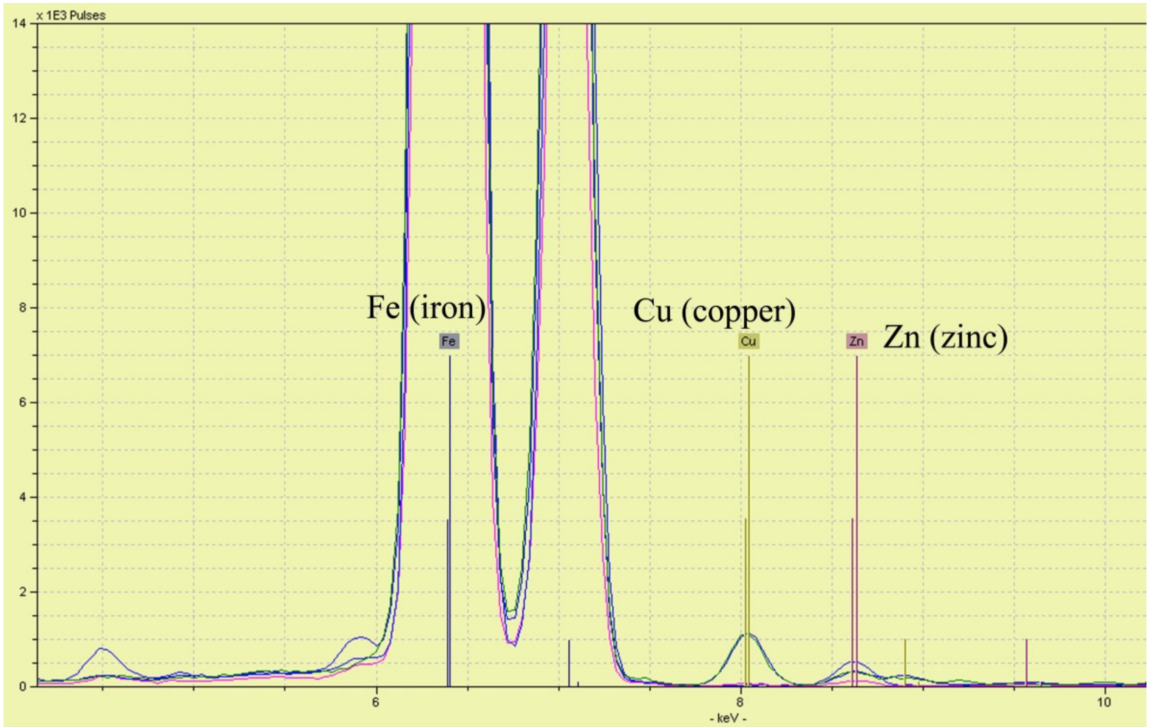

Figure 5:19 Variation between harpoons from Fort Michilimackinac.

Repair and Production at Fort Michilimackinac

Based on the analyses of documentary sources, archaeological contexts, observed attributes, and pXRF data, evidence of repair and methods of local manufacture were identified in several categories of artifacts recovered from Fort Michilimackinac. While some goods were produced, the frontier was not a production area; it was an area of survival and procurement of natural resources. The blacksmiths at Fort Michilimackinac were not specializing in producing a single type of object, instead they were producing a variety goods based upon the requests of individuals and covered a range of goods. This is evident in the French era inventories and British era correspondence regarding blacksmithing, which list goods that were either repaired or produced at Fort

Michilimackinac and included darts, hoes, spiked tomahawks, daggers, swords, picks, axes, and various gun parts (Lefeurre 1746; Amiot 1747a, 1747b; Johnson 1921-1965, 10: 556, 702, 808; Gage 1762-1776). The blacksmith would have been continually challenged to meet the miscellaneous demands of repair and production in order to support such an environment where every member of the community was dependent upon metal goods.

Brazing, riveting, and welding were the most common methods of repair. Within this study, objects that exhibited evidence of brazing included gun parts and kettle parts. Kettles were also repaired with rivets, which were also observed in the repair of hoes from the fort. Axes and trap parts were repaired by welding and scrapped pieces of these objects were recovered and would have been reused to complete other weld-based repairs. Projectile points, harpoons, saws, and strike-a-lites did not exhibit any observable repair, but pXRF analyses indicate that these objects were locally manufactured.

Following the analysis of each artifact group, several observations were made that revealed the characteristics of repair and local production methods at Fort Michilimackinac, and upon further inter-site comparisons, may be unique to the frontier environment. These included:

- the presence of cut edges,
- the use of rivets appear to be the most common repair method,
- non-ferrous metals were used to repair ferrous objects,
- ferrous metals were used to repair non-ferrous objects, and
- chemical variation is present within artifact types.

The following sections discuss these characteristics and the significance of these attributes of repair and production at Fort Michilimackinac.

Reuse and Welding

Reuse was a necessity within the frontier setting, particularly since supplies, raw materials, and new goods were unavailable during portions of the year at Fort Michilimackinac. Payment in goods or services was common in the fur trade economy within the frontier setting (Usner 1987; Ford 1971: 21), but no documentary evidence has revealed this practice at Fort Michilimackinac. The practice has been recorded at rural 18th century blacksmith shops that also experienced, to some degree, a lack of raw materials (e.g. Bessey 1995; Daniels 1993; Bruegel 2006). The use of scrap material as payment, would have most likely been a result of a transaction between the blacksmith and trader or other civilian member of the community since the military, particularly the British military, and later, the Department of Indian Affairs, were more likely to pay using nationally sanctioned monies or through provisions.

Blacksmiths at the site would have reused objects to make repairs or produce items. Individuals may also have provided their own raw materials or salvaged parts for the blacksmith to reuse in the jobs that were solicited (e.g. scrapped axe parts for the repair of an axe). Reusing salvaged pieces of objects to repair or create a usable item was typical at other frontier sites as stated by Unglik (1984) in his analysis of axe repair at Fort St. Joseph, on St. Joseph Island in Ontario. He points out several axes recovered from Fort St. Joseph had been pieced together using parts from several different axes (apparent following the thin sectioning and etching of axes recovered from the site), which were then welded together to form a 'new' axe (Unglik 1984: 87-88). The cut edges on trap parts also indicate that this may have occurred in the production or replacement of springs. Since the methods of this research did not include the metallurgical analysis of thin sections or etching, both destructive methods, welding is inferred to have been taking place at Fort Michilimackinac based on the presence of cut edges on scrapped pieces of artifacts that were typically produced or repaired by welding (i.e. axes and traps). Another factor that supports the theory of community members paying the blacksmith with scrap or providing their own materials for the work requested is the fact that the majority of the artifacts examined were recovered from French contexts, usually within a trader's house. This affords indirect evidence that the civilian community who lived within the fort walls was consuming the services and products of a blacksmith. Minimally, these settlers recognized the value of keeping broken metal objects for the potential improvement that a blacksmith could make to their material lives.

This artifactual evidence, coupled with the documentary evidence that axes were being repaired, and likely produced, at Fort Michilimackinac (Amiot 1747b), solidifies the conclusion that blacksmiths at Fort Michilimackinac were welding axes and trap parts. It is likely that other metal objects were also being welded but further chemical and macroscopic analysis is required to identify these instances.

Figure 5:20 Ax poll exhibiting a cut edge (photograph by the author).

Figure 5:21 Axe polls and blades from Fort Michilimackinac (photographed by the author).

Rivet Repair

The use of rivets was the most common type of repair evident on kettles and hoes. The way in which rivets were used to repair highlights an interesting phenomenon in the integration of metal types. The use of ferrous materials for the repair of non-ferrous objects, and conversely, the use of non-ferrous materials to repair ferrous objects is unique to the frontier setting (Light 1987: 31-36). The hoes examined from Fort Michilimackinac exhibited repairs of this type. Cupreous rivets were used to reattach the blade of the hoes to the wooden handles. This phenomenon is exceptionally visible in the repairs of kettles. Pieces of scrap copper were fashioned into rivets in order to reattach the iron lug to the body of the iron kettle, as seen in Figure 5:22 A, D & E. In another case, Figure 5:22 F, an iron link was forged to connect the handle of a kettle to the copper lug of a kettle or pot, the original material of which remains unknown. Ferrous materials were also used to repair non-ferrous objects, and can be seen in Figure 5:22 E, where an iron lug was attached to a copper kettle using copper rivets. Repairs using ferrous materials on non-ferrous objects, and vice versa, seem to follow the rules of typical repair techniques made to non-ferrous objects, namely riveting and brazing.

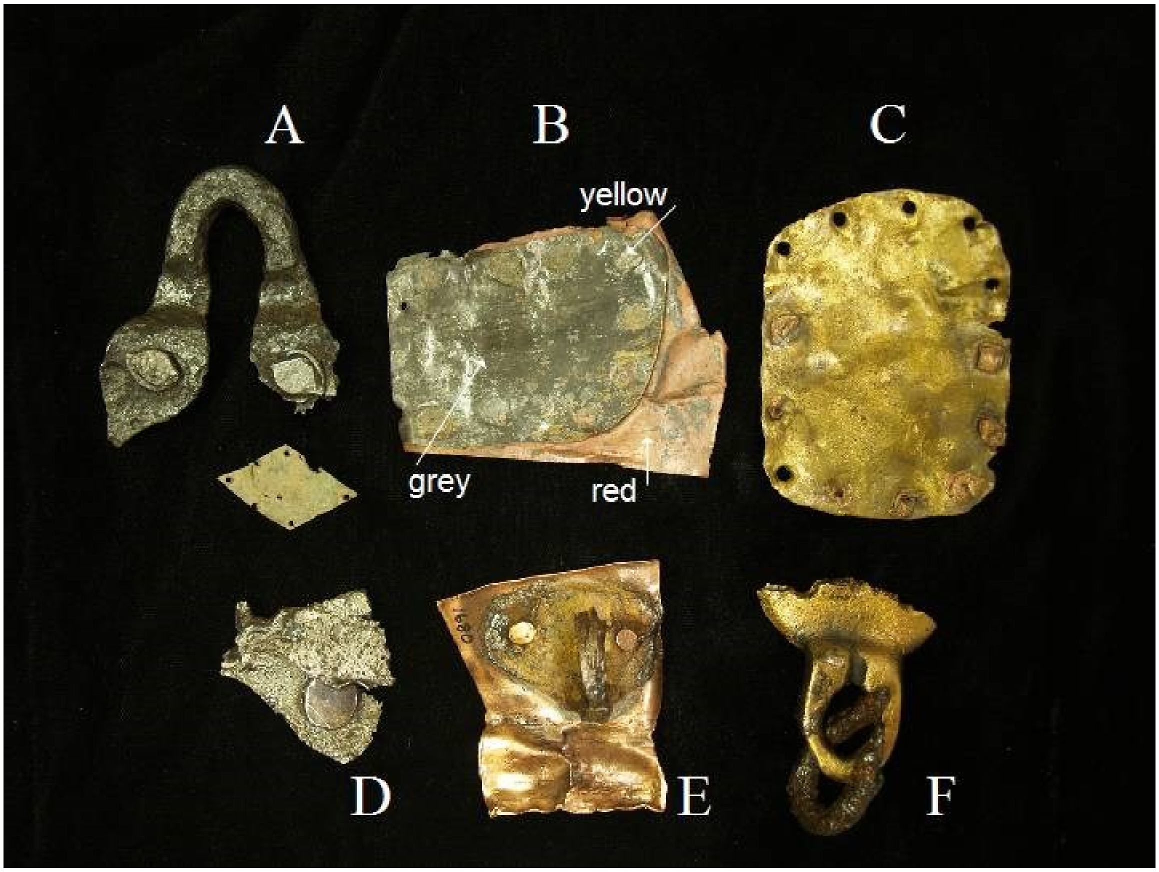

Figure 5:22 Kettle parts from Fort Michilimackinac that exhibit repair (photographed by the author).

The combined use of metals for repair is most likely the result of a lack of resources available to the smith, as well as a lack of understanding of the physical and chemical properties between metals. As Light notes,

> Very few people in the early nineteenth century knew about the galvanic reaction between dissimilar metals and it is not surprising to find a smith using incompatible metals in this manner. His [the blacksmith's] lack of adequate stock may have hampered him in this regard too, so that he used whatever materials were at hand. (Light 1987: 33)

While the processes of galvanic reaction may not have been common knowledge, the strength, quality, and working properties of various metals would have been basic knowledge. Even if a blacksmith understood that using a copper rivet to reattach an iron lug to an iron kettle would render a weak product, ultimately resulting in repeated business, the blacksmith may not have hesitated to provide such service to a customer particularly if 1) the customer was providing the material for the job, or 2) the material provided by the customer did not match the value equivalent to the material necessary, which the smith would have to provide from his own stock in order to provide the customer a high quality repair.

The possibility of metal working having been undertaken by non-blacksmiths is also of importance in interpreting the manipulation and production of metal objects within the frontier. It is significant that, in most cases, the use of rivets to repair an object did not require the skill of a blacksmith. The cupreous rivets could have easily been made by reusing scrap copper or salvaging broken kettles or other cupreous objects. While the blacksmith possessed specialized skills for iron working, working with non-ferrous metals would not require a high degree of metal working knowledge or skill since the material is easily malleable. Moreover, it is already known that several traders, and possibly soldiers, at Fort Michilimackinac and other fur trade fortifications were participating in crafting their own lead shot and copper cones, sometimes called tinkling cones or tinklers, for trade with Native Americans (Morand 1994; Giordano 2005; Nassaney et al 2007). Other objects made of iron may have been cut, filed or cold-hammered into shape, such as projectile points and/or harpoons. It is possible that some members of the community were performing their own riveting or patching repairs for a variety of reasons. For instance, it may have been the case that members of the community at Fort Michilimackinac had limited access to the blacksmith, since access was dependent upon institutional affiliation and/or the ability to provide adequate payment for services (i.e. provide scrap vs. repair materials vs. monetary compensation).[117] Therefore, these people would have sought out the most feasible way to repair items of necessity, even if that meant repairing objects themselves. No matter the truth behind the motives for integrating the application of ferrous and non-ferrous metals in repairs, the purpose of the phenomenon is to adapt to the conditions of the environment and improve the quality of life through the preservation, or repair, of the objects used in daily life by using the materials readily available. These rivets and patches are a material example of the way in which people at Fort Michilimackinac, and other frontier sites, were adapting to the fur trade frontier.

Impurities and Variation as Indicative of Local Production or Repair

Due to the diverse nature of production, it is difficult to determine solely from historic documents exactly which metal objects were being produced at Fort Michilimackinac. One strategy that may be useful in identifying potential locally manufactured items is to identify anomalies between objects. For example, the axe with

[117] More in-depth research of archival records is required in order to find information confirming the so-called monopoly of Jesuit priests over the industry or craft of blacksmithing during this time period within the frontier setting. As mentioned in Chapter 3 (footnote 62), only secondary sources state this monopoly. Conversely, there does seem to be great control over blacksmithing by M. de la Mothe Cadillac, who required all blacksmiths, gunsmiths and locksmiths to hold a permit and/or pay regular fees to Cadillac at Fort Ponchartrain. Several of these accounts are illustrated in the Cadillac Papers (MPHS, vol. 33: 409, 425, 686). Much information can be gained concerning the economic context of 18th century blacksmithing through further archival research into the rates of exchange pertaining to blacksmithing services at several frontier fur trade sites, including Fort Michilimackinac, over the course of several years which should correspond to varying political or military controls. While this topic is interesting and relevant it is not within the scope of this dissertation.

significant copper inclusions would have been locally produced or, minimally, repaired at a frontier site. Other impurities found in the ferrous objects analyzed for this research broadly include lead (Pb), zinc (Zn), nickel (Ni), chromium (Cr), manganese (Mn), tin (Sb), antimony (Sn), and arsenic (As). There are no significant patterns to the distribution of impurities to indicate that these anomalies are the result of reduction processes during the conversion of ore to wrought or pig iron, nor is there any pattern that indicates the impurities are a signature related to source material.[118] Following pXRF analysis, most altered or repaired objects generally include larger than normal, as compared to pure iron and cast iron, amounts of copper (Cu), tin (Sb) and zinc (Zn) as compared to objects that did not exhibit features related to repair, alteration, or local manufacture.[119] As an example, the raw data comparison between axes as shown in Figure 5:23 indicate that there are at least four examples of axes that have outlier levels of copper (Cu), zinc (Zn), or lead (Pb). These impurities may indicate a frontier driven processes of adaptation through production practices.

[118] The comparison between iron objects at Fort Michilimackinac and iron sources in North American (i.e. Montreal, Troi Riviéres, Saugus) is an avenue of future research that may provide more insight to the sources of goods and patterns of trade and exchange that took place between urban centers and peripheral frontier communities.
[119] See Appendix 1 for a complete list of objects used in the pXRF analysis.

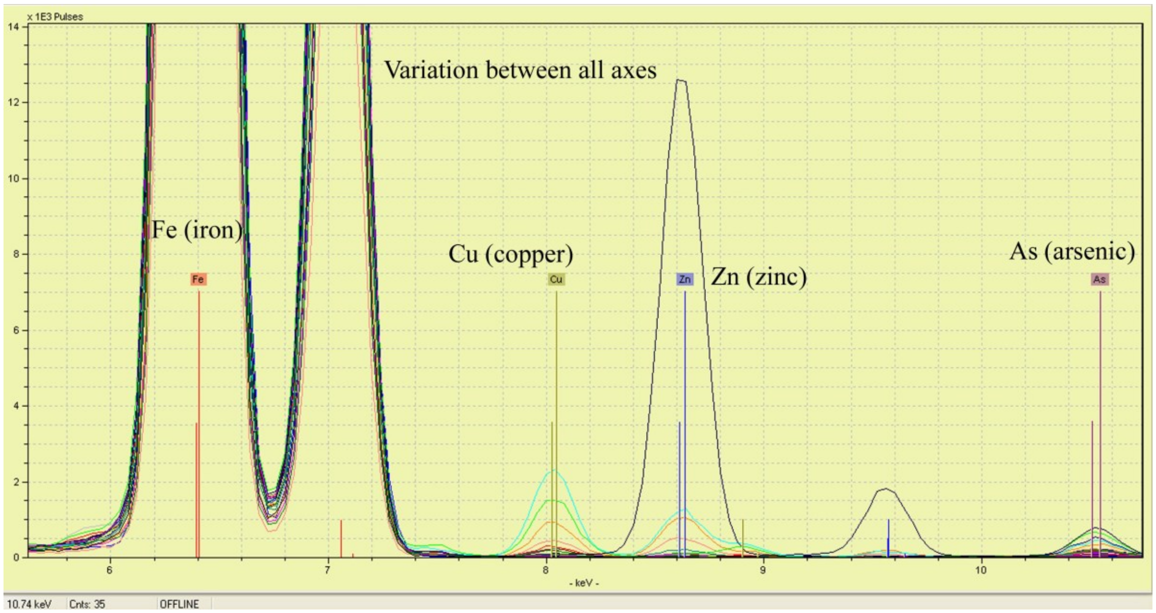

Figure 5:23 Variation visible in raw data pXRF spectroscopy of axes recovered from Fort Michilimackinac.

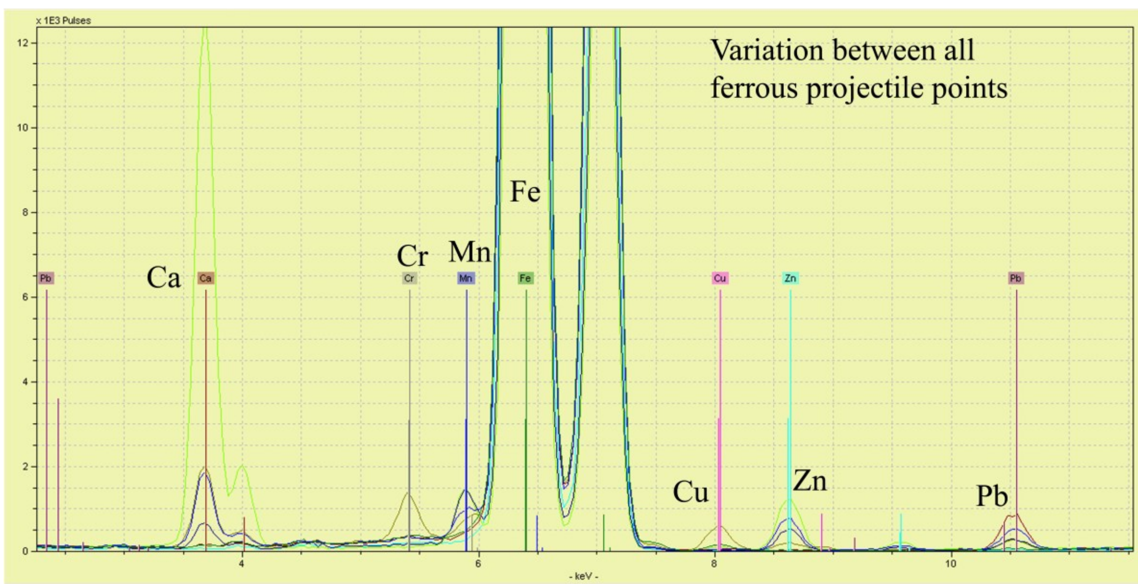

Figure 5:24 Variation visible in raw data pXRF spectroscopy of ferrous projectile points recovered from Fort Michilimackinac.

As seen in Figure 5:24, ferrous projectile points also exhibited a variety impurities, including calcium (Ca), chromium (Cr), manganese (Mn), copper (Cu), zinc (Zn), and lead (Pb). The presence of lighter elements in at least three points indicates that these were made from cast iron, which contains more impurities and lighter chemical elements. These cast iron points were likely made by cutting and filing the points from other cast iron objects, such as barrel hoops. Other projectile points may exhibit variation as a result of the blacksmith combining scrap pieces of metal through the process of heating and hammering (similar to the welding process), or may be a result of being exposed to contaminates in the slag or coals of the forge during heating events. Cupreous projectile points do not exhibit the degree of variation, as shown in Figure 5:25, with differences resulting from the type of metal used (brass or copper) which can be inferred by the presences of zinc (Zn). Ferrous saw blades were another group of artifacts that exhibited variation, with some artifacts containing elements of copper (Cu) and zinc (Zn), while other contained lead (Pb) as shown in Figure 5:26.

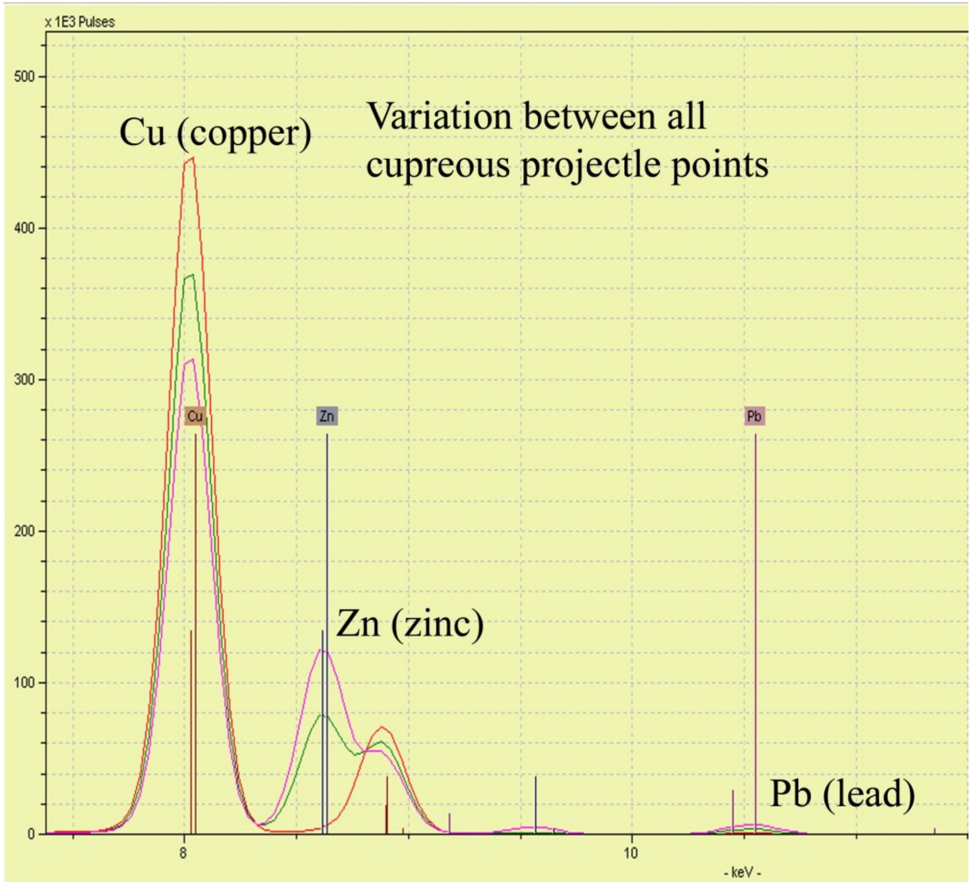

Figure 5:25 Variation visible in raw data pXRF spectroscopy of cupreous projectile point recovered from Fort Michilimackinac.

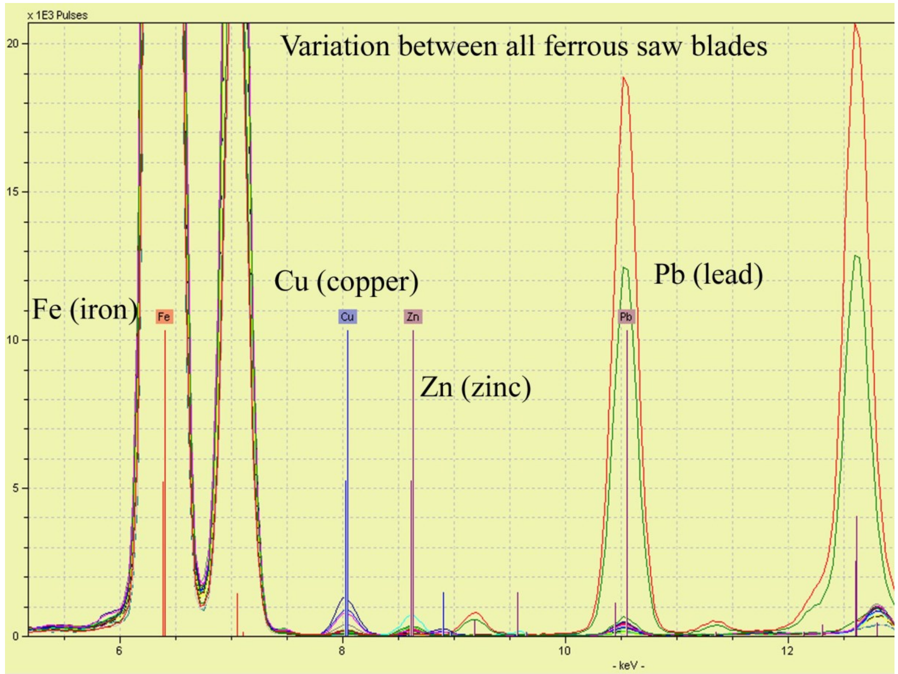

Figure 5:26 Variation visible in raw data pXRF spectroscopy of ferrous saw blades recovered from Fort Michilimackinac.

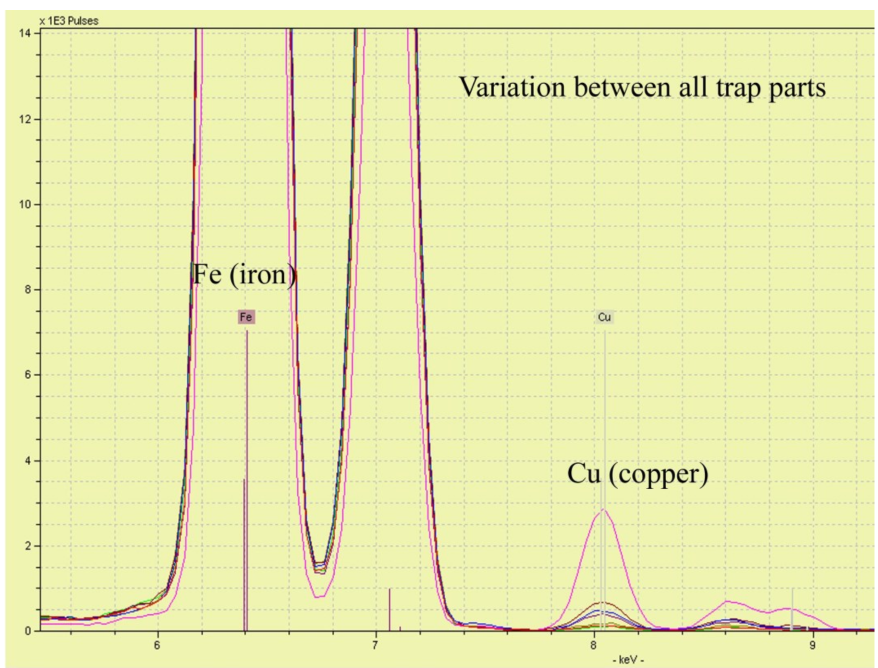

Figure 5:27 Variation visible in raw data pXRF spectroscopy of trap parts recovered from Fort Michilimackinac.

The variation between objects within an artifact type is likely a result of the production process. Whether the variation is a result of production within the frontier environment or from production centers is a challenge to prove. By way of comparison, examining objects that exhibit little variation, such as trap parts (Figure 5:27), it may be argued that more chemical uniformity exists in objects that derive from production centers or from individuals that specialized in producing objects, such as trap parts. The variation exhibited in projectile points, saws, and axes, most likely derived from the un-pristine environment of a frontier blacksmith shop where contamination might occur in several places: the forge, which may contain remnants of material from brazing processes; the blacksmith's hammer, which could be contaminated from working on a variety of metals; or in the process of production, which may have included the welding or combining of different parts or different pieces of scrap material. As compared to objects deriving from production centers, it makes sense that pristine products would not have a high degree of variability since the primary purpose of production centers is to refine and produce. The opportunity for the inclusion of various metals is severely restricted at production sites since the objects are being produced by the same processes each time. Variability within these pristine goods is likely a result of the presence of trace elements from the ore sources and would be consistent when objects of the same type are compared. Variability exhibited in the raw pXRF spectroscopy of ferrous projectile points, saws, and axes is most likely a result of their production or repair, within the setting of a frontier blacksmith workshop. When coupled with the historic documents, it can be inferred that saws, projectile points, and axes were being produced at Fort Michilimackinac.

Summary

The attributes of repair and manufacturing processes may call to question our existing knowledge of metalworking on the 18th century frontier, revealing the less-than ideal work settings and the adaptive processes within frontier communities. Since metal objects supported all aspects of daily life within the context of an 18th century fortified fur trade post, these items would have had to be fabricated and repaired. The blacksmith would have had the opportunity to service a variety of needs, ranging from domestic needs such as food preparation and consumption, to politically and economically driven activities of the military or traders who operationalized the fort. In some cases, need may have led non-blacksmiths to repair or produce their own hoes, kettles, projectile points or spears.

Through a survey of historic documents, direct observation of artifacts, and application of pXRF analysis, it is possible to identify the characteristics of frontier blacksmithing. One of the most distinguishing attributes of blacksmithing within the frontier context at Fort Michilimackinac is the use of ferrous materials to repair non-ferrous objects. In addition to repair methods that included brazing, welding, and riveting, locally manufactured goods were produced by blacksmiths, and include projectile points, axes, and saws. Analyzing characteristics of repair and production also helped to identify the interactive processes of production and consumption involved with altering materials in order to adapt to the conditions of the frontier. Knowing how the blacksmith repaired items and identifying attributes of frontier production informs interpretations about the processes of technological adaptation to the frontier. The last chapter expands the theoretical underpinnings of technological adaptation, summarizes the accomplishments of this research, and identifies future avenues of inquiry related to frontier metals and blacksmithing.

Chapter 6: Technological Adaptation to the Frontier Environment

"Some may see it as old and rusting iron - but other may see much more" (Ross 1999: iv).

Applying the model for identifying the archaeological attributes of frontier blacksmith workshops resulted in the reanalysis of the archaeological archives and collections. These reinterpretations better contextualized the blacksmith spatially within the fort during various time periods. Metal artifacts from across the site were also analyzed for evidence of repair or production characteristics. The documentary sources, archaeological record, and pXRF data provided a framework to examine the characteristics of frontier metals and the attributes of frontier blacksmithing. Furthermore, the results of these analyses provided the context to interpret technological adaptation at Fort Michilimackinac. This chapter reiterates the theoretical framework and archaeological significance exhibited through the analysis of the 18th century fur trade frontier blacksmith at Fort Michilimackinac.

Interpreting Spatial Associations of the Blacksmiths

Through the spatial analysis of the archaeological archives and the application of the frontier blacksmith model, it was possible to identify three blacksmith workshops within the confines of the fortification. Reexamining the spatial characteristics of the blacksmith workshop at the site aided in contextualizing the blacksmith and his work within the community. Two of the workshops (locus A, circa 1725- circa 1740 and locus B, circa 1750-1765) date to the French occupation of the fort and are spatially correlated with the Jesuit church. More in-depth research of archival records is required in order to find information confirming the so-called monopoly of Jesuit priests over the industry or craft of blacksmithing during this time period within the frontier setting (Boynton 1996: 36). Yet, whether the Jesuit priest controlled access to the blacksmith, the connection between blacksmithing and the church cannot be denied when the structures were so closely associated. During French control of the fort (1715-1760), the blacksmith was likely providing services for the military and Native American groups who frequented the fort. With the blacksmith so closely associated with the church, it might be surmised that the Jesuit priest was promoting the blacksmith's services to these specific groups. The military served to support the expansion of the fur trade and the success of the Jesuit mission, which assisted in maintaining relationships with the Native Americans who were targeted for conversion to the Jesuit faith. In short, the French military and Native Americans were closely associated with the Jesuit church and priest, and probably frequented the blacksmith that was associated with the priest. Traders and other members of the community would have also required the services of the blacksmith to support their daily regiments. It is not well known if the Jesuit priests, or the blacksmiths occupying the fort during the French control, were providing services to these groups, but it is likely, given the constant need for repair services.

In contrast, the third forge structure (locus C, 1751-1765) was spatially located within a more publicly accessible area of the fort and was used during a portion of the British occupation. The forge was located near the British barracks. The British military attempted to gain authority and control over the operation of the fort and the individuals who occupied and traded at the fort. Furthermore, it is well documented that the British military needed regular access to a blacksmith and also provided blacksmith services to Native American allies. One strategy the military may have used to gain control and influence may have been to employ a blacksmith and then control access to his services, and/or provide services to specific communities at the fort. For example, the British Department of Indian Affairs often provided blacksmithing services to Native Americans as a measure to maintain relationships between Great Britain and tribes like the Ottawa, Ojibwa, and Potawatomi. Traders and other members of the community were also essential to British success at Fort Michilimackinac and, given this dependence upon the civilian population and the spatial orientation of the forge within the fort, it is likely that the blacksmith who worked at this third forge provided a variety of services to all members of the community during British control of the fort. Additionally, military personnel would have also frequented the blacksmith for services like gun repair.

The spatial attributes of the blacksmith workshop and the orientation of the workshop within the fort reinforce the importance of the blacksmith to the community and allude to the complex social nature of the blacksmith. As a social actor within the fur trade frontier setting, the blacksmith provides a unique perspective from which to examine processes of technological adaptation.

Material Attributes of Blacksmithing

The nature of the frontier fur trade promoted frequent travel, the copious exchange of goods, and innovation for survival. Therefore, it is extremely difficult to pin-point where the artifacts exhibiting repair were actually repaired, and subsequently, hard to identify which blacksmith most likely made the repair. Likewise, the identification and characteristics of frontier produced items is difficult to source in terms of where the object was actually produced, as opposed to the origination of the raw material. While concrete assertions about the activities of specific blacksmiths or interpretations about blacksmithing specifically at Fort Michilimackinac may be hard to conclude, broad interpretations about the general characteristics of frontier blacksmithing were presented through the data analyzed in this research. In regards to the products and repair characteristics of frontier blacksmithing, three main attributes were identified through the analysis of metal artifacts recovered from Fort Michilimackinac.

The majority of metal that exhibited repair was modified by methods of welding, brazing, or riveting. These were the repairs most commonly observed within the sample selected for analysis. The repair methods were visible on both finished and utilized objects, like riveted hoes, and unfinished objects, like axe parts. Another significant characteristic of frontier metal was the heterogeneity of materials used for repairs, as seen on kettle patches. The inconsistency in the use of ferrous and non-ferrous material to repair objects is a characteristic unique to the frontier. On the other hand, mass produced objects, or objects that could easily be replaced due to proximity of production or distribution centers, were homogenous in terms of the consistency of metal. In contrast, numerous examples of the use of ferrous material to repair non-ferrous objects were examined and revealed processes of technological adaptation to the frontier setting. Additionally, locally produced items, such as harpoons, exhibited a high degree of variation in both form and composition. Generally, mass produced objects for broad consumption were made in the same manner each time with little variation. The presence of various inclusions and the lack of uniformity indicate that a frontier blacksmith was producing these objects. The variation in form and composition may be attributed to methods of adaptation that the blacksmith had to employ in regards to technique and the availability of materials.

The attributes of repair and manufacturing processes may call to question our existing knowledge of 18th century blacksmithing by demonstrating through material analysis the assorted workings of a specialized metal worker within the less-than idealized work setting. The seasonality and remoteness of Fort Michilimackinac would have necessitated that the blacksmith adapt his skills to meet the demands of the community while working with the supplies he possessed. The physical, social, economic, and political complexities of the frontier community at the fort provided a unique setting in which to examine the blacksmith as a supporter of the fur trade community and the processes of technological adaptation exhibited through artifacts recovered at the site.

The frontier blacksmiths at Fort Michilimackinac were engaged in processes of technological adaptation through their labor and the skill of repairing and producing metal objects for the fur trade community. Analyses of the spatial and material characteristics of blacksmithing at the fort illustrate the value of reexamining archaeological archives and collections through the perspective of broader cultural phenomena like technology and technological adaptation.

Technological Adaptation on the Fur Trade Frontier

Reexamination and reinterpretation of archaeological data at the site helped to identify the characteristics of 18^{th} century blacksmithing broadly, and the spatial and chronological characteristics of blacksmithing at Fort Michilimackinac specifically. In the first chapter, the paradigm of technology and the application of the term were reviewed in context of archaeological and historical analyses. While the term may not be widely used in historical archaeologies, the utility in framing 'technology' from a multi-scalar perspective allows for the analysis of 18^{th} century blacksmithing through the lens of microhistory in order to identify processes of technology within the frontier fur trade environment.

This research focused on the blacksmith; an individual with a specific skill set that was necessary for the continuation of daily activities for the diverse community within the frontier setting. The theoretical framework used to analyze the material characteristics of the blacksmith that enabled the analysis of technology through a microhistory perspective. Studies in microhistory, broadly defined, do not deal directly with literal scale (Levi 1991:93), but are more concerned with the expression of broader cultural and historical processes, like technological adaption (Ginzberg 1993: 22). Fort Michilimackinac provides a unique setting from which to conduct this type of theoretical inquiry because of the significant amount of historical and archaeological data and analyses that have been compiled for over fifty years. In regards to microhistory, reexamining these data through a different perspective is an example of the type of approach advocated by microhistorians, as new information is discovered through a different lens when data is reexamined. Through this approach, technology becomes visible within frontier settings and micro-occurrences of technological adaptation can be observed through the work of individuals like the blacksmith. As exhibited through the analysis of metal artifacts exhibiting repair or that were produced locally at Fort Michilimackinac or other frontier fur trade sites, technological adaptation within the frontier environment is exhibited through altered form or material composition of objects used in daily life at the site. Since metal objects during the 18th century were essential to nearly all aspects of daily life within the frontier setting (i.e. cooking, trapping, cutting wood, etc.), the intervention of a blacksmith to aid in the continued use of these objects is exhibited through these repairs or locally produced items. The use of iron to repair copper objects, or the heterogeneity in the composition of arrowheads, for instance, is not typical traits of objects mass produced for consumption. These small alterations and seemingly inconsequential traits, reflect the decision making process of the blacksmith given variables such as the availability of materials. It is in these subtle alterations in form or composition that frontier technological adaptation is exhibited. Furthermore, this subtle exhibition of technological adaptation occurs on objects that are utilized in daily life within the fur trade community at Fort Michilimackinac.

The need to patronize the blacksmith, minimally for repair services, was a routinized phenomenon within the frontier setting. Since metal objects supported all aspects of daily life within the context of an 18th century fortified fur trade post, the blacksmith would have had the opportunity to service a variety of needs, ranging from domestic work such as food preparation and consumption, to politically and economically driven activities of the military or traders who operationalized the fort. Through metal objects and their repair and production, the blacksmith would have been immersed in the maintenance of daily life at Fort Michilimackinac. While the blacksmith supported the use and reuse of metal objects at Fort Michilimackinac, he also consumed metal objects. As a producer and consumer of metal, the blacksmith would have also been affected by the same supply/demand/reuse challenges that others in the community faced and upon whom they relied to help them adapt to the frontier environment. As McGuire states, "Labor consumes products in order to produce products" and the blacksmith and his work exemplify this dynamic (McGuire 2002: 104). Not only was the blacksmith depended on for production and repair services, he also faced the same shortages in supplies that drove the demand for his work due to the isolated setting of the fur trade frontier. This may be reflected in the way in which the frontier blacksmith chose to overcome supply shortages through the use of ferrous material to repair non-ferrous objects, and vice versa. The presence of axes and trap parts with cut edges may also indicate the value of conserving metal parts of objects for use in repair within the frontier setting. These are micro-examples of technological adaptation. As previously mentioned, alterations made to metal objects and deviations from the norm are in the hands of the blacksmith. This decision-making process relies upon the availability and commonality of the object and/or material within the cultural norm of the group that is both enacting change (the blacksmith) and accepting change (the customer), and ultimately depicts technological adaptation through the alteration of metal objects (Branstner 1992; Turgeon 1997; Dietler 1998; Cusick 1998; Ehrhardt 2005). Essentially, the blacksmith is accepting or rejecting the technological adaptations exhibited in material culture within the fur trade frontier setting.

The blacksmith was a necessary part of the fur trade frontier since daily life revolved around the utilization of metal objects. Within the remote setting of Fort Michilimackinac, his ability to repair and produce metal objects meant that he was a key to the success and survival of the community. The dynamics of the frontier situate the blacksmith as a consumer of products and producer of products who maintains daily life for the community and who's daily life is centered on the community. The sample of artifacts included in this research was derived from a variety of sources in order to best identify the types of artifacts typically repaired or produced by the blacksmith at Fort Michilimackinac. Based on the historic documents, archaeological data, and observed characteristics, the sample consisted of objects typical to daily-life at a fur trade fortification. In other words, as metal objects were infused in every part of daily life and as a result, nearly every part of daily life is represented in the sample; from agriculture (hoes), to cooking (kettles), chopping wood (axes), to hunting and trapping (arrowheads, harpoons, trap parts), and military activities (gun parts). While these objects were not exclusively used for the aforementioned activities, this list of activities and corresponding objects illustrates the diversity in the sample and the application of the objects to daily activities. Essentially, this diversity also demonstrates the "materiality of labor in daily experience" or the material result of Silliman's labor-as-practice (Silliman 2001b: 379). The nature of the blacksmith's work as exhibited through the attributes of repair and production of everyday objects reinforces the blacksmith's position as a significant social actor imbued in the maintenance of daily life within the frontier community at Fort Michilimackinac.

This approach to reexamining the archaeological archives and collection at Fort Michilimackinac contributed to a different understanding of the history and archaeology of the site. Connecting the blacksmith and his work to the broader context of the social and technological interactions of the fur trade frontier provided a different perspective to understand the material, historical, and adaptive characteristics of the community at the fort. Revisiting historical and archaeological knowledge in order to bring meaning and action to previously unknown phenomena and connecting people and objects to the broader context of technological adaption in this case, is a characteristic of the microhistory approach in archaeology (Ginzberg 1993:22). Connecting the micro-occurrences of adaption exhibited through the work of the blacksmith in the repair and production of metal objects utilized in daily activities within the frontier provided a unique perspective to analyze 18th century frontier blacksmithing.

Expanding Avenues of Research

This study provides a unique perspective from which to view 18th century blacksmithing and the characteristics of metal within the frontier context. There are numerous questions that arose as a result of the data collected for this research which encouraged an expanded analysis of blacksmithing and metal. For example, a comparison of the traits of frontier metal at various sites within the Michilimackinac region of northern Michigan and the Straits of Mackinac would provide further evidence regarding the processes of adaptation over time. Fort Michilimackinac has a well-known history and the movement of French, British, and American troops in the Straits of Mackinac and northern Great Lakes region provides consecutive sites that should be compared. The Native American communities and small farmstead communities that moved and grew with these militarized outposts will also provide information about the degree of interaction, dependence, and resourcefulness of these communities and further the analysis of processes of technological adaptation. Examining metal objects from the 'suburbs' located outside Fort Michilimackinac during the 18th century, and/or the Native American villages known to trade with traders and settlers from Fort Michilimackinac would also provide a holistic understanding of the use, repair, distribution of metal objects and the social significance imbedded in metal within the frontier environment. There is a high likelihood of the presence of a blacksmithing workshop outside the fortification which would also provide comparative data from which to examine the social processes of the material culture of blacksmithing at the site.

The methodology utilized in this research also lends itself to larger scaled investigations of metal, technology, and the social implications of repair, production, and distribution or the trade of metal objects within smaller scaled communities, particularly communities that exhibit cultural, social, and material diversity as that of a fur trade post. Furthering the line of analysis related to adaptive processes as it applies to frontier fur trade fortifications would benefit from a larger scaled analysis. Moving beyond the regional context of technological adaption previously described, a comparative study examining various trade posts and frontier sites as people moved westward would further understanding of the processes of adaptation as it relates to metal objects. Looking at the westward expansion of blacksmithing, metal working, and methods of repair and manufacture within frontier communities would require the inclusion of other frontier fortifications, potentially with military associations, such as Fort Union in North Dakota, and continuing westward toward Fort Vancouver in Washington.

Framing the comparison of metal objects and blacksmithing within the communities of other frontier sites would also allow for the comparison of social structures that may have influenced the work of the blacksmith and subsequent technological adaptive processes. For example, the cultural, political and economic settings of Fort Vancouver, Fort Michilimackinac, *Trois Rivères*, and the Hudson Bay settlement of Fort Albany provide similar contexts in terms of their function as fur trade posts, but differ in the social and political schema which may or may not influence the use, alteration, and production of metal objects. Comparatively examining frontier fur trade fortifications with a focus on the metal objects would provide information relating to: the availability of supplies and how that affected the work of blacksmith, including repair and manufacturing opportunities; the degree of knowledge and specialized versus generalized skill required of the blacksmith; the spatial, social, and physical properties of blacksmithing for a community associated with a military fortification; and intercultural material adaptation facilitated by the expertise of the blacksmith. The data from a comparative study would inform how metal objects were distributed within North America during the colonial era and westward expansion.

Finally, the use of pXRF analysis to examine 18th century metal artifacts is unique and the data acquired for this research was not utilized to its full potential. Further intrasite comparison, examination of potential source material, and more in-depth information regarding the material characteristics of specific objects, traps for example, are among the various avenues to inquire that the data collected may facilitate. This research highlights qualitative analysis of the pXRF data. A methodological presentation of the resourcefulness of utilizing qualitative analyses in regard to the application of a 'hard science' method would also benefit the understanding of the overall potential for the use of pXRF beyond the archetypal applications present in the literature (e.g. Ferretti et al 1997; Guerra 1998; Ferretti 2004; Bonizzoni et al 2006; Čechák et al 2007; Shackley 2010). In this regard, qualitative applications of pXRF may expand the use of the technology in the study of archaeological materials. Quantitative research may also be possible with the dataset acquired for this research and further pXRF readings of source material and unaltered objects would provide a baseline dataset from which to calculate and compare ratios and percentages of intrusive materials.

There are numerous avenues of inquiry made possible through the methodological and theoretical approach to this research. Among these include studies regarding frontier blacksmithing and workshop characteristics, the comparison of metal attributes at frontier fur trade sites, the multi-scalar examination of the processes of technological adaptation, and the expansion of pXRF analyses.

Conclusion

Several significant goals were accomplished through this research, which have broad implications for studying 18th century blacksmithing and technological adaptation within the frontier setting. Methodologically, a model for identifying spatial characteristics of 18th century frontier blacksmithing was illustrated and revealed the presence of other blacksmith work areas within the fort at the site. This model was applied to archived archaeological data and exhibited the utility in reexamining archaeological archives in order to attain new information via a different analytical perspective. This data may also be used comparatively to examine the characteristics of frontier blacksmithing at other sites. Additionally, the use of pXRF to analyze the compositional characteristics of frontier metal was also illustrated. The use of pXRF in historical archaeology research is fairly new and illustrates the potential for acquiring scientific data and the utility of qualitative analysis in regards to historic materials, specifically metal archaeological objects.

In terms of analysis, this research illustrated the utility in examining technological adaptation by way of the 18th century frontier blacksmith. The nuances exhibited in the alteration of metal objects at Fort Michilimackinac illustrate the subtle changes to material culture that takes place within the frontier setting. The subsequent techniques and adaptive processes used by the blacksmith to negotiate the fur trade frontier are illustrated through the characteristics of metal artifacts recovered from the site. The unique political, cultural, and physical environs of the frontier contribute to the innovative adaptation of materials as exhibited through the material culture analyzed in this research.

This research also illustrates the way in which the 18th century frontier blacksmith can be framed within the theoretical dynamics of technology, labor-as-practice, and adaptation. By situating the blacksmith within the broad structure of technology and illustrating the manipulation of material objects that reinforced daily life at sites like Fort Michilimackinac, processes of adaptation become visible in relation to the technological structure. This multi-scalar approach complements the multiple layers of structures in which the blacksmith was imbedded within the context of the fur trade frontier. This approach contributes to a broader approach for examining blacksmithing in the archaeological record.

Appendix 1: Sample of Metal Artifacts from Fort Michilimackinac

Sample of Metal Artifacts from Fort Michilimackinac					
Object Type	**MS2#**	**Other description**	**Observations**	**Repair/Local Manufacture**	**Alteration Type**
Axes	25.1			Yes	Scrapped
Axes	56.3			Yes	Scrapped
Axes	174.4	Blade	Lipped edge	Yes	Scrapped
Axes	294.1	Head		Yes	Scrapped
Axes	818.12	Blade	Blade use-wear and separation	Yes	Forged
Axes	1343.17			Yes	Scrapped
Axes	1362.3			Yes	Scrapped
Axes	2373	Blade	Wavy blade	Yes	Scrapped
Axes	2669.8	Blade		Yes	Scrapped
Axes	3908.2	Blade		Yes	Scrapped
Axes	4414.32	Head		Yes	Scrapped
Axes	4414.39	Blade		Yes	Scrapped
Axes	5057.4	Blade		Yes	Scrapped
Axes	5255.3	Head		No	
Axes	6351.4	Blade		Yes	Forged
Harpoon	69.6		Possibly made from knife blade or chisel end; No barbs, dull point	Yes	Locally Manufactured
Harpoon	438		Chisel reuse	Yes	Forged
Harpoon	2998.2			Yes	Forged, weld
Harpoon	3513.6		Very sharp barb at end	Yes	Forged
Hoe	1965.1		Evidence of use wear	Yes	Forged, weld
Hoe	3025.2			Yes	Rivet
Hoe	6644.1			No	
Ice Chopper	2055.9			No	
Ice Chopper	6865.17			No	
Kettle Part	650	Lug		Yes	Rivet
Kettle Part	802.1	Lug	Brass w/copper rivets	Yes	Brazed, rivet

Kettle Part	1209	Lug	Cut patch, sm like rivet, w/small holes punched	Yes	Scrapped
Kettle Part	1805.12	Lug	Sewn	Yes	Locally Manufactured
Kettle Part	4414.56	Fragment		Yes	Rivet
Kettle Part	5560.3	Lug		Yes	Forged
Kettle Part	10439.7	Fragment		Yes	Rivet
Kettle Part (Iron)	976.2	Lug	Clean break, iron lug on copper kettle remnants	Yes	Brazed
Kettle Part (Iron)	1680.5	Lug	Iron lug on copper kettle remnants	Yes	Rivet
Kettle Part (Iron)	2018.6	Lug	Copper kettle w/iron chain for handle	Yes	Forged
Kettle Part (Iron)	2044.3	Lug	Clean break, originally had iron rivets	Yes	Scrapped
Kettle Part (Iron)	2077.6	Lug	Clean break, remains show connected to copper kettle	Yes	Brazed
Kettle Part (Iron)	2538.8	Handle		No	Forged
Kettle Part (Iron)	3998.23	Lug		Yes	Forged, rivet
Kettle Part (Iron)	4219.15	Fragment	Cast iron	No	
Kettle Part (Iron)	5446.11	Rim	Iron rim w/copper plating	Yes	Brazed
Kettle Part (Iron)	6462.27	Lug		Yes	Rivet
Knife	840.5	Clasp knife		No	
Knife	2477.8	Bone handled knife		No	
Knife	4607.8	Wood handled		No	
Knife	13051.28	Blade tip		No	
Knife	22444	Clasp knife		No	
Projectile Point	5496.11	copper/brass		Yes	Locally Manufactured
Projectile Point	6545.23	copper/brass		Yes	Locally Manufactured
Projectile Point (iron)	6264.4	Long, Possible Harpoon		Yes	Locally Manufactured
Projectile Point (iron)	6601.24	Hole in middle w/twisted iron base		Yes	Locally Manufactured
Projectile Point (iron)	6686.14	Pointed base for insertion		Yes	Locally Manufactured

Projectile Point (iron)	6991.11	Pointed base for insertion		Yes	Locally Manufactured
Saw (brass)	2085.14		Pattern	Yes	
Saw (brass)	2966.2		Pattern	Yes	Locally Manufactured
Saw (iron)	1091.3			No	
Saw (iron)	1687.1			No	
Saw (iron)	2742.2			No	
Saw (iron)	3238			No	
Saw (iron)	3242.5			No	
Saw (iron)	4032.22			No	
Saw (iron)	4414.22			Yes	Locally Manufactured
Saw (iron)	4696.1		Reuse of razor, chisel, or file	Yes	Forged
Saw (iron)	5058.9			Yes	Locally Manufactured
Saw (iron)	6810.33			No	
Strike-a-lite	283.4	Stamped "A"	Chisel reuse	Yes	Forged
Strike-a-lite	1171.2		Cut edge	Yes	Scrapped
Strike-a-lite	2399.13	Engraved/stamped		Yes	Forged
Strike-a-lite	3598.3			No	
Strike-a-lite	4898.7			No	
Strike-a-lite	6009.6		Cut edge	Yes	Scrapped
Strike-a-lite	6377.4			No	
Trap Parts	22.5			Yes	Scrapped
Trap Parts	373.3		Cut edge	Yes	Scrapped
Trap Parts	1343.9			No	
Trap Parts	2070.2			No	
Trap Parts	2657.9	Tooled ring	Eye-hole bent close to ring	Yes	Locally Manufactured
Trap Parts	2710.2	Tooled ring	Cut edge	Yes	Scrapped
Trap Parts	5099.6	Tooled ring	Cut edge	Yes	Scrapped

215

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Curriculum Vitae

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EDUCATION

2004-2013 *Syracuse University, Anthropology Department*
- *2013* *Ph.D., Anthropology*
- *2007* M.A., Anthropology

2000-2004 *Michigan State University, East Lansing, MI*
- B.A., Anthropology
- Certificate in Museum Studies

RESEARCH INTERESTS

Cultural adaptation and technology, frontier communities, history of technology, North American fur trade, historic blacksmithing, westward expansion and material adaptation

TEACHING INTERESTS

Prepared Courses
- Historical Archaeology
- Introduction to Archaeology
- Laboratory Methods in Archaeology
- Introduction to Cultural Anthropology
- Introduction to Anthropology
- Culture, Health and Healing
- Bioarchaeology

Proposed Courses
- Introduction to Museum Studies
- History and Archaeology: Fur Trade
- Methods of Archaeological Analysis
- North American Archaeology
- Cultural Resources and Public Policy

TEACHING EXPERICENCE (Teaching Portfolio: www.amyroachefedchenko.wordpress.com)

ANT 185: Global Encounters: Comparing World Views and Values Cross Culturally
ANT 100: Introduction to Cultural Anthropology
ANT 100: Introduction to Anthropology
ANT 131: Introduction to Biological Anthropology
ANT 145: Introduction to Historical Archaeology
ANT 415: Culture, Health, and Healing

PROFESSIONAL EXPERIENCE

Museum Specialist, National Park Service, Fort Stanwix National Monument, Rome, NY

June 2009-present
- Complete reports related to the museum collection, maintain the cultural resources related web pages, maintain and catalog museum collections
- Supervising archeological surveys related to NHPA Section 110, monitoring construction related excavations as related to NHPA Section 106, serving as PEPC administrator, providing NHPA Section 106 feedback for park projects

Adjunct Faculty, Department of Sociology and Anthropology, Utica College, Utica, NY

Aug. 2012-present - Develop and teach ANT 415: Culture, Health and Healing, a course required for completion of the Nursing, Health Professional, and Physical Therapy programs

Instructor, Department of Anthropology, Syracuse University, Syracuse, NY

May 2011-present - Develop and teach ANT 100: Introduction to Anthropology, a four-field online course.

Graduate Assistant, Professional Development Programs, Graduate School, Syracuse University

Jan. 2009-present - Coordinate and assist in program planning and implementation
- Aid in projects with the Future Professoriate Program and the Preparing Future Faculty initiative

Adjunct Faculty, Sociology/Anthropology Department, State University of New York, Cortland

Aug. 2008-Dec. 2008 - Design and implement Introduction to Cultural Anthropology
- Create and organize course to aid student comprehension of course material

Field Technician, John Milner Associates, Inc., Fayetteville, NY

July 2008 - Conduct field survey and excavations

Lab Assistant, Department of Anthropology, Syracuse University

Jan 2008-March 2008 - Assist with lab reports and publications
- Conduct research for designated projects

St. James Cemetery, Madison County, NY

March 2007 - Assist in recovery of human and coffin remains

Instructor, University College, Syracuse University

Aug 2007-Dec 2007 - Teach ANT 185: Global Encounters: Comparing World Views and Values Cross Culturally
- Prepare lectures, class discussions, and assignments, student assessment

Teaching Assistant, Department of Anthropology, Syracuse University

Aug 2005-May 2007 - ANT courses: Global Encounters: Comparing World Views and Values Cross Culturally, ANT 141 Introduction to Historical Archaeology, ANT 151 Introduction to Biological Anthropology
- Lead discussion sections, grade and assist students with course

Archaeology Field Supervisor, Mackinac State Historic Parks, MI

May 2007-Aug 2007 and May 2006-Aug 2006
- Supervise and coordinate excavations and lab work

- Public Interpretation

Archaeology Crew Member, Fort Drum, NY
May 2005-Aug 2005 - Field survey and shovel testing
- Artifact processing in the lab
- Data entry and GIS applications

Friends of the Park, Virgin Islands National Park, National Park Service, St. John, USVI
June2005-July 2005 - Document archaeological site conditions and survey historic sites

Lab Technician, Department of Anthropology, Syracuse University
Jan 2005-May 2005 - Process artifacts from the Harriet Tubman Site, Auburn, NY
- Direct and guide undergraduate volunteers in the lab

Archaeological Research Assistant, Consortium for Archaeological Research, Michigan State University, MI
Jan 2003-Aug 2004 - Lab technician for artifacts from Marquette Mission Site, St. Ignace, MI
- Compile research from 30 years of excavation by creating and maneuvering databases and the use of ArcGIS 9.0

Archaeologist, Mackinac State Historic Parks, MI
June 2003-Aug 2003 - Excavation and public interpretation
- Design and implement Front End Survey for the opening of the Old Mackinac Point Lighthouse

Michigan Archaeology Day, State of Michigan Historical Museum
October 2003 - Design and present an interactive display for public event

GRANTS, AWARDS, FELLOWSHIPS

Dissertation Writing Fellowship, Graduate School, Syracuse University 2009-2010
STAR Award, National Park Service 2009 & 2010
Teaching Fellow, Professional Development, Graduate School, Syracuse University 2008-Present
Outstanding Teaching Assistant Award 2008
Industrial Heritage Preservation Grant, Society for Industrial Archaeology 2007
Teaching Associate, Anthropology Department Syracuse University 2006-2008
Roscoe-Martin Research Grant, Maxwell School of Citizenship, Syracuse University 2006

PUBLICATIONS

Book Chapters:

2009 An Air of Integrity: Creating a Preventative Classroom Environment. IN *Pedagogy Not Policing: Positive Approaches to Academic Integrity at the University*, ed. Tyra Twomey, Holly White, and Ken Sagendorf. Syracuse, NY: Syracuse University Press.

Book Review:

2007 *Historical Archaeology: Why the Past Matters.* By Barbara J. Little. Walnut Creek, Calif.: Left Coast Press, 2007. 207 pp., illus., refs., bibl., index. $29.95 pb (ISBN 978-1-59874-023- 3). *Journal for the Society of Industrial Archaeology* 33(1):51-52.

Film Review:

2009 Review of "Unearthing Fort St. Joseph: A Field Work Case Study". *Anthropology Review Database*. September 15. Electronic document, http://wings.buffalo.edu/ARD/cgi/showme.cgi?keycode=3383, accessed October 7, 2009.

PRESENTATIONS

Guest Lecture:

October 16, 2010	Utica College, Introduction to Archaeology course, *Museum Practices and Careers*
November 10, 2009	SUNY Oswego, Introduction to Archaeology course, *Research in Historical Archaeology, Fort Michilimackinac 1715-1781*
September 9, 2009	Fort Stanwix National Monument, Rome, NY *Everyday Life on the Colonial Frontier*
April 28, 2008	Pathways to Knowledge, Syracuse University, Syracuse, NY, *The Archaeological Study of an 18th Century North American Blacksmith*

Paper Presentations:

2011 Society for Historical Archaeology 50th Annual Conference on Historical and Underwater Archaeology, Austin, TX, January 2011
A Case Study in the Value of pXRF in the Analysis of Archaeological Collections: Fort Michilimackinac Metal Technology

2010 Society for American Archaeology 75th Annual Meeting, St. Louis, April
Adaptations of a Blacksmith: Maintaining European Expansion and Economic Growth on the North American Fur Trade Frontier

2009 Annual Meeting of the Society for Industrial Archaeology, Pittsburg, May 2009
Evidence of Local Production: Blacksmithing in the 18th Century Fur Trade Frontier, A Case Study from Fort Michilimackinac, 1715-1781

2009 Society for American Archaeology 74th Annual Meeting, Atlanta, April 2009
18th Century Metallurgical Investigation of Blacksmithing at Fort Michilimackinac

2009 Society for Historical Archaeology 42nd Annual Conference on Historical and Underwater Archaeology, Toronto, January 2009
Civilian Contributions to Maintaining Supplies: A Case Study from Fort Michilimackinac

2007 Annual Meeting of the Society for Industrial Archaeology, Philadelphia, June
French or British? British or French? Reinterpreting 18th Century Blacksmiths at Fort Michilimackinac, MI.

<u>Poster Presentations:</u>

2011 Society for Historical Archaeology 50th Annual Conference on Historical and Underwater Archaeology, Austin, TX, January 2011
'Rediscovering' Material Culture at Fort Stanwix National Monument. Co-authored.

2006 Society for American Archaeology 71st Annual Meeting, San Juan, PR
17th-18th Century Trade Sites of the St. Lawrence Valley: Characteristics, Identification, and Location. Co-authored poster presentation.

2004 Society for American Archaeology 69th Annual Meeting, Montreal, QC
Applications of GIS to Delineate Space, Time and Ethnicity at the Contact Period Marquette Mission Site. Co-authored poster presentation.

TRAINING AND OTHER PROFESSIONAL DEVELOPMENT

Pedagogical Seminars, Conference, and Programs:

Annual Preparing Future Faculty and Future Professoriate Conference (Organizer, facilitator)

- Pedagogical Conference for Syracuse University, SUNY-Oswego, Hamilton College, Colgate University, SUNY-Empire

Annual Teaching Assistant Orientation Program (Organizer, facilitator)

- University-wide program for new domestic and international graduate students, Syracuse University

Pedagogy Not Policing: Positive Approaches to Academic Integrity at the University (Presenter)

- University-wide seminar, Syracuse University

Differences in Higher Education Settings and Goals: Varieties of Faculty Experiences (Organizer)

- University-wide seminar, Syracuse University

Getting the Most from your Evaluations (Organizer, presenter)

- University-wide seminar, Syracuse University

Designing a Course (Facilitator)

- Seminar for the Anthropology Department graduate students, Syracuse University

Creating an Effective Lesson Plan (Presenter)

- Seminar for the Anthropology Department graduate students, Syracuse University

Natural and Cultural Compliance Training:

Archeological Resource Protection Act (FLETC) May 2012
NEPA and NHPA Section 106 Workshop, Sept. 2010
NPS Director's Order 12 and NEPA - Module 1, April 2011
NPS Director's Order 12 and NEPA - Module 2, April 2011
Managing Archeological Collections Assessment, Oct. 2009
NPS-Introduction to PEPC (Planning, Environment, and Public Comment), Oct. 2010
NPS-PEPC Administrative Features, Dec. 2010
NPS-Managing Projects with PEPC, Oct. 2010

Safety and Occupational Safety and Health Awareness Training:
Safety: Introduction to OSHA, March 2011
Safety: Introduction to OSHA Standards, March 2011
Safety: First Responder Awareness Level (HAZWOPER), March 2011

National Park Service and Department of the Interior Training:
NPS Fundamentals I, Dec. 2009
NPS Fundamentals II, Nov. 2010
NPS Fundamentals III, March 2011
NPS Fundamentals IV, March 2012
NPS Fundamental V, May 2012
NPS-PMIS Course 1: Introduction to PMIS, Dec. 2010
Office of Personnel Management: Telework 101 for Employees, March 2011
NSC Defensive Driving II, May 2010

SERVICE AND MEMBERSHIPS

Council for Northeast Historical Archaeology Conference Committee	2011
Program for Future Faculty Steering Committee Member	2006-2007
Anthropology Future Professoriate Program Associate and Organizer	2006-2008
Anthropology Graduate Student Organization member	2004-Present
Anthropology Graduate Student Organization Treasurer	2005-2006
The Maxwell Review journal, 2008 Edition Editor-in-Chief	2007-2008
The Maxwell Review journal, Editorial Board Member	2006-2007
Maxwell Review Journal, Editor	2005-2006
Society for Industrial Archaeology member	2006-2011
Society for Historical Archaeology member	2005-Present
Society for American Archaeology member	2003-Present

COMPUTER SKILLS

- Blackboard
- ANGEL
- Adobe Design Suite
- ArcGIS 10.1
- Trimble, GPS Pathfinder, TerraSync
- Tracer World/ARTAX
- Planning, Environment and Public Comment (PEPC - NPS)
- Archeological Sites Management Information System (ASMIS – NPS)
- Project Information Management System (PMIS – NPS)
- CMS Web Content Server (NPS)
- Interior Collections Management Software, Re:discovery (Dept. of the Interior)