"…A Thousand Beads to Each Nation:" Exchange, Interactions, and Technological Practices in the Upper Great Lakes c. 1630-1730

by

Heather Walder

A dissertation submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

(Anthropology)

at the

UNIVERSITY OF WISCONSIN – MADISON

2015

Date of final oral examination: 05/01/15

This dissertation is approved by the following members of the Final Oral Committee:

Sissel Schroeder, Professor, Anthropology
Jonathan Mark Kenoyer, Professor, Anthropology
Larry Nesper, Professor, Anthropology
Sarah Clayton, Assistant Professor, Anthropology
Robert Ostergren, Professor, Geography

Abstract

"…A Thousand Beads to Each Nation:" Exchange, Interactions, and Technological Practices in the Upper Great Lakes c. 1630-1730

By Heather Walder

Under the supervision of Professor Sissel Schroeder

At the University of Wisconsin-Madison

This dissertation addresses the timing of the introduction, exchange, and social implications of two complementary lines of evidence, reworked copper and brass objects and glass trade beads, from 38 archaeological sites of the Upper Great Lakes region dated to c. 1630 to 1730. In this situation of intercultural contact and colonialism, local Midwestern Native peoples encountered European-made trade items, displaced Native newcomers, and eventually non-Native explorers, traders, and missionaries. Anthropological questions of regional interaction, technological continuity and change, long-distance trade, and population mobility are the focus of this project, which has identified material correlates for the chronology and scope of socially-structured exchange networks that facilitated intercultural interaction.

I applied elemental characterization and attribute analysis methods that revealed how long-standing technological practices, such as native copper-working, persisted through time and what techniques people developed to adapt to new materials, allowing me to build inferences about the social significance of these technologies. Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) was used to identify the "recipes" of 874 glass adornments, which revealed chronological change in glass-making technology in Europe and Native glass reworking methods in North America. A portable X-Ray Fluorescence (pXRF) pilot study and physical attribute analysis of 3,705 copper-base metal artifacts such as beads, tinkling cones, other ornaments, partially worked blanks, and waste products revealed patterns in types and styles of finished objects, the mean size of discarded materials, and continuity of technological practice over time. The project verified pXRF as a viable technique for differentiating native and smelted copper without any cleaning of corroded artifacts.

Conducting new laboratory-based analyses on previously excavated artifacts has enhanced the value of existing collections and highlights the importance of long-term curation strategies for artifacts as well as associated excavation records, maps, and other primary documentation of provenience information and recovery methods. Together, metal and glass analyses demonstrated that the diverse peoples inhabiting the Upper Great Lakes region accessed different quantities and kinds of trade items, and that the trade items themselves and technological methods applied to them varied through time, across space, and according to the historically-attributed ethnic identity of communities.

Table of Contents

List of Figures

List of Tables

List of Appendices

“Archaeology is a marathon,

and you don’t win marathons with speed.

You win them with character”

(Flannery 1982: 277)

For my family, who always have been cheering at the finish line!

Acknowledgements

This dissertation owes its existence to the countless excavators, field school students, avocational collectors, and institutional curators who, over approximately 80 years, contributed to the archaeological projects that yielded the assemblages I analyzed. Through their fieldwork, publications, detailed notes and reports, and long hours in the lab, I have been able to access artifacts and information needed for my own project. To all of these archaeologists who have come before me: Thank you for your meticulous attention to detail and dedication to the field; my small contribution would not be possible without your work.

Many individuals deserve special thanks, the first of whom is my advisor, Sissel Schroeder, for her patience, encouragement, and detailed comments on my countless abstracts, grant proposals and papers, and every page of every draft of this dissertation. Sissel continually offered sound advice and constructive criticism of my underlying theories, empirical methods, and compositional style. I value her example as a role model in the classroom, and I have developed my own teaching philosophy based on my work with her as a teaching assistant. I also thank my co-advisor, J. Mark Kenoyer, especially for his time and effort spend working with me early in my graduate career. My interests in technology and adornments are a direct result of this training, and I value the time spent working under his guidance in a wholly different Early Historic period: that of South Asia. The contacts I've made and the research questions that I developed during that time have continued to benefit me in my career. I also value Mark's recent contributions to my work in North America as a co-advisor and committee member.

James H. Burton of UW-Madison helped me as I was developing the framework for archaeometric research questions and methods, and I would not have found such early success without participating in his Archaeological Chemistry course. Laure Dussubieux, of the Chicago

Field Museum, trained me in the archaeometric methods that I applied in this project and has been an excellent mentor and collaborator throughout my research process. T. Douglas Price (UW-Madison Professor Emeritus) and his Research Methods course guided me through the refocusing of my research interests, helping me realize that a geographic and directional shift would not mean a step backwards. I also thank other committee members at Madison: Larry Nesper, Sarah Clayton, and Robert Ostergren for their valuable insight and guidance.

This project has its inception at a dinner organized by the Charles E. Brown chapter of the Wisconsin Archeological Society in honor of speaker Jeffery Behm, of the University of Wisconsin Oshkosh, in November of 2010. I had recently refocused my research to the Upper Great Lakes region, and Amy Rosebrough's invitation to that event, also attended by John Broihahn, Ernie Boszhardt, and Danielle Benden, was invaluable to the quick reorganization of my dissertation research to a Great Lakes regional study. By the end of the evening's discussions, I was welcomed into the dedicated and collegial archaeological research community in Wisconsin. Furthermore, Jeff had convinced me that the Bell Site would be a good jumping-off point for the project. From that point on, he provided access to the UW-Oshkosh collections, reams and gigabytes of reading material, critically important field experiences at the Olen Site and Lasley's Point (not a single glass bead from fieldwork though…), and a solid dose of perspective at every stage of my dissertation research. As a mentor to this project, Jeff has been a phenomenal resource well-versed in the history and practice of Wisconsin Archaeology.

John Broihahn and Amy Rosebrough at the Wisconsin State Historical Society have also been of invaluable assistance to my research project from its inception. Without the opportunity to participate in the Hanson site reanalysis, I would not have found my niche in Midwestern Archaeology nearly so quickly. Thank you for unfettered access to the gray literature and a copy machine! Carol I. Mason and Ronald J. Mason, Professors Emeriti of the University of Wisconsin – Fox Valley and Lawrence University, also helped me from the very beginning of my project, always providing encouragement, even when it was clear that I was beginning with questions that were far too large for a single student to answer in a lifetime, much less a dissertation. Whenever I visited in Appleton, the Masons extended gracious hospitality and all the research assistance that they could offer; I sincerely treasure my memories all of our dinners, conversations, and the antics of their very well-trained dogs. Their meticulous excavation and curation of the Rock Island materials have proven invaluable to my dissertation research, and it is my hope that these cultural resources will remain available for study for all people of the State of Wisconsin and beyond for the foreseeable future.

Kathy Ehrhardt also deserves special recognition; her book, *European Metals in Native Hands*, taught me that complex technological processes could be (and needed to be!) studied in my own backyard. She has helped me gain access to collections, reviewed drafts with a sharp editorial eye and an uncanny ability to anticipate my advisor's comments, and offered hospitality in her home in Missouri. She too was never more than a phone call or email away, and generous with her time and energy in helping me through the research and dissertation process.

Janet Speth helped me make contacts in the early stages of my work and introduced me to the Red Banks collection at the Neville Public Museum. At the end of the project, she read a complete draft of this dissertation (in about a week!) and cross-checked the bibliography with the text. I greatly value her attention to detail and enthusiasm for my work

From here on, the list of colleagues, curators, and dedicated avocational archaeologists who have contributed to my project grows longer, as I eventually included artifacts from 38 archaeological sites. In roughly the order that they came to know and assist me, I thank the following people and institutions: Louise Pfotenhauer of the Neville Public Museum; Richard P. Mason of Appleton, WI; Denise Wiggins and Marlin Hawley of the Wisconsin Historical Society; Dawn Scher Thomae of the Milwaukee Public Museum; Danielle Benden of UW-Madison; William T. Billeck of National Museum of Natural History; William Lovis and Jodie O'Gorman of Michigan State University; Steve Cotherman and Sheree Peterson of the Madeline Island Museum; Patricia and John Richards of UW-Milwaukee; Bob Sasso of UW-Parkside; James W. Bradley of Archlink and Director Emeritus of the Robert S. Peabody Museum of Archaeology; Thomas Pleger, President of Lake Superior State University, and his father Ernest Pleger; Rochelle Lurie of Midwest Archaeological Research Services, Inc.; Dean L. Anderson and Jessica Yann of the Michigan Office of the State Archaeologist; Ray Reser of UW-Stevens Point; David Overstreet of the College of the Menominee Nation; Ron Strojny and Robert "Cubby" Couvillion of Peshtigo, Wisconsin; Susan and Patrick Martin, and Timothy Scarlett of Michigan Technological University; Marla Buckmaster and Scott Demel of Northern Michigan University; James Paquette of Negaunee, Michigan; Lynn Evans and Brian S. Jaeschke of the Mackinac State Historic Parks; Jeffery Sommer of the Historical Society of Saginaw County; Terrance and Claire Martin of the Illinois State Museum; Michael Nassaney of Western Michigan University; Carol Bainbridge of the Niles History Center; Jane Bigham of the Missouri State Parks; Mark Dudzik of the Wisconsin DNR; John Doershuk of the Iowa Office of the State Archaeologist; Bradford M. Jones and Jim Bruseth of the Texas Historical Commission. It has sincerely been a pleasure working with each of you; thank you for your patience at my many collections requests, your interest in my work, and for being a part of this journey.

Funding for this project came from many different organizations and grants, including: a National Science Foundation Doctoral Dissertation Improvement Grant (BCS-1321751, PI Sissel

Schroeder); a Mellon-Wisconsin Summer Fellowship for Dissertation Writing; Graduate Women in Science, Beta Chapter, Ruth Dickie Grant-in-Aid (2011) and Scholarship (2012); a Wisconsin Archeological Society Research Award (2012); the 2014 Society for Historical Archaeology Ed and Judy Jelks Travel Award; two UW-Madison Department of Anthropology Conference Travel Grants; two Vilas Research Travel Grants; and a research grant from the Chicago Field Museum Elemental Analysis Facility.

Graduate student colleagues and friends at University of Wisconsin – Madison have made this journey both easier and more enjoyable, as they cleared paths before me, offered insight on statistics and bead research and how best to get through our program, and shared daily successes and gripes over beers and cheese curds at the City Bar and the Terrace, and lately even on Skype. Thank you, roughly again in order of appearance: Brad Chase, David Meiggs, Randall Law, Marc Kissel, Brett Hoffman, Bernadette Cap, Katie Lindstrom, Gregg Jamison, Mary Davis, Alison Carter, Gwen Kelly, Kurt Gron, Christina Dykstra, Laura Brodie, Meg Turville-Heitz, Noah Theriault, Zach Throckmorton, Aaron Sams, Heather O'Connor, Ken Seligson, Jake Pfaffenroth, Joe Quick, Abby Work, Alia Gurtov, Tegan McGillivray, and Sarah Tate.

Thank you to my mentors and friends at other universities: Namita Sugandhi, thanks for many home-cooked meals in Hyde Park and for writing a phenomenal dissertation about the Ashokan Edicts. We'll go back someday. At Michigan State University, I thank Adrianne Daggett for a place to stay in Lansing, help with the NSF proposal process, and great collaboration on glass beads from around the world. Thanks also to fellow students of Midwest archaeology at MSU: Alexandra Conell, Jessica Yann, Megan McCullen. I also thank LisaMarie Malischke and Emily Ferenc Powell for camaraderie and transportation adventures at the SHA meetings and making me an honorary member of the Fort St. Joseph extended family.

I have had the opportunity to teach at supportive institutions while collecting my data and writing my dissertation. I thank Ned Farley and Jeremiah Cady of Wisconsin Lutheran College for a year's use of a fantastic lab space as well as the chance to work with talented undergraduate students. The University of Wisconsin - La Crosse and the Mississippi Valley Archaeology Center provided unfettered access to lab space, an office and laptop while I was writing up, conference travel support, and research assistance. I am grateful to my colleagues and mentors at UW-L: Kim Vogt, Tim McAndrews, Dave Anderson, Christine Hippert, Kathy Stevenson, Connie Arzigian, Kate Grillo, Jessi Halligan, and Lisa Kruse, as well as my many UW-L undergraduate students and volunteers who have helped me in my data collection, analysis, and digital data curation processes. Special thanks to Yoli Ngandali for all her help with GIS!

Finally, I am grateful to my family. Thank you to my parents, Janice and Dennis Walder, who always encouraged me to follow my own path, and made it possible for me to do so. As I was growing up, I came to value education and enjoyed exploring the past, particularly Wisconsin's past, through many visits to museums, historic sites, and nearly every brown roadside historical marker across the state. Mom, it is no wonder that I became an archaeologist! Proud encouragements, cards, phone calls, and understanding from my grandparents, aunts, uncles, and close friends kept me going during the difficult years of graduate school. I also thank Brent Martinson, for his endless supply of patience, for keeping me grounded, and for Dudley, my writing companion and lap-warmer during long days of dissertating. I thank all of my family members for their unconditional love and support of my unconventional career choice, no matter where it takes me. You have all been part of helping me reach my goals; thank you!

Chapter 1. Early Native American and European Interaction in the Upper Great Lakes: Context, Problem Orientation and Research Questions

"On the fifth of February, there came to Onnontagué many Hunters from Sonnontouan and Oiogoen , whom the Father greeted with two presents of ***a thousand beads to each Nation****; telling them that they entered not only the country of the Onnontaguehronnons, but also that of the French, since the two formed but one People.*

He added that the joy at their coming was general; and he wished that Onnontio could have seen what fine children he had in that Country, for he would be especially pleased with them. He also, with the present offered in his name, wiped away the blood still remaining on their persons from their latest engagement with the Cat Nation. They responded with two similar presents, after which they prepared for their war-feast."

(Thwaites 1890 [2000]:42:120-121)

This regional-scale dissertation project focuses on the chronology and scope of socially-structured exchange networks that facilitated intercultural interaction in the Upper Great Lakes region of North America, c. 1630 to 1730. At this time, local Native groups encountered European-made trade items, displaced Native newcomers, and European explorers, traders, and missionaries in a situation of intercultural contact and colonialism. I applied chemical characterization and attribute analysis methods to glass and copper-base metal artifacts from 38 archaeological sites in the Upper Great Lakes region to examine how diverse groups of people employed long-standing technological practices such as copper-working and incorporated new materials like glass into existing symbolic and representational systems over time and across the region. I identified patterns of variation in two material data sets: glass trade beads, and objects fashioned from copper and brass trade items, and demonstrated that trade items themselves and the working methods applied to them varied through time, across space, and according to the ethnic identity attributed to inhabitants of each site. These findings support the presence of historically-documented, socially-structured exchange relationships across the Upper Great Lakes region reflected in the material culture category of personal adornments.

The *Jesuit Relations*, a compilation of accounts of French exploration, describe socially-structured exchange relationships in the North America during the seventeenth century (Thwaites 1890 [2000]:42:1-219). Gift-giving of beads and other trade items in the Upper Great Lakes and in eastern North America helped foster fictive kinship relationships between the French "fathers" like "Onnontio," the governor of Canada, and their Algonquian trading-partner "children" (White 1984; White 1991:36,180-181; Witgen 2012:49-54), so conceptualizing exchange networks as both social and economic relationships is an appropriate framework for investigating cultural or ethnic affiliations. The quotation in the title of my dissertation, "…a thousand beads to each Nation," refers to the fictive kinship ties, situationally fluid alliances, and French recognition of Indigenous Nationhood (Witgen 2012:75) that emerged in New France in the seventeenth century. In the volume of the *Jesuit Relations* for the years 1655-1656, Father Jean de Quen (Thwaites 1890 [2000]:42), recounted the work of missionaries to the Onondaga Iroquois who were living in the Finger Lakes region of present-day New York (Bradley 1987). De Quen mentioned that the Jesuit Father leading the Mission (of St. Marie among the Iroquois) greeted hunters from neighboring tribes with "…a thousand beads to each Nation" as a present from the French governor, Onnontio, to his "children." The present made up for lives lost in a conflict with a neighboring group and sealed the trading alliance between the French and the Hurons of Onondaga (Thwaites 1890 [2000]:42:121-122). De Quen later recounted another speech from the Jesuit Father regarding peaceful alliances among several Iroquoian nations, a speech that ended with more gift-giving and another reference to the gift of "a thousand beads to each Nation" (Thwaites 1890 [2000]:42:189). The Iroquoian Nations in turn reciprocated by presenting the French with collars of beads of their own, partially to cover a recent violent death, and also in thanks for their “adoption” by Onontio, further exemplifying how gift-giving of highly-visible adornments strengthened alliances and was used to atone for deaths (Witgen 2012:207).

De Quen also recorded the journey of “two young Frenchmen,” whom historians have identified as Radisson and Groseilliers (Lurie and Jung 2009: 120-121; Thwaites 1890 [2000]: 42:12-13; c.f. Mason 2015). They were reporting back to Quebec from explorations in the French Upper Country, or *pays d’en haut,* and had arrived in a fleet of fifty canoes laden with furs, the “goods which the French come to this end of the world to procure,” and they presented the French Governor with gifts of information about the peoples to the west, such as the areas where Huron and Algonquin languages were spoken, and names for landforms and other peoples, including the “Stinkards,” or People of the Stinking Water, possibly the Ho-Chunk (Lurie and Jung 2009:121; Thwaites 1890 [2000]:42:218-219). The “gift” of information parallels the material exchanges, like the “thousand beads to each Nation,” that were so common throughout New France in the seventeenth century. Gifts of information, experience, materials, and captive or enslaved human beings reinforced trading relationships among the Five Nations Iroquois and their French “fathers,” and throughout the Upper Great Lakes as well (Bradley 1987; White 1991). When artifacts like trade beads or copper kettles are recovered archaeologically, it can be impossible to determine whether they were material “gifts” given to cover the dead, to seal an alliance, in exchange for furs or European-made objects, or for other reasons. However, by theorizing the exchange as structured by personal relationships as well as economic considerations, trade goods take on social significance and can represent interactions among diverse ethnic groups.

Identifying and tracing ethnic groups, which I define loosely as communities that self-identify with a shared cultural or ancestral background (after Emberling 1997), has been recognized as an archaeological problem in the Upper Great Lakes region for decades (e.g. Gibbon 1995; R. J. Mason 1976; McKern 1939). In this dissertation, I use “ethnic group” to refer to historically-documented peoples, and “cultural group” as a broader term to delineate people sharing material culture and practices in situations where archaeological sites have not been linked to any particular named group of people in the historical record. Connecting modern Native American tribes or ethnic groups such as the Ho-Chunk, Menominee, Huron, Meskwaki and others to historically-documented peoples and to pre-contact cultures identified only through archaeology is a major challenge for the study of ethnicity in this region. However, ethnicity, as one facet of identity, may be understood materially through the study of ornaments and dress (e.g. Kinietz 1965; Loren 2010; Vanhaeren and d'Errico 2006) Since metal and glass trade items recovered from Upper Great Lakes historic-era archaeological contexts were often used as ornaments, like the “thousand beads to each Nation,” I focused on their physical attributes and chemical composition to learn more about the influence of ethnic identity on material exchange and expression of identity through adornment in a colonial context.

Colonialism refers to contact among cultures where one party has an economic or political interest in dominating another (Silliman 2005), but in the seventeenth and eighteenth centuries, the Upper Great Lakes region or *pays d’en haut*, the French “Upper Country,” was a “middle ground” with mutual accommodation, movement of people, and complex interaction unlike colonial encounters in other regions of the North America (White 1991). In the middle ground, a balance of power and strong Native control of trade networks allowed local groups such as the Anishinaabe to maintain social, political, and economic distinctiveness and power in a “Native New World” of their own making well into the eighteenth century (White 1991:50-186; Witgen 2012: 109-168). Therefore, by documenting technological processes that culturally-distinct groups of Native people used to confront the social and economic challenges of displacement, migration, conflict, and the influx of both European material culture and people, my research specifically investigated the strategies and circumstances that shaped Native American and European interaction in the Upper Great Lakes.

My goals for this project included collecting a regional dataset on the use and modification of European objects of glass and copper-based metal to determine roughly when and how trade goods arrived in the Upper Great Lakes, and tracing the movement of different groups of people including displaced Native refugees, seasonally-mobile local inhabitants, and European explorers, traders, and missionaries. Investigating colonial processes through a fine-grained case study of technological practice builds on the work of archaeologists and ethnohistorians in other regions of North America. Other scholars have investigated related outcomes of colonial interaction, including: ethnogenesis, which is the formation of new ethnic groups; cultural hybridity, which is the incorporation of existing material and social traits in the production of new constructs; and multi-ethnicity, where individuals of different ethnic backgrounds share resources, territory, and ways of representation within a single community (Baram and Hughes 2012; Card 2013a, b; Gosden 2004; Silliman 2013; Stein 2005; Weisman 2007). In the Midwest and Upper Great Lakes region, previous archaeological research on cultural or material hybridity and multi-ethicity has focused on site-level analyses (e.g., Bodoh 2004; Carlson 2012; Ehrhardt 2013; Nassaney 2008). Investigating these concepts at a regional-scale through the material data set of adornment provided a more complete picture of the social dimensions of contact and colonialism because the broader scope of the analysis helps account for the outcomes of intercultural interaction through movements of people and material culture.

1.1 Introduction to the Research Problem

The study of diverse peoples coming into contact with one another has been a fundamental area of interest since the beginnings of anthropology as a discipline (Hodgen 1964:22). In the Upper Great Lakes region, there have been historical overviews (Kinietz and Raudot 1965), cartographic analyses (Tanner 1987), and synthetic reviews of archaeology for general audiences (Cleland 1999; C. I. Mason 1988, 1997), but there has been no in-depth regional-scale investigation of archaeological materials related specifically to initial colonial encounters. Because early instances of European contact in the Upper Great Lakes were indirect and intermittent at first, they have produced an ephemeral and sparse archaeological record (Ehrhardt 2010; Staeck 2000; Walthall and Emerson 1992). In Wisconsin, especially, there is poor geographic and chronological understanding of the first encounters. This condition stands in stark contrast to instances where early interactions between Indigenous groups and French, Dutch, English and other Europeans were locally sustained and resulted in an abundant archaeological record, as in colonial New England (c.f. Grumet 1995; Silliman 2009).

Documentary evidence of the presence of Meskwaki, Potawatomi, Huron, Odawa, Anishinaabe, and other Native groups, as well as French colonial fortification sites, informs research in the Upper Great Lakes (Behm 2008; Brandao and Nassaney 2006; Lurie and Jung 2009; Mason 1986; Thwaites 1890 [2000], White 1991; Witgen 2012). By the 1600s, European explorers and cartographers produced accounts and maps that labeled or described the social or ethnic identity of Indigenous groups involved with contact events or colonial presences at many locales in my study (Champlain et al. 1922-1956; Champlain and Libraries 1980; Sanson et al.

1976; Thwaites 1890 [2000]; Winsor 1894; Wroth 1954). Historians have used these lines of evidence to infer that trade relationships at this time were structured by kinship, long-standing seasonal movements or aggregation patterns, and social relations among Native groups (White 1991; Witgen 2012), while archaeologists have relied on eighteenth-century trade manifests (Anderson 1992, 1994; Wheeler 1975) in order to better understand the movement of different categories of trade items into this region. The existing understandings and assumptions about socially-structured trade relationships among sites that emerged from previous investigations of the historical record have structured my research questions. To test prior interpretations of cultural affiliations of archaeological sites, I developed research questions related to geographic and temporal distribution of patterns in the chemical compositions of blue glass beads and the technological styles of producing metal ornaments at these sites.

I compared materials from roughly contemporaneous sites across the region to delineate the patterning of glass trade bead recipes and styles of reworked metal objects produced from copper-based metal trade items. This allowed me to understand a wide range of approaches that Native peoples of the region applied to foreign or unfamiliar trade goods related to material practices of identity performance in the context of regional and dynamic population movements. The presence of European-made trade items such as glass beads and non-native copper or brass objects in Upper Great Lakes assemblages affiliated with Native American inhabitants can be explained by down-the-line exchange, face-to-face contact with foreign traders or their middle(wo)men, or direct interaction with other Indigenous groups who were involved in trading relationships with Europeans. However, these methods of transport are not easily distinguished from one another in the archaeological record without aide from textual evidence. The regional scope of the study is centered on major habitation sites or temporally-discrete site components as well as mortuary contexts in Wisconsin and Michigan, which were compared to sites in adjacent areas of Minnesota, Iowa, and Northeastern Missouri that were also occupied by Native people c. 1630 – 1730 in order to identify and contrast material culture patterns across the broader Upper Great Lakes region. By linking compositional and technological patterns to known chronological, geographic, and cultural attributes of archaeological sites, I investigated how Native American groups in the Upper Great Lakes region maintained and altered strategies for acquiring European-made materials used for personal adornments and other purposes during the early contact and colonial era (c. AD 1630 – 1730).

I examined archaeological evidence of material exchange related to personal adornment because dress and adornment allow individuals to customize the expression of their identity to effectively navigate complex social situations (Loren 2009; Nassaney and Brandao 2009; Wobst 1977). Specifically, I investigated how socially-structured trade networks facilitated the economic exchange of finished ornaments and raw material, and studied the production processes of personal adornments such as copper-based metal tinkling cones and rolled beads, and blue glass pendants produced from reworked European-made glass trade beads, because patterns of difference in adornment production strategies provide material evidence for cultural affiliation during situations of colonialism or intercultural interaction (Barth 1969; Bayman 2009; Emberling 1997; Lightfoot et al. 1998; Schortman and Urban 1998; Voss 2008). The different ways that groups modified trade items reflect learned technological practices (Minar and Crown 2001), and these may vary according to the ethnicity of crafters (Bayman 2010). For this reason, patterns in the modification and social exchange of trade items (many of which were personal adornments) can be used as one line of evidence to test existing archaeological interpretations of cultural affiliation, which may then be linked to historically-known ethnic groups through the documentary record in some cases. In other early contact situations in North America, Indigenous ornamentation practices quickly incorporated new materials for use as personal adornments in existing symbolic or ideological systems, (Bradley and Childs 1991; Fox et al. 1995; Miller and Hamell 1986; Turgeon 2001a,b). In these examples, Native people altered the meanings and sometimes the physical forms of European-made objects to better suit their material and social needs, and similar transformations of the forms and meanings of trade items likely occurred in the Upper Great Lakes region.

The blue glass beads and copper-base metal ornaments that are the focus of my study are some of the most distinctive European-made trade items in Upper Great Lakes assemblages. Other commonly-recovered diagnostic trade items include iconographic or “Jesuit” rings (Mason and Ehrhardt 2009; Mason 2009), firearm parts (Gladysz 2011), as well as axes, hatchets, knives, and lead shot (Quimby 1966:64-66). Although gunsmithing has been documented in at least one local of Native habitation (Bodoh 2004), and the bands of iconographic rings may have been intentionally removed from their decorative plaques (Behm 2008:57), the practice of reworking and physically modifying trade items for the purpose of producing personal adornment is best represented across the region in the material categories of copper base metal and glass beads.

In general, glass beads were selected for analysis because these personal adornments were traded widely during early intercultural encounters, possibly because glass beads may have taken on new meanings as metaphors for naturally-occurring crystals that were important in Native ideological systems (Miller and Hamell 1986: 325-326). I selected blue glass trade beads in particular because of the ubiquity of this color on the earliest sites in my study sample, such as Goose Lake Outlet #3 and the New Lenox site, which may both date to the first third of the seventeenth century (Billeck 2010; Lurie 2013 personal communication). While beads of many colors including white, black, and red are present on some sites in the study sample, if an Upper Great Lakes seventeenth century assemblage includes only one color of bead, they are generally blue. Furthermore, reworked glass pendants are also generally blue or blue with white decorative elements, so blue beads were analyzed to better understand on-site production of these objects.

Copper-base metal, often repurposed into ornaments or other forms, is also recovered very frequently from early seventeenth century sites, and reworking of copper-based metal trade items reflects long-standing ideological associations and technological practices of copper-working in the region (Martin 1999; Pleger and Stoltman 2009). Metalworking technology can symbolize or represent community identity expressed through shared practice (Ehrhardt 2014; Iles and Childs 2014; Lechtman 1984, 2014). Therefore, using the analytical framework of *chaîne opératoire*, or the study of the operational sequence (Lechtman 1977; Leroi-Gourhan 1943, 1945; Vidale et al. 1992), I examined the entire production process of copper-based metal ornaments to identify patterns of difference and similarity in technological style of reworking among different communities in the Upper Great Lakes.

I applied analytical methods developed for similar assemblages in Illinois, Missouri, Ohio, Ontario, and the Northeast (Anselmi 2008; Drooker 1996; Ehrhardt 2005; Hancock 2013) to facilitate wider, inter-regional comparison. Using Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) analysis of glass trade beads and reworked glass pendants, and attribute analysis of the technological style of reworked copper-base metal artifacts, I identified patterns of difference at the regional level, which facilitated the exploration of the social and economic dimensions of contact in this dissertation. These methods produced data sets in which material patterns were interpreted as related to chronology, exchange, population movement, and ethnic affiliation. Results of compositional analyses of selected glass artifacts allowed me to refine the chronology of the introduction of certain types of beads, as has been accomplished in other regions of North America (e.g., Hancock et al.1994; Hancock 2013). The glass bead analysis revealed a chronologically-significant change in the glass recipes used around AD 1700. This clarified the timing of occupation of some sites in the study sample. By mapping locations of chemically similar beads, I trace possible paths by which glass trade beads entered the Upper Great Lakes region and demonstrate that culturally distinct communities, for example a group of probable Huron migrants or refugees in buried in Wisconsin at the Hanson site (Rosebrough et al. 2012), may have had access to different sources of glass beads. Some sites had bead recipes that were not common at other contemporary locales in the region, possibly indicating that the inhabitants brought beads with them from areas outside the region, or obtained them through networks of down-the-line trade not available to others in the region.

The metal attribute analysis revealed how resource availability may have differed among sites, and how people adjusted their adornment strategies accordingly. Furthermore, the style of objects produced from copper-base metal scraps or blanks cut from kettles differed regionally, possibly as a result of social preferences for particular finished forms. The metal assemblage attribute analyses also revealed evidence of re-fired glass production waste on Rock Island, indicating that local production of these hybrid objects probably took place in the Great Lakes region. By analyzing variation in physical attributes of artifacts produced by reworking metal, I identified additional regional patterns in the technological style and production process of ornaments made from European objects like copper kettles. As a whole, these findings highlight trade-item repurposing and distribution as representative of down-the-line trade and migration of diverse groups of non-local Native people into this region. My interpretations account for the possibilities of ethnogenesis, multi-ethnic communities, and other historically known responses to colonial involvement during the first century of European presence in the Upper Great Lakes.

1.2 Previous Studies of Contact and Colonialism in the Upper Great Lakes

Drawing on current theoretical frameworks (including Card 2013a,b; Gosden 2004; Silliman 2005), I re-evaluated the findings of archaeologists who relied on a framework of acculturation to construct inferences about the consequences of colonialism in the Upper Great Lakes (e.g., Armour 1977; Brose 1983; Brown 1979; Fitting 1976b; Linton 1940; Quimby 1966). These scholars emphasized the cultural and technological superiority or dominance of European peoples over Native Americans in general, rather than as culturally distinct and situationally-variable social units, or they focused on individual archaeological sites in the historically-documented territory or migration paths of particular ethnic groups. Outside of the Upper Great Lakes, archaeologists working in North America, particularly the Southeast, Northeast, coastal California and the Pacific Northwest, have developed more extensive regional historical archaeology research programs that examine the multiple facets of contact and colonialism from various theoretical perspectives that emphasize the role of individuals, the hybrid and sometimes shifting nature of ethnic identities, and the situational nature of personal adornment (Cusick 1998b; Deagan 1996, 2013; Lightfoot 1995; Lightfoot et al. 1998; Voss 2008).

Several researchers recently have investigated identity, intercultural interaction and population movement in the Great Lakes region (Branstner 1991, 1992; Howey 2011; Nassaney 2012; O'Gorman 2007a; Scott 2008). White's accommodation model of shared power and cultural continuity of Indigenous peoples in the face of incoming non-local Native groups (1991) continues to inspire discussions of interaction in this region today (Bodoh 2004; Kerr 2012; Koziarski 2012; Malischke 2009). However, all of these earlier efforts focused on site-level analyses rather than comparative investigations of interaction or material culture across the region. Therefore, I expanded on previous research by investigating interaction among diverse Native American groups and locales of European presence at the regional scale, and I applied a theoretical framework that specifically accounted for the possibility of hybrid identities and multi-ethnic communities that are known to emerge in other colonial situations (Beaudoin 2013; Card 2013b; Liebmann 2013). This was accomplished by examining patterns of variation and diversity in the kinds of metal and glass trade items available and the ways in which these objects were exchanged and modified through time by different cultural groups across the region.

1.3 Regional Data Set

To document patterns in the movement of European-made trade items across the landscape and fully investigate how ethnic and cultural affiliation may have shaped both access to trade networks and technological style in the modification or reworking of European-made objects into ornaments, I studied previously excavated artifacts in collections from 38 sites across the Upper Great Lakes region, spanning approximately the first one hundred years of direct European presence in the region, c. 1630 – 1730. The data set included 874 glass artifacts and 3,705 copper-based metal artifacts such as tinkling cones and the scrap used to produce them. In Wisconsin, archaeological evidence linked to the contact or early historic era, or the early and transitional phases of the French fur trade (as defined in Anderson 1992:11-33) has been recovered through research programs targeted at specific sites and gathered as part of cultural resource management projects. Materials that I investigated for this project come from excavations as well as surface collections and are scattered among numerous museums, universities, CRM firms, and other curation facilities (see Chapter 3, Table 3.3).

I designed the project to include data from all kinds of archaeological collections, focusing on relatively recently excavated and published archaeological sites, but the sites investigated grew into a "snowball sample:" curators and colleagues directed me to unpublished or less-accessible collections or surface finds in their facilities or of which they had other prior knowledge, connecting me to further materials and additional sites. By including artifacts with only site-level provenience information, I was able to expand the geographic scope of my study and to obtain more data points within the region, which was helpful in understanding both patterns of interaction across the region and within specific areas, such as Green Bay and the Door Peninsula, where many key sites are represented only in surface collections. In Chapter 3, I address problems with my wide-reaching and broadly comparative data set, including variable methods of artifact recovery in the field, the chance that some collections were inadvertently overlooked because they had never been published, and the possibility that some collections not examined may include trade items that were not recognized. While the data set is necessarily complicated by my site sampling strategy, the regional patterns of variation documented in glass bead compositions and styles of metal reworking demonstrate the utility of a site-level, collections-based regional approach to archaeological questions of population mobility, multi-ethnicity, and hybritity in contexts of colonialism and intercultural interaction.

1.4 Research Questions and Hypotheses

To investigate intercultural contact and colonialism in the Upper Great Lakes, I present the expectations and outcomes of three interrelated research questions, a primary hypothesis, and a falsifiable null-hypothesis designed to deal with the complications of using a regional data set. The research questions apply existing theoretical frameworks of colonial encounters in anthropology and archaeology (e.g., Bhabha 1994; Gosden 2004; Jordan 2009; Silliman 2005;

White 1991) to the particular historical circumstances of colonialism in the Upper Great Lakes region. I briefly introduce each of the research questions and associated expectations, and I provide working definitions of terminology that are further explained in Chapter 2.

1.4.1 Research Question 1*:* In the region of study, is there archaeological evidence for commonly recognized historically-documented outcomes of colonial interaction, such as multi-ethnicity, hybridity, and ethnogenesis?

I expected to identify outcomes of colonial interaction, including multi-ethnicity, hybridity, and ethnogenesis in the material practices and adornment strategies in historic-era Upper Great Lakes communities because of the shared power structures and socially-structured trade networks described by historians (White 1991; Witgen 2012). Since style may reflect ethnicity (e.g. Bayman 2010), I expected that patterns of technological style or reworking methods related to adornment production would include diverse or innovative styles at multi-ethnic or hybridized sites and greater standardization at sites associated with only one archaeologically-visible cultural group or historically-identified ethnic group. The development of new adornment styles would provide evidence for processes of ethnogenesis or cultural innovation (Emberling 1997:308-309; Voss 2009:423). To test these expectations, I examined metal artifacts from archaeological sites in the Upper Great Lakes region with ethnic attributions derived from historic records, as well as sites without a clear tribal or ethnic affiliation. I expected that the styles within particular types of reworked metal objects like tinkling cones and projectile points would vary along previously delineated cultural lines because the production of these objects would have been a learned technological practice at a local or community level. Variation was present in the data set, both in the range of types produced and within types, especially in the patterning of styles of metal projectile points and to a lesser extent in the closure styles of tinkling cones. Since availability of metal "raw material" in the form of trade items may have been structured by ethnic affiliation and differential access to trading partners, patterns of technological style may actually reflect both trading connections and the presence of predominant ethnic groups at communities in the study.

To lay out the theoretical framework of this research question and its expectations, this dissertation draws on the work of post-colonial archaeologists and theorists (Bhabha 1994; Cipolla 2013; Ferris 2009; Gosden 2004; Liebmann 2008:2-4; Liebmann and Rizvi 2008; Said 1979 [2014]:39-41; van Dommelen 1997). These scholars have countered the hegemonic construction of power present in scholarly discussions of the nineteenth and twentieth centuries and critiqued the separation of “Native” and “European” peoples into binary categories of colonized people and colonizers (e.g., Quimby 1966). Specifically, I rely on the work of Homi Bhabha, who argued that to truly “decolonize” the scholarly discourse, it is necessary to reject broad categories, including colonizer and colonized, in order to better understand actual power structures that underlie interactions among diverse cultures in situations of diaspora or resistance against colonizing entities and the development of non-binary, new cultural constructs in colonial situations (1994:160-198). Applying this concept of hybridity acknowledges that encounters among cultural groups often produce social and material outcomes that blend technology, preferred style, and social meaning to produce new constructs that incorporate desired aspects of the contributing cultures (Card 2013b; Silliman 2013; Deagan 2013). Therefore, hybridity related to the emergence of new cultural constructs through the process of ethnogenesis in colonial situations (Haley and Wilcoxon 2005; Weisman 2007). Fully understanding the historical contingency and diversity of phenomena identified in the post-colonial critique, such as hybridity and ethnogenesis evidenced through technological or stylistic change, requires integrated and localized analyses of these processes through case studies (e.g.

Baram and Hughes 2012; Ehrhardt 2013; Liebmann and Rizvi 2008) as well as cross-cultural comparative investigations (e.g. Card 2013a; Stein 2005), and my research project contributes a regional, cross-cultural investigation in the Upper Great Lakes.

1.4.2 Research Question 2: Do spatial and temporal patterns of variation in the chemical composition of glass beads and the reworking styles of metal objects correlate with present understandings of the locations of ethnic groups on the regional landscape?

Archaeologists working on seventeenth and eighteenth century Native American sites in the Upper Great Lakes have assessed ethnicity by assigning distinctive ceramic styles that predominate at particular archaeological sites in locations that match historically documented Native settlements to ethnic groups or tribes present at those locations in the documentary record (Behm 2008; Branstner 1992; C. I. Mason 1976; R. J. Mason 1976, 1986; Rohrbaugh et al. 1999; Wittry 1963). In some cases, once a distinctive ceramic style has been affiliated with a specific tribe, then other sites that yield similar pottery are commonly identified with the same historic tribe (e.g., Bird 2003; Mazrim and Esarey 2007; Naunapper 2010). Such interpretations can be problematic because they do not account for effects of trade, multi-ethnic communities, or other outcomes of intercultural interaction. To test the pre-existing ideas about the locations of historically documented ethnic groups or tribes on the colonial landscape, I employed two data sets that are independent of previous ethnic interpretations: the attributes of re-worked copper-based objects such as tinkling cones and the chemical compositions of blue glass beads traded throughout the region. I expected that archaeological sites affiliated with a particular tribe or ethnic group would have technologically or stylistically similar types and forms of copper-based metal personal adornments because technological style would be learned and shared as part of the culture of a community. I also expected that these sites, if contemporaneously occupied, would have blue glass trade beads of similar chemical composition because they would have shared the same socially-structured trading relationships with other Native groups and with Europeans. I found that patterns of variation in the metal adornment reworking styles, technological styles of reworked glass pendants, and the glass recipes of unmodified glass beads recovered at those sites matched existing interpretations of the spatial distribution of cultural groups in most but not all cases.

Personal adornments made from trade items were integrated into existing Native ideological or representational systems connected to social affiliations or standing (Hamell 1992; Loren 2010; Miller and Hamell 1986; Turgeon 2004). However, reworking practices applied to both metal and glass trade items also may have been influenced by the relative abundance or scarcity of these materials. Since trade networks were socially-structured and dependent on relationships among communities (White 1991; Witgen 2012), access to European trade goods was influenced by the connections among particular ethnic groups on the landscape. The technological practices that Indigenous people applied to rework metal artifacts likely would have differed depending on the availability of copper-based metal trade items to use as raw material, the stylistic preference of the intended users of finished objects, and the background or training of the craftspeople producing the objects. Therefore, patterns of difference in reworking methods for metal ornaments may reflect all of these socially-structured factors (availability, stylistic preferences, and skill), but it is not possible to separate how each factor influenced the final metal assemblage.

For glass beads, spatial patterns of variation in the compositions of the blue glass trade beads makes it possible to map their movements across the landscape via direct or down-the-line exchange, and such exchanges may represent both economic and social interactions. Patterns identified in the glass bead compositions can be linked to the timing of movements of particular historically-documented ethnic groups, such as Huron migration into the Upper Great Lakes region after AD 1650, or arrival of the Meskwaki in the Lake Winnebago region at the end of the seventeenth century. Blue glass bead compositions and attributes of copper-based metal reworking practices serve as complementary lines of evidence to investigate the influence of ethnic identity on the exchange and modification of non-local trade items in the colonial-era Upper Great Lakes.

1.4.3 Research Question 3: In the Upper Great Lakes, when and where did non-local trade items arrive, and how did socio-economic factors influence their distribution?

Since Dutch, French, and English traders in the Northeast made alliances with some Indigenous groups and came into conflict with others, trade relationships were social relationships (Bradley 2007), and therefore I examined the role of social and economic factors on trade as a single topic of socio-economic influences. Gift-giving and ritualized exchange among Indigenous groups fostered community bonds and further circulated these materials to groups or individuals who may not have had direct contact with Europeans, as illustrated in descriptions of the Feast of the Dead among Huronian groups who included European observers in these rituals (Thwaites 1890 [2000]:10:278-303). Control of trade networks was competitive at this time, therefore Indigenous peoples ended up in conflict with one another as well as European groups throughout the Americas as they sought to control the waterways and strategic points along routes, such as Madeline Island and the Fox River in Wisconsin, and the Straits of Mackinaw in present-day Michigan (Edmunds and Peyser 1993; Garrad 2014).

Anthropological and archaeological case studies from other contexts of European colonialism worldwide have shown that both economic and social factors influenced the timing and distribution of European-made items to Indigenous peoples (Bayman 2010; Howey 2011; Panich 2014; Sahlins 1993), and through the research presented in this dissertation, I demonstrate that this was the case in the Upper Great Lakes. In trying to determine the chronological sequence of the arrival of these trade items, archaeologists have heavily relied on textual evidence to determine both what kinds of materials were present at different times (Anderson 1994) and the specific sites where items arrived (e.g. Mason 1986; Nassaney et al. 2003; Stone 1974). The radiocarbon dating method yields statistical dates that often span 80+ years at the 1-sigma level, which is too coarse-grained to be useful in the historic period, where significant changes in material culture could occur in less than a decade. Seriations such as the Glass Bead Periods applied in eastern North America (Kenyon and Kenyon 1983) may not transfer to the Upper Great Lakes without being affected by complicating factors, such as the effects of down-the-line trade. Therefore, the development of an independent chronological measure that was based on a widely available material type with the potential for fine temporal distinctions was necessary to investigate interaction among archaeological sites. Glass workshops in Europe, which were variously located in Venice, Amsterdam, Paris, London, and perhaps other locales as well (Bradley 2007; Dussubieux 2009; Janssens et al. 2013; Tyler and Willmott 2005; Van der Linden et al. 2005), held their own proprietary recipes for making beads, and these recipes changed through time in their raw material selection and preparations (see Hancock 2013). Consequently, I explored the possibility that variation in the chemical composition of blue glass beads could be used to develop a chronology that could clarify the occupation dates for archaeological sites in this region that lack good temporal control.

Furthermore, the variation in chemical composition of blue glass trade beads from one workshop to the next and through time meant that blue glass beads might be used to trace the movement of beads across the landscape. Previous studies of trade records and discussions of other documentary evidence for the trade (Anderson 1991; 1992; 1994; Kent 2001; 2004; White

1991; Witgen 2012) and the primary sources as recorded in the *Jesuit Relations* (Thwaites 1890 [2000]) indicate that major waterways were the historically documented "highways" of the fur trade (Burpee 1914; Dalton 2011:140; Sleeper-Smith 2009:xxxiii), although overland trails were also widely used (C. L. Mason 1994:10). Assuming that glass beads entered the Upper Great Lakes in batches that came from one European workshop at one moment in time, then chemically similar beads at different sites can be used to infer that some kind of trade relationship was common to the inhabitants of both sites. By connecting archaeological sites with beads sharing similar chemical compositions, the particular routes of the movement of the beads can be mapped. I expected that if sites with chemically similar beads were mapped in relation to waterways and historically documented trade routes, it would be possible to suggest possible geographic routes that the beads followed. Furthermore, I expected that it would be possible to suggest trade routes or relationships that may have existed but are not documented historically. These expectations were supported in the spatial patterning of glass trade bead chemical subgroups, which showed that some communities had access to beads that others did not.

1.4.4 Primary Hypothesis, Null Hypothesis, and Assumptions

The **primary hypothesis** of this research is: *Different Native social groups practiced varying strategies of using and reworking European trade goods.* I specifically tested previous interpretations of ethnicity, as identified through historic maps, records, and published archaeological interpretations using new lines of evidence, chemical analysis and reworked-metal attribute analysis. Addressing the primary hypothesis required data from multiple social groups that could be distinguished on the basis of material culture. The sample set included several contemporaneous sites with securely attributed ethnic affiliations, making it possible to compare sites where known differences in working methods of metal objects and glass bead recipes should have occurred. To deal with “the messy idiosyncrasies of evidence–context–culture–history” (Hauser 2012:184) that occur when trying to compare archaeological data from a large number of site contexts excavated in different ways with diverse sampling strategies, I developed a null hypothesis (Connor and Simberloff 1986) in opposition to the primary hypothesis described above. While “messy data” may not clearly support a positive hypothesis, it may be possible to falsify a null hypothesis using the same data. To account for the possibility of making a Type I error and incorrectly rejecting the null hypothesis as false, I designed the null hypothesis to be very broad.

The **null hypothesis** is: *Among Native archaeological assemblages of comparable temporal range and activity patterns there will be minimal or no variation in the technological style of utilization and reworking of European trade goods, regardless of the social or ethnic affiliation of the assemblage*. By “utilization” I refer to acquisition and modification of the objects, but not necessarily their contexts of use as adornment objects, as such practices are not well represented archaeologically. Regional-level comparisons of technological style of metal artifacts and re-worked glass objects from behaviorally and temporally similar sites attributed to different Native cultural groups have revealed variations falsifying this null hypothesis, which is discussed further in the data and interpretation chapters (Chapters 5 and 6). These variations need to be considered within the context of the dynamic processes associated with contact and colonialism, particularly the influx of trade materials in concert with population movement, settlement in multi-ethnic villages, and widespread epidemic disease.

In order to falsify the null hypothesis, I sorted the sites into groups of similar time and activity, and then compared patterns identified in the glass compositional subgroups and technological styles of metal reworking among them. My initial expectations were that copper-based metal assemblages that were temporally or spatially close to one another would have generally similar attributes, and that glass bead compositional groups would also be similar. For instance, contemporaneous sites located on the same waterways were expected to have similar levels of participation in trade networks and therefore similar resource availability, but the null hypothesis would be falsified if those sites were attributed to different cultural groups. Behavioral contexts of each site also could influence ornament production and use; for example, Lorenzini demonstrated that trading outposts had more diverse assemblages of glass beads when compared to contemporary small habitation sites (1999). For this reason, the activities that took place on a site were considered when comparing assemblages, and the null hypothesis was deemed falsified when contemporary sites along the same trade routes with generally similar behavioral contexts but different cultural affiliations exhibited dissimilar patterns in the glass and metal datasets.

1.5 Summary of Introductory Chapter

In Chapter 1, I have introduced the research problem: investigating intercultural interaction in the early contact and colonial era of the Upper Great Lakes at a regional scale of analysis. I presented my primary hypothesis and research questions, which I summarize here. I formulated three **research questions**, each with specific expectations: 1) *In the region of study, is there archaeological evidence for commonly recognized historically-documented outcomes of colonial interaction, such as multi-ethnicity, hybridity, and ethnogenesis?* **Expectation:** Patterns of technological style or reworking methods related to adornment production would include diverse styles at multi-ethnic or hybridized sites and greater standardization at sites associated with only one ethnic group. 2) *Do spatial and temporal patterns of variation in the chemical composition of glass beads and the reworking styles of metal objects correlate with present* *understandings of the locations of ethnic groups on the regional landscape?* **Expectation:** Patterns of variation would fit with archaeologically and historically documented locations of ethnic groups; if variation did not match the existing understanding, new hypotheses would be developed using the framework of cultural hybridity, multi-ethnicity, and ethnogenesis. *3) In the Upper Great Lakes, when and where did non-local trade items arrive, and how did socio-economic factors influence their distribution?* **Expectation:** Patterns of variation would correspond to occupation dates of sites and known trade networks; contemporary communities thought to participate in the same trade networks would have similar resource availability and share technological practices.

The three interrelated research questions lead to the **primary hypothesis** of this project: ***Different Native social groups practiced varying strategies of using and reworking European trade goods.*** In my research, I identified chemical subgroups in glass beads that vary temporally and spatially, and diverse reworking methods at communities affiliated with different historically-documented tribal or ethnic groups in the Upper Great Lakes region. These patterns support my primary hypothesis and falsify the null hypothesis. Through the identification of temporally-sensitive chemical subgroups in glass beads and patterns of technological variation in metal reworking, I have contributed new interpretations of the chronology and scope of the socially-structured exchange networks that facilitated intercultural interaction in the seventeenth century, when local Native people of the Upper Great Lakes encountered European-made trade items, displaced Native newcomers, and non-Native explorers, traders, and missionaries. In the Upper Great Lakes region, Indigenous people acquired European-made items like copper kettles and glass beads and manipulated these objects to fashion personal adornments to represent diverse and possibly hybridized ethnic identities. Through analyses of glass and metal artifacts, I identified patterns of regional interaction, technological continuity and change, long-distance trade, ethnic or cultural affiliation, and population mobility in a colonial situation.

1.6 Overview of Chapters

In Chapter Two, I outline the theoretical frameworks that structured my investigation of the research problem, in the context of the historically-documented situation of balanced power structures between non-native groups and various tribes present on a dynamic social landscape. Interrelated theories that inform my research questions include scholarship on hybridity and ethnogenesis drawing from post-colonial studies, and the relationship between technological style and ethnicity examined through the analytical framework of *chaîne opératoire* (Bhabha 1994; Gosden 2004; Iles and Childs 2014; Lechtman 1977). I highlight other anthropological studies of hybridity and multi-ethnicity in colonial situations as documented in material culture (Card 2014a; Beaudoin 2013; Ehrhardt 2014; Voss 2008) to draw parallels to the case-study of the Upper Great Lakes region. I describe the framework of *chaîne opératoire* (Leroi-Gourhan 1943, 1945) used examine all phases of metal reworking resource acquisition to discard of waste products to define patterns of technological style (Kingery 1993; Lechtman 1977), the decisions in production methods that a craftsperson makes that do not otherwise relate to material properties or availability of resources and raw materials. These decisions may be learned behaviors that reflect some aspect of a social group, possibly ethnicity. I define hybrid material culture as objects created from the application of culturally-distinct technological processes to unfamiliar or unexpected raw materials, resulting in finished forms that combine the practices, resources, and symbols of two or more ethnic or cultural groups, and share stylistic or material traits from all contributing groups (Bhabha 1994; Card 2013a). Hybrid material practices were expected in technological style patterns, since material and cultural hybridity has been documented in other situations of intercultural interaction in North America, and cultural hybridity often develops through ethnogenesis in situations of colonial encounters with power imbalances among two groups interacting with one another (Barth 1969; Emberling 1997).

In Chapter Three, I review the culture history of the Upper Great Lakes region and present archaeological, historical, and ethnohistoric background on the Native American groups, including the original Ho-Chunk and Menominee inhabitants as well as Potawatomi, Huron, Meskwaki, Anishinaabeg, Illinois, and Ioway groups that arrived through migration or emerged from processes of ethnogenesis later in the seventeenth and early-eighteenth century. I also describe the archaeological site excavation histories for sites in my study sample. The glass and metal artifacts from these sites, assessed using different analytical methods, provide complementary lines of evidence to assess population movement, interaction, and chronology.

Chapter Four provides specific information regarding the methods applied to the metal and glass artifacts. The archaeometric techniques applied in this research were well-suited to the materials: LA-ICP-MS measures glass composition at the level of parts per million appropriate for statistical analysis, while portable X-Ray Fluorescence (pXRF) differentiated between smelted and native copper in a pilot study of 48 copper-base metal artifacts. LA-ICP-MS was used to identify the "recipes" of 874 glass adornments, which revealed chronological change in glass-making technology in Europe and Native glass reworking methods in North America. I also describe the attribute analysis method used to qualitatively and quantitatively document 3,705 reworked metal artifacts, using technological attributes including size and shape and working-methods, such as hammering, scoring, bending, clipping, folding and crumpling, following procedures that other scholars developed to investigate colonial-era copper-base metal assemblages from elsewhere in North America (Anselmi 2008; Bradley 1987; Ehrhardt 2005).

In Chapter Five, I present the results of the LA-ICP-MS analyses of glass beads and pendants, and interpret the results as they relate to all of research questions. I identified chemical subgroups in glass bead recipes that correspond to known periods of site occupation, demonstrating that European glass workshops shifted their recipes over time and providing a way to clarify the chronology of less-securely dated sites in the Upper Great Lakes region. The geographic distribution of glass bead recipes among contemporary sites indicates that some communities participated in trade networks with European traders or via down-the-line exchange systems that were not available to other groups. I suggest that ethnic identity may have been a contributing factor to these differences in access to trade networks. Native-made re-fired glass pendants were made of glass beads similar to those recovered near their archaeological find-spots in some, but not all cases, indicating that the technological knowledge or practice of re-firing glass beads to produce pendants may have been limited to certain locales, including Rock Island and St. Ignace, and that pendants were traded across the Upper Great Lakes region.

In Chapter Six, I present the results of metals attribute analyses and the archaeometric studies of copper-based metal, and my interpretations related to each of the research questions. The copper-based metals archaeometric analysis establishes that visual differentiation between smelted and native coppers was less reliable than pXRF and that, in some places, the use and perhaps production of native copper artifacts persisted after European metals arrived. Attribute analysis of the metal assemblages reveals patterns in the technological style of production of beads, other adornments, and tools such as projectile points. I interpret these patterns as the result of differences in availability and types of European copper-based metal and differences in metalworking practices in each community. Native communities and individuals applied a range of technological practices to convert European items into more socially significant and useful objects like tinkling cones, metal beads, and projectile points. Size and style of adornments and scrap and proportions of finished to unfinished objects corresponded with existing understandings of ethnicity and with historically-documented differential resource availability, indicating that socially-structured trading relationships affected the ornament production process.

In Chapter Seven, I synthesize the significance of this research, which has produced new archaeological evidence that shows how the ethnic affiliation of historically-documented Native American groups in the Upper Great Lakes region, including the Huron, Potawatomi, Meskwaki, Anishinaabe, and Odawa, structured the exchange and modification of trade items across the region. Examining both metal and glass artifacts provided complementary data sets that allowed me to identify evidence of overlap in the technological practices of Native peoples, such as copper-base metal scraps covered in blue-glass residue from a component of the Rock Island site that also contains re-fired blue glass pendants. Together, metal and glass chemical analyses demonstrate that particular ethnic groups or culturally-affiliated communities across the region accessed different quantities and kinds of trade items, and that trade items themselves and technological methods applied to them varied through time, across space, and according to the probable social identity of communities. Building inferences about patterns identified through compositional characterization and technological style analyses investigates the relationship between culture and technology during a period of dynamic population movement and socio-economic change in the Upper Great Lakes region. This contributes to broader investigations of how Indigenous populations in contact with colonial power(s) maintained cultural continuity when faced with interaction and material change.

Chapter 2. Ethnicity, hybridity, and technological style in colonial contexts: theoretical framework and research questions

This chapter integrates the research questions introduced in Chapter 1 with theoretical frameworks that support the overarching goal of the project: to identify material patterns that can be interpreted to address regional interaction, trade networks, and social relationships among the culturally diverse communities of the Upper Great Lakes region in the seventeenth and early eighteenth centuries. In this chapter, I explain how the overarching concepts of this project are interconnected and how they structure interpretations of the archaeological data sets of metal and glass adornment objects gathered using the analytical approach of *chaîne opératoire* to assess technological style. I then lay out the primary assumptions about human behavior and the archaeological record that are foundational to my study and expand my definitions of key concepts. Finally, I present each research question in the context of the theoretical framework(s) that relate to it and describe specific material expectations related to the archaeological data sets.

In the discussion of each research question, I present archaeological and anthropological case studies of historically-documented intercultural interaction in other regions of North America (Beaudoin 2013; Voss 2008; Weisman 2007), instances that break down binary dichotomies of colonizer and colonized as applied to material culture, space, and ethnicity (Deagan 1996; Mann 2008; Sahlins 1993; Silliman 2010) and examples of how technological styles of personal adornment signify aspects of identity in situations of contact or ethnogenesis (Ehrhardt 2013; Lechtman 1977; Schortman et al. 2001; White 2008). The introduction and cultural interpretation of non-local materials are primary questions of archaeological research in the colonial era because "Colonialism is a process by which things shape people, rather than the reverse" (Gosden 2004:153). Glass and metal personal adornments and associated production waste offer the opportunity to examine the manipulation of personal adornments to signify social or ethnic boundaries in a colonial situation, along with more basic explorations of material exchange, resource availability, and chronology. As viewed through the archaeological record of glass trade beads and reworked metal adornments from the colonial-era Upper Great Lakes, I examine the production and exchange of hybridized objects that reflect the situation of intercultural interaction, with possible outcomes of multiethnic or hybridized communities.

2.1 Definitions and interconnected theoretical frameworks

To build inferences about intercultural interaction from the study of patterns of difference identified in the compositions of glass beads, and hybrid material culture in the form of reworked metal ornaments and glass pendants, I rely on concepts from both technology studies and post-colonial theory to make the connection between the archaeological record and past human behaviors. I have visually mapped the relationships among key concepts that I use to examine intercultural interaction including: technological style examined through analytical frameworks of *chaîne opératoire*, ethnic identity, and material and cultural hybridity (Figure 2.1).

In my research, I have investigated the technological processes used to produce reworked metal and glass objects that are examples of hybrid material culture, which are objects created from the application of culturally-distinct technological processes to unfamiliar or unexpected raw materials. This results in finished forms that combine the practices, resources, and symbols of two or more ethnic or cultural groups and share traits from the cultures of all contributing groups (Card 2013b; Liebmann 2013; Silliman 2013). Anthropological examinations of technology focus on how and why objects are produced, and *chaîne opératoire* studies investigate and link all phases of production and use, from resource acquisition to discard of waste products (Ehrhardt 2013; Helms 1993; Hodges 1970; Kingery 1993; Leroi-Gourhan 1943, 1945; Miller 2007; Schiffer 2001; Vidale et al. 1992).

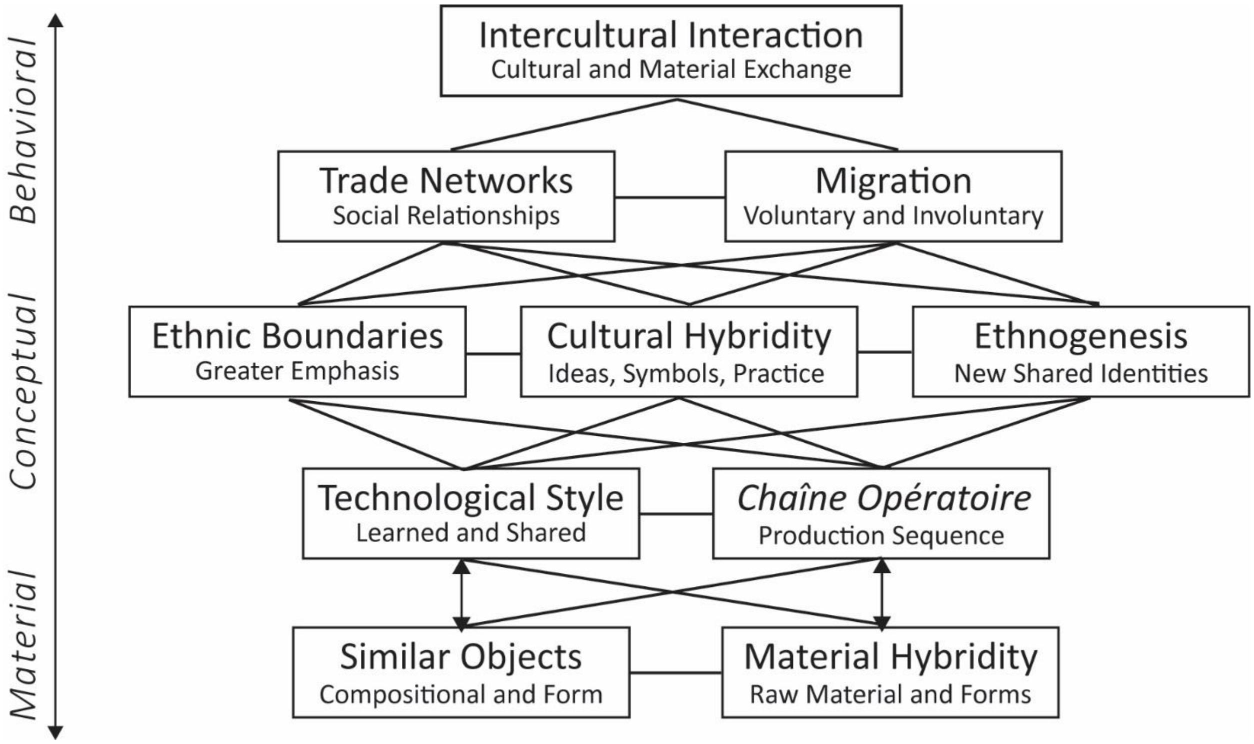


*Figure 2.1 Map of concepts from technology studies (*chaîne opératoire*) and post-colonial theory (ethnogenesis, cultural hybridity, and greater emphasis on ethnicity) illustrating how I built inferences from the material record to examine past socially-structured trading relationships and population movements. Lines indicate influence, moving from behavior to theoretical concepts to material culture, while arrows indicate a shared relationship, where desired finished object forms influence production methods and vice versa.*

Technological style refers to the investigation of particular choices in production methods and design that a craftsperson makes within the constraints of material properties or availability of resources and raw materials (Dietler and Herbich 1998; Ehrhardt 2005, 2013; Lechtman 1977, 2014). These stylistic choices may be learned behaviors that reflect some aspect of a social group, including ethnicity, which is defined as a cultural origin or background shared and mutually acknowledged among members of a group (Barth 1969; Emberling 1997; Jones 1997).

Hybrid material culture reveals a particular technological style that can be understood by studying *chaîne opératoire*.

Cultural hybridity is a concept developed by scholars who situate themselves in opposition to colonial constructions. These scholars are deemed "post-colonial" theorists (e.g. Bhabha 1994; Gosden 2004; Liebmann et al. 2008; Liebmann and Rizvi 2008; Nassaney 2012; see overview in Patterson 2008; Said 1979 [2014]). The post-colonial critique acknowledged that some past scholarly research reinforced the power imbalance of colonialism by seeking to separate cultural groups into binary categories of colonizer and colonized, Native and European, or other rigid classes. Post-colonial theorists emphasize the situational, dynamic, and hybridizing nature of colonial encounters (Ferris 2009; Gosden 2004; Liebmann and Rizvi 2008; Patterson 2008; Rizvi 2008). A de-colonized theoretical framework recognizes that as people of different backgrounds conduct sustained residential interaction with one another, ethnic boundaries become emphasized and can be used instrumentally and intentionally to facilitate situations of intercultural exchange (Hu 2013). New socially-recognized groups may form, in a process of ethnogenesis or cultural hybridity (Galloway 1998; Naum 2010; Weik 2014; Weisman 1989, 2007, 2012). Hybridized groups often develop in situations of colonial encounters, where power balances among two groups interacting with one another may not be equal (Card 2013a). Because colonial exchange often introduces novel material culture in the form of trade items (Gosden 2004:4), hybridized material culture is a strong material correlate of cultural hybridity.

Concepts of cultural hybridity, ethnogenesis, and ethnicity allow me to build inferences to understand the past behaviors of exchange and population movement that resulted from intercultural interaction, but in order to do this, I made several assumptions about the archaeological record and human behavior. In the next section, I lay out the basic assumptions I made in the course of this project, followed by expanded definitions of key concepts mapped in Figure 2.1, and an explanation of how I applied these ideas as a theoretical framework for my dissertation data set. With the framework established and concepts defined, I then present the research questions and related case studies that contextualize the study of exchange of non-local materials, especially personal adornments in colonial situations, and how such adornments may signify ethnicity or other aspects of identity. Finally, I draw on the developed frameworks and case studies to present expected outcomes of the research questions.

2.2 Primary assumptions underlying the research design

The archaeological assemblages included in my study resulted from unique human behavioral activities, primary and secondary depositional and discard processes, and later cultural and natural formation processes. Among the sites examined, different excavation procedures were used, affecting comparability of assemblages. For example, the smallest glass trade beads are no more than 1.5 mm in diameter; consequently, they rarely have been recovered on sites where archaeologists used standard ¼ in wire mesh screens but did not conduct flotation. The first assumption that I made in this research was that artifacts of the same material types from contemporary sites in the Upper Great Lakes are comparable with one another even if they were recovered with different methods because addressing larger-scale questions of regional interaction does not require detailed intra-site provenience information or universal recovery at all sites in the region. Studying both metal and glass materials allowed me to address different but related research questions and include historic-era archaeological sites that only produced glass beads or metal objects, expanding the number of data points in my regional site sample.

When materials such as copper-based metal objects and glass beads became available in North America through trade, Indigenous people adopted them for use as personal adornments and incorporated them into existing representational or ideological systems (Bradley and Childs 1991; Fox et al. 1995; Miller and Hamell 1986; Turgeon 2001a,b). Another fundamental assumption of my project is that patterns of difference in how adornments and other objects are produced can reflect distinct cultural groups and provide material evidence for ethnic identity during situations of cultural contact (Barth 1969; Bayman 2010; Emberling 1997; Lightfoot et al. 1998; Schortman and Urban 1998; Voss 2008). The expression of identity through personal adornment is performative (Voss 2008:409-411; White 2008:18-19). For this reason, archaeologists have been able to demonstrate that manipulating appearances could foster community solidarity through a shared unadorned style of dress that de-emphasized individual differences (Voss 2005: 466) or be used to confuse or mock an enemy, in the way that Seminole people wore European military uniforms as “trophy jackets” (Weisman 2007:205-206). Based on these examples, I assume that different groups of Native people of the Upper Great Lakes region used distinct technological practices to transform the meanings and sometimes the physical forms of European-made objects to suit their material and social needs. I selected adornments as the focus of this project because dress and adornment were used as tools to delineate ethnic affiliation through personal expression during other colonial situations (Loren 2009; Nassaney and Brandao 2009; Voss 2005). I assume that as in other colonial situations, in the Upper Great Lakes region, ethnic expression via personal adornment became an important social practice for negotiating trading partnerships and other relations among diverse Native ethnic groups as well as with Europeans. I also assume that socially-structured trading relationships, migration, and possibly ethnogenesis in the colonial situation of population movement and interaction among local and non-local Indigenous peoples as well as Europeans shaped the exchange of personal adornments like glass beads and affected the production of reworked ornaments made of both copper-base metal and glass.

In a preliminary study, I identified chemical differences among the compositions of visually similar glass beads from five archaeological sites in Wisconsin and I interpreted these as connected to temporal variation in European glass workshops, and not to varying depositional contexts at each site (Walder 2013b). Glass is a relatively stable material and taphonomic processes such as corrosion from archaeological contexts (e.g., contact with soil) generally only affect the surface of the glass (Melcher and Schreiner 2013), which is removed during the LA-ICP-MS chemical analysis. Therefore, I assume that compositional variations identified in glass recipes across sites in the Upper Great Lakes are not a product of taphonomic processes, but rather of differing production processes among as yet unidentified European workshops.

Variation in glass bead recipes used in European workshops would mean that different European trading partners introduced chemically-distinct batches of beads into North American trade networks, and beads would have arrived in the Upper Great Lakes via direct or down-the-line exchange or through migration of people along waterways, described as "highways" of the fur trade (Burpee 1914; Dalton 2011:140; Sleeper-Smith 2009:xxxiii), although overland trails were also widely used in the late prehistoric and early historic periods (Mason 1994:10; Whittaker 2015). Based on these assumptions, patterns of recipe variation in glass beads from contemporary archaeological sites along the same waterways may reflect the socially-structured trade routes through which glass beads entered the Upper Great Lakes region, but it is not possible to distinguish among mechanisms of movement. To link compositional patterns to historically documented ethnic groups, I assumed that if group social networks defined and structured the political economy of this time, glass trade bead distribution patterns would reflect social relationships among contemporaneously occupied locations in this region.

Additional assumptions are fundamental to the study of the reworked copper-based metal artifacts, particularly those used as personal adornments. I assumed that variation in physical attributes of reworked copper-based metal artifacts reflects distinct technological styles of producing ornaments. As defined previously, technological style reflects differences in the complete system of an artifact's life history, including production process, or *chaîne opératoire,* which might be connected to a unique cultural group. However, the material circumstances of this cultural group (e.g., a self-identifying ethnic group such as the Meskwaki or Potawatomi) would have been contingent on quantity and type of trade items available to them during the entire period of site occupation. Therefore, patterns of variation in the reworking of copper-based metal trade items likely represent trade-item availability as well as the potential influences of cultural preference; it does not seem possible to distinguish these two factors. I argue instead that technological style of finished personal adornments in the copper-based metal assemblages examined in this research project represents both resource availability and some aspects of the culture of the maker or user, including ethnicity as well as other aspects of identity.

Equifinality is an important consideration in the discussion of my theoretical framework because despite the assumptions laid out above, it is not always possible to differentiate between the use of material culture to signify cultural affiliation and the influence of resource availability. For example, in a case-study of El Presidio de San Francisco, Voss noted that some material differences that distinguish the militant, colonial *Californios* and the peoples living outside of the Presidio's fortifications may result from "consumer choice." However, she warned that it is not possible to separate consumer choice from variations in economic supply to the region, which would be possible only with more detailed documentary records for shipping and receiving than are available for this period (Voss 2005:446). To mitigate for this possible situation of differential access to materials masking outcomes of consumer choice, Voss focused on widely-available categories such as ceramics or wild game, and the use of local building materials such as adobe. For this reason, Voss's case study provides a good parallel with the Upper Great Lakes region where European-made materials may have differed widely in availability to Native Americans. Instead of working to separate consumer choice from supply, I strove to investigate how cultural affiliation affected or influenced the introduction or delivery of goods (e.g., glass beads). Trade item availability would have structured how Indigenous people used and deconstructed European materials; for example, if no copper-base metal objects were available, or if this material was present in limited quantities, it would constrain the options for how the material could be used and influence how people modified trade items to create meaningful hybrid adornments such as metal beads and glass pendants. This relationship is examined by using the analytical framework of *chaîne opératoire* to identify differences in the technological style of reworked objects in contexts that probably differed in resource availability, which may itself be socially-structured.

The lens of the post-colonial critique is useful even if equifinality prevents a clear delineation of specific factors involved in the distribution of trade items. Framing exchange as a social relationship and ethnic affiliation as emphasized and instrumental allow rethinking of how regional interaction in the Upper Great Lakes region might have happened. By drawing on post-colonial concepts of hybridity and using a "de-colonized" approach, I broaden the scope of this dissertation to examine outcomes of intercultural interaction that may not otherwise be apparent, such as the formation of multi-ethnic villages, or cultural affiliation shaping the routes of trade.

2.3 Expanded definitions and contextualization of theoretical and analytical frameworks

This section defines and contextualizes the theoretical concepts that frame this dissertation research, beginning with how the fundamental anthropological research topic of intercultural interaction has been addressed in the recent scholarly critique of scholarship on colonial encounters, which led me to incorporate post-colonial concepts of hybridity and decolonization in my research design. I present expanded definitions of related theoretical concepts including identity, ethnicity, ethnogenesis, and multi-ethnicity. Lastly, I describe how research questions regarding ethnic and cultural affiliations can be addressed archaeologically using the analytical framework of *chaîne opératoire* to assess technological style.

2.3.1 Culture contact, acculturation, and colonialism

"Contact" has a complex history in archaeological discussions, and at its most basic level, "contact" denotes a brief initial encounter unlikely to lead to cultural change. Early twentieth century models proposed that sustained contact between groups of would lead to cultural change of one group to become more like the other, but this "acculturation" was not defined as unidirectional cultural oppression, but rather used it as a general descriptor of cultural change as a result of sustained interaction (Cusick 1998a; Redfield et al. 1935). However, subsequent investigations of "contact" and "acculturation" considered the adoption of trade items as a strictly material, economic decision based on the technological "superiority" of European-made materials, such as axes, metal cooking pots, and firearms, over Native-made stone tools and ceramics (e.g., Quimby 1966; Fitting 1976b; Feest 1980). Such use of these terms reinforces stereotypes of Native peoples as passive receptors of superior European materials, rather than as active agents, and glosses over the unbalanced power dynamics, violence, and severity of encounters between Native Americans and European groups (Ferris 2009:9-17; Silliman 2005).

Recent research demonstrates that exchange of manufactured items in other colonial contexts was often socially, not technologically, motivated (e.g. Ferris 2009; Gosden 2004; Silliman 2010). In this dissertation, I use the term "contact" sparingly, to recognize that in some cases in the region of study, "contact" describes initial and fleeting direct encounters among historically-known ethnic groups, without any implied power imbalance or technological superiority. I prefer the term "interaction" for its generally neutral connotations and apply this term frequently to discuss the relationships among groups in the study.

When the balance of power between groups in contact begins to shift in one direction or another, then "colonialism" may be the more appropriate term. In this case, I apply Gosden's flexible and material-culture focused definition of colonialism: "a particular grip that material culture gets on the bodies and minds of people, moving them across space and attaching them to new values" (2004:3). This definition emphasizes material culture and integrates two of the hallmarks of colonial encounters, the movement of people and the re-structuring of material values based on new experiences of other cultures. Archaeological sites examined in the course of this dissertation research fall across a spectrum of contact, interaction, and colonialism and provide the opportunity to understand the variability in these processes at the regional level.

I avoid using the term "culture contact" when the situation actually represents emergent "colonialism," recognizing these concepts describe spectrum of interaction rather than two distinct situations (Silliman 2005) and accepting the premise that intercultural contact generally occurs among all human groups (Ferris 2009:25). Although Ferris chose to eliminate the term "contact" altogether in his discussion of Indigenous peoples of the eastern Great Lakes in favor of recognizing "changing continuities" that result from interaction prior to the true "colonial" era of the eighteenth century (2009:168), I maintain that the term "contact" is useful for describing some of the very earliest interactions in the Upper Great Lakes, keeping in mind that this contact did not necessarily lead to immediate acculturation or culture change, and that "colonialism" (in a "middle ground form," after Gosden 2004, White 1991) better describes most of the situations in my study sample.

Richard White's critique (1991) of how anthropologists applied the acculturation paradigm in the Upper Great Lakes (e.g., Fitting 1976b; Linton 1940; Quimby 1966) also influenced my decision to frame the present study as a series of colonial encounters. In his influential text *The Middle Ground*, a historical case study of the French 'upper country,' the *pays d'en haut*, White demonstrated that a key prerequisite for acculturation, "continuous first-hand contact," (Linton 1940:463) did not occur. He established that the initial period of European "contacts" was a historically-contingent "Middle Ground" of population movement, interaction, and accommodation unlike other regions of the continent (1991:50-94). Perhaps as a consequence of this complexity, no archaeological research program addressing large-scale colonial interaction and the multiple facets of contact and colonialism from various theoretical perspectives is currently active in the Upper Great Lakes, aside from French colonial studies at individual sites (e.g., Carlson 2012; Nassaney et al. 2009; Nassaney 2012). However, Silliman recognized that colonial-era Great Lakes as groups such as the "Chippewa" actively resisted capitalist economies through the balanced power structure of their trading relationships, in a form of "middle ground colonialism" (2005:66 citing Cleland 1992, 1993; c.f. Gosden 2004: 82-113).

Discussions of both colonialism and cultural contact often distinguish among different processes and outcomes along a spectrum of interaction, based on power dynamics, material values and exchange, and intensity of interactions (e.g. Alexander 1998; Gosden 2004; Paterson

2011; Stein 2005; Webster 1997). As circumstances change, new descriptors of the situation are required. For example, White argued that by the early nineteenth century, the balance of the middle ground in the *pays d'en haut* was gone, lost to what Gosden called "*terra nullis*" or no-man's-land forms of colonial encounters. In such situations, Western conceptions of land-ownership and agriculture as the only way to demonstrate improvement or dominion over territory take precedence over other, less-intensive traditions of land-use, such as seasonal mobility or shared territories (Gosden 2004: 114-152). In contrast, Ferris convincingly demonstrated that long-term continuities in subsistence practices and settlement patterns of Southwestern Ontario counteracted increasing European populations and land-clearing activities well into the nineteenth and twentieth (2009). The presence of European-made material culture in "colonial spaces" need not represent discontinuity of Indigenous practices (Ferris 2009; Silliman 2010) and Witgen's reexamination of the historical record shows how the Anishinaabeg, among other Great Lakes peoples, maintained power in this region well into the nineteenth century, by retaining territorial sovereignty in practice if not on paper much later than White had originally suggested (Witgen 2012). Because the focus of my study centers on the turn of the eighteenth century, full-scale *terra nullius* colonialism is simply not taking place on the archaeological sites in question. The balance of power and material exchange persist through this period of contact, interaction, and accommodation, and it is up to archaeologists to interpret the material remains of this middle ground using a framework appropriate to the historically-documented constructions of ethnicity and self-identification operating on the past landscape.

2.3.2 Post-colonial theories: decolonization and hybridity

The post-colonial critique that took place throughout the social sciences in the 1980s and 1990s identified and attempted to correct for Western-biases and the often elitist nature of scholarly discourse, particularly in discussions of the non-Western "Other." Scholars recognized they were reproducing the power imbalances of colonialism in their own work (Liebmann 2008, 2013; Liebmann and Rizvi 2008; Patterson 2008; Said 1979 [2014]; Silliman 2013:491-492; Webster 1997). Anthropologists and archaeologists working under the post-colonial paradigm seek to understand why and how groups experiencing colonial encounters adopt non-local materials, without resorting to one-sided acculturation-based or strictly functionalist interpretive frameworks. Technologically-driven studies of material culture conducted with attention to this post-colonial critique have investigated how groups adapted and modified foreign materials using both known and innovative production processes to fit with existing and newly-developed ideological systems (Deagan 2004; Ehrhardt 2013; Panich 2014). Archaeologists have specifically applied one aspect of post-colonial theory, the concept of hybridity, to emphasize the new cultural productions that result from the formation of multi-ethnic communities and processes of ethnogenesis or creolization (Beaudoin 2013; Deagan 1996; Fahlander 2007; Lightfoot et al. 1998; Tronchetti and van Dommelen 2005; Voss 2005), but archaeological investigation of these topics in the Upper Great Lakes has been fairly limited (but see Nassaney 2012).This dissertation is an effort to "decolonize" the study of ethnicity in the Upper Great Lakes region through the study of the acquisition, adoption, and modification of trade items.

Decolonized approaches to the archaeology of interaction recognize that writing about the colonizers and the colonized or "Native" versus "European" encounters oversimplifies historically contingent situations of intercultural interaction and reproduces the inherent power differential and struggles of marginalized groups in the modern world (Baram and Hughes 2012; Deagan 2013:262; Scheiber and Mitchell 2010; Silliman 2005). Cautious of distorting the reality of situations for the sake of political correctness or decolonization, Deagan has recently argued that archaeologists should seek to understand local interactions, which sometimes likely *did* take place under the broader dichotomous constructions that theorists seek to dismantle (2013:263). In light of recent thoughtful discussion of how to address the problem of dichotomies, to contextualize my application of hybridity and multi-ethnicity, I synthesize case studies from outside the Great Lakes region that highlight the successful application of a decolonized approach to delineating the instrumental and sometimes situational nature of ethnicity and cultural hybridity occurring in a colonial situation. These case studies both work within these dichotomies and point out situations where they are inappropriate, which illustrates how a similar approach informs my regional investigation of sites in the Upper Great Lakes.

Hybridity is a key term from the post-colonial literature, stemming from Homi Bhabha's original use of it to critique and describe literature of the South Asian diaspora (Bhabha 1994). Bhabha developed the concept of hybridity as an active process of identity formation, rather than an outcome of colonialism. In this dissertation, I use the term hybridity to refer to the process of establishing new material and social amalgamations out of existing forms. A recent volume on the topic (Card 2013a) defines hybrid material culture as "the production of material objects incorporating elements of multiple existing stylistic or technological traditions" (Card 2013b:1). This definition refers only to objects, but Card's volume as a whole attests that individual identities and communities can also be described as "hybridized" (e.g. Ehrhardt 2013). The definition of hybridity may be simplified to the "accommodation of difference" among individuals and communities (Silliman 2013:488), but the concept of hybrity as a theoretical framework may work best when applied as a descriptor of practices and processes, rather than materials or people (Silliman 2015; Liebmann 2015). "Hybrid" material culture does not necessitate the development of hybridized cultural identities (Deagan 2013). The process of hybridity is related to multi-ethnicity and ethnogenesis because a new community of social practice develops from intercultural interaction or entanglement (Liebmann 2008). Liebmann has recently narrowed his definition, suggesting that perhaps hybridity may occur only during extreme power imbalances, when the creation of such newness is "forced" (2013, 2015). This is not yet a widely accepted criterion for hybridity, and hybrid forms can develop without power asymmetry (Deagan 2013: 263) and may be a normal and frequent occurrence both during colonial processes and in general as people form identities through daily interactions (Beaudoin 2013). Balanced "middle ground" situations of colonial interaction (after Gosden 2004) can foster practices leading to the development of material and cultural hybridity: in the Upper Great Lakes, individuals of European, Native, or Métis mixed biological ancestry might have employed situational shifts or emphases of particular ethnic identities through hybrid material culture such as tinkling cones or a re-fired glass pendant in order to foster trading relationships or demonstrate affiliation with a particular group on a daily basis.

2.3.3 Identity and ethnicity

Culture contact, interaction, and colonialism all involve relations among two or more groups or peoples of different cultural or ethnic affiliations; ethnogenesis is a common result of such interactions (Weik 2014: 292). As it relates to the narrower study of ethnicity, I apply the term "identity" to refer to "self-understanding and social location," (Brubaker and Cooper 2000:17-20), since categories of "self-identification" as part of a group relate directly to ethnic identities, which are constructed with reference to the self. While Brubaker and Cooper highlight the necessity of clarifying the many meanings of "identity," they pointed to its individual and collective meanings in the construction of ethnicity. The communal experience of shared participation in a group is a critical aspect of the formation of ethnic identity (Barth 1969;

Emberling 1997; Jones 1997). Meskell and Preucel (2004) suggested that community-level studies of ethnicity might be productive for investigating both personal and collective identities, which is a useful approach for the present project because the assemblages in the regional analysis can offer site-level information about "groupness" or collective identity, particularly ethnicity. Since both individual and group activities would have taken place at each archaeological site in the study sample, I will use the terms "ethnicity" and "ethnic identity" interchangeably, keeping in mind that individual self-identification as a group member is a key aspect of ethnicity.

Ethnicity is defined as self-selected, sometimes situational or dynamic membership in a social group often but not exclusively based on shared ancestry and cultural practices (following Emberling 1997). Ethnic group identification is closely tied to individual identity and self-representation, and leaves little intact material evidence, which makes understanding the archaeological signature of "ethnicity" challenging (Barth 1969; Emberling 1997; Jones 1997). Archaeological interpretations of ethnic identity also can be difficult because ethno-archaeological research has demonstrated that several ethnic groups may share common styles or forms of material culture, some of which may be produced by ethnically diverse artisans (Kenoyer et al. 1991: 56). Brubaker has argued that "ethnic groups" is a conceptually messy term that attempts to delineate groups that are neither substantial nor fixed (2002:168). However, at times of threat or challenge to the identity of a group, the outward portrayal of ethnicity, commonly signaled through physical appearance, often becomes increasingly important (Comaroff 1987). Therefore, archaeologists can examine the production of distinctive ornamentations as a possible material outcome of the desire of a group to distinguish themselves from others in situations of intercultural interaction. Initial instances of European contact generally do not entail immediate full-scale capitalist domination of a Native group because such exchanges were intermittent and bidirectional (Deagan 1996; Sahlins 1988; Wesson 2010; Wolf 1982). However, even at a sporadic level of interaction, industrialized groups (i.e., the French in the Upper Great Lakes) may have wielded power over material production, while consumers of the products of that group may have emphasized their own (Indigenous) ethnic identity as a way to organize their society in the face of colonial authority (Barth 1969:33). For this reason, I argue that understanding ethnicity may be possible at the site-level of archaeological investigation.

Archaeologists have attempted to link modern Indigenous peoples, particularly the Menominee and the Ho-Chunk (Winnebago), to the archaeologically-documented Oneota tribes or ethnic groups who populated the Upper Great Lakes region immediately prior to and indeed, after, European contact (e.g. Hall 1993, 1997; Hickerson 1974; R. J. Mason 1997; McKern 1939; Overstreet 2009; Richards 2003). Some investigations of ethnicity in the Upper Great Lakes region during the seventeenth and eighteenth centuries have focused the criteria necessary to connect historically documented Native American tribes or ethnic groups to particular archaeological sites, termed “site-unit ethnicity” (R. J. Mason 1976:351). Mason’s criteria for identifying site-unit ethnicity include: 1) a single-component archaeological site with a known date determined from historical documents; 2) appropriate Native-made and/or European-made artifacts; 3) a named group of people clearly mentioned in historical records as living at the particular site; and 4) no disagreement among the above lines of evidence (R. J. Mason 1976). In 1976, only two sites in Wisconsin, the Rock Island and Bell sites, met these criteria, and today no other early historic sites in Wisconsin meet all four of these requirements, with the possible exception of the Marina site on Madeline Island (Birmingham and Salzer 1984). Overstreet has argued for a less stringent “territorial ethnicity” applied to sites in historically known regions of occupation, focusing his attention on the areas of eastern Wisconsin generally attributed to the Menominee people (R. Mason 1976:351; Overstreet 2009; 2014).

"Site-unit" ethnicity and "territorial ethnicity" are useful concepts for considering the formation, movement, and interaction of ethnic groups during the historic era, but they do not fully account for the possibilities of multi-ethnic communities or ethnogenesis so often recorded in contexts of colonial encounters in other regions (e.g. Baram and Hughes 2012; Haley and Wilcoxon 2005), or the potential for situational construction of ethnicity (e.g. Voss 2005). Mason argued this point, noting that "the complexity and scale of social and cultural transformations in the Upper Great Lakes in the historical period militate against *simplistic* one-to-one correlations of particular artifacts or assemblages and specific ethnic identification wherever those artifacts or assemblages occur" (R. Mason 1976:360-361). In this dissertation, I have chosen to apply the language and concepts of post-colonial theory, particularly hybridity, to account for the long-recognized complexities of this situation and reduce reliance on "simplistic one-to-one correlations" between artifacts and peoples. By recontextualizing earlier discussions of ethnicity in the Upper Great Lakes with this theoretical framework, I approach regional interaction with a perspective that can account for multi-ethnicity and cultural hybridity, even if equifinality of the archaeological record prevents differentiation of related factors that influenced archaeological assemblages, including ethnicity, resource availability, and means of exchange.

2.3.4 Multi-ethnic communities and ethnogenesis

Multi-ethnicity differs from ethnogenesis or hybridity, because a uniquely new ethnic identity is not necessarily developing; rather, several ethnic groups form a single, cohesive community out of necessity, shared self-interest, or other motivations. When diverse groups of people come together to form "multi-ethnic" communities, some social boundaries may be maintained while others are ignored in order to form more cohesive social units (Liebmann 2013; Lightfoot et al. 1998; Nassaney 2012). Mason (1986) described archaeological evidence for the occupation of the Rock Island site from 1650-1651 as a Huron-Petun-Odawa village, which may be multi-ethnic community. Although not explicitly defined in the terms of post-colonial studies, the shared refugee-status of these Iroquoian groups would have been a situation necessitating the instrumentalist development of a multi-ethnic community. Nassaney describes the Fort St. Joseph locale as “multi-ethnic” because Native individuals, French colonists, and Métis all maintained individual aspects of their original culture while at the same time participating in cultural hybridization (2012). Lightfoot and co-authors theorized a similar conservation of individual ethnicity at the household level in their discussion of multiethnic or “pluralistic social settings” composed of Native Californian women and Native Alaskan men within the colonial Fort Ross community (Lightfoot et al. 1998). All of these scholars focus on the maintenance of pre-existing culturally-significant practices such as architecture and foodways, rather than investigating development of a new or blended ethnic community through the process of ethnogenesis, another possible outcome of colonial interaction.

Ethnogenesis is defined as the formation of a distinct ethnic group as a result of shared interactions among formerly non-affiliated communities, and it is a hallmark of colonial encounters when boundaries between social groups become more pronounced (Emberling 1997; Weik 2014:296-297). Cross-culturally, studies of ethnogenesis tend to focus on the active agency of individuals and groups using ethnicity to manipulate trading relationships, gain and maintain social and political power, and foster stronger ties among disparate communities (Barth 1969; Bawden 2005; Bayman 2009; Buzon 2006; Haley and Wilcoxon 2005; Hickerson 1963; Levy and Holl 2002; Mann 2008; Stojanowski 2005). Such goals would likely have been similar for peoples of the Upper Great Lakes region, demonstrating a need to conceptualize colonial encounters in this region as almost certainly resulting in ethnogenesis in some form or another.

Some investigations of ethnicity and ethnogenesis in the Upper Great Lakes region have focused on the transformative role of trade items on ritual practice. Hickerson argued that the Ojibwe Feast of the Dead and Midewiwin ceremonies were responses to new trade goods and the new social role of trade middleman in the 1700s (Hickerson 1960, 1963, 1988). More recent scholarship has challenged this conventional interpretation as Eurocentric, tracing the Midewiwin back to prehistoric rituals and attributing the practice as to cultural stability and adaptation in the face of contact and material change (Angel 2002; Howey 2011; Howey and O'Shea 2006; Weeks 2009). Hu's quadripartite scheme for visualizing the range of theoretical perspectives and possible motivations for ethnogenesis, from primordialist to instrumentalist, and isolationist to interactionist allows comparisons of instances of ethnogenesis cross-culturally, definitions of situations leading to ethnogenesis, and explanations of strategies that individuals and communities used to deploy ethnicity as a tool in colonial situations (Hu 2013). In the Upper Great Lakes, since people actively used ethnic affiliation to facilitate trading relationships, I argue that motivations for ethnogenesis, if present, were interactionist and instrumentalist.

2.3.5 Technological style, chaine opératoire, and trade

In this dissertation, I am investigating the arrival of novel material culture forms and the effects of intercultural interaction on material practices. To effectively build inferences about ethnicity from archaeological record, it is necessary to understand how technology and social constructions, such as ethnicity, are related. The choices that a craftsperson makes are always constrained by material properties, but technological style refers to choices made *within* material constraints that do not affect the functional outcome of the finished product. I investigate materials acquisition and production processes through the analytical framework of *chaîne opératoire* (Lemonnier 1986, after Cresswell 1976; Leroi-Gourhan 1943; 1945) because the analysis of technological style does not focus only on finished products, but rather the whole "technological system" of materials acquisition, modification, use, and discard, as embedded in social practices (Lemmonier 1986:154-156). My analysis applied the theory of technological style, following methods developed by Lechtman (1977) and applied by Ehrhardt (2005) and Anselmi (2004). I used Ehrhardt's methods as a research framework and conceptual model for the investigation of technological styles that different groups of people employed to produce new objects from the "raw materials" of European-made metal and glass. Identifying and comparing technological style cross-culturally can link material practices to particular social groups (Lechtman 1977).

I frame my discussion of ethnicity as an assessment of technological style differences among contemporary assemblages of materials used to produce personal adornments. Ornaments are the focus of this discussion because they could have been used in the construction or performance of identity in historically-documented ethnic groups or more broadly shared across an archaeologically-visible culture, which might incorporate multiple ethnic groups. In her work in the Midwest, Ehrhardt defined technological style as "the dynamics of particular technological systems as they are elucidated for individual culture groups" (Ehrhardt 2005:12, after Lechtman 1977). Lechtman applied this method to understand prehistoric metallurgy in Peru (1984), while Ehrhardt examined protohistoric Illinois (Iliniwek) tribes and prehistoric metalworking in the Midwest (Ehrhardt 2004, 2005, 2010; 2013; Ehrhardt et al. 2000). Technological style builds on the generally accepted opinion that "style is a way of doing" (Hegmon 1992:518) by applying this principle to production processes rather than finished objects.

Within any technological process, from flintknapping to iron smelting, there are certain material constraints that limit the options of the craftsperson: smooth, finely-grained stone will break predictably; the melting point of metals is consistent and must be reached for smelting to occur. However, within these constraints, there is room for variation among individual crafters or communities of technological practice, for example, choosing to twist twine in an-S-twist versus a Z-twist. This is an example of an “isochrestic” style, which may be “socially transmitted through formal or informal learning processes, and so can reflect historical traditions and social relations” (Miller 2007:192). In the same way, Bayman has investigated individual adoptions of unfamiliar technologies during colonial interaction in Hawaii, and suggested that “Technology and social identity are directly linked, and archaeologists and other scholars must explore the connections between them more deeply to advance studies of contact and colonialism” (2010:131). The link between technology and ethnic identity is difficult to establish but remains a fundamental part of the theoretical framework of this dissertation because it enables the investigation of intangible aspects of human culture, such as ethnicity, through material data sets widely available to archaeologists: finished ornament forms and production waste. As I discuss in the presentation of the research questions, patterns of difference in technological style are tested against existing historical interpretations of ethnic affiliation.

Trade and technological practices throughout a *chaîne opératoire* are interrelated because the availability of resources obtained through trade would necessarily determine what modifications or technological processes might be applied to particular items. For the purposes of my dissertation, trade is defined as the exchange of items between two or more individuals or groups of people. Archaeologically, the many possible motivations for trade, such as strengthening a relationship, obtaining necessary resources, or maintaining control over the flow of goods into a region, are difficult to identify and separate from one another. Dillian and White (2010) summarized two main anthropological approaches to the study of past economies, the formalist approach (e.g., Hodder 1982) and the substantivist approach (e.g. Sahlins 1972 [2006]; Mauss [1950] 2000). In the latter approach, "Exchange…is controlled by moral and social obligations" (Dillian and White 2010:6). Mauss presented convincing ethnographic evidence that no gift comes without reciprocal obligations, while Sahlins demonstrated that economic systems of non-capitalist societies incorporate reciprocity as a means of "banking" wealth. Jennings has argued that in prehistoric complex societies, long distance trade in rare, high-value items such as obsidian, precious metals, and socially significant or ritual objects constituted "ancient globalizations," where cultures were united by socially structured trading relationships (2011). For example, artifacts such as copper ritual objects and shell-tempered pottery, along with distinct architectural features and shared iconography reflect the globalized social network of Mississippian culture, which both drove and structured the exchange of goods and ideas (Jennings 2011: 77-98). Following these substantivist approaches, I maintain that the economic and social aspects of exchange are so deeply intermingled with one another that individual motivations are not discernable from archaeological evidence alone, but that trade networks are inherently social networks. Gosden also applied substantivist principles to colonial situations, noting that material exchange and reinterpretation of meanings through misunderstanding and cultural differences are central to colonial encounters (2004: 39-40).

2.4 Research Questions and theoretically-informed expectations

The following sections discuss each research question of this project within its theoretical context, followed by material expectations developed from reviews of other case-studies of colonial encounters. The presentation of the research questions and supporting case studies below is ordered hierarchically, from conceptually challenging research questions about ethnicity and hybridity in colonial contexts to the more concrete understandings of material and economic behaviors such as trade and exchange and chronology. This ordering inverts Christopher Hawkes' so-called "ladder of inference" (Hawkes 1954:161-162; Trigger 2006:306), which posited that building inferences about human behaviors related to the actual formation of archaeological sites and functioning of technological systems and subsistence economies is considerably less difficult than delineating the social, political, and ideological institutions of a group. I address the higher order questions first because the social context of exchange in the colonial situation shapes the entire framework for answering the basic questions of chronology and economic resource availability on the lower "rungs" of Hawkes' ladder. In the process of investigating a dynamic issue like ethnicity, it was necessary first to develop a theoretical framework to delineate patterns of difference in objects related to the expression of cultural affiliation or ethnic identity, such as glass trade beads, refired glass pendants, and reworked copper-base metal. Then, material patterns could be linked to historical events of intercultural interaction, in order to make interpretations about how those interactions influenced economic factors, chronology, or exchange relationships among sites in the Upper Great Lakes.

2.4.1 Research Question 1: In the region of study, is there archaeological evidence for commonly recognized historically-documented outcomes of colonial interaction, such as multi-ethnicity, hybridity, and ethnogenesis?

This project examined broad spatial and temporal patterns of variation in the metal and glass beads from 38 sites in the Upper Great Lakes region. Scholars who have assessed the individual sites in this sample have proposed associations with specific historic tribes for many of these sites (e.g., Mason 1986; Behm 2008; Branstner 1991; 1992; Rohrbaugh et al. 1999). This is a necessary aspect of building archaeological inferences to interpret the results of excavations; however, this perspective homogenizes the composition of these individual communities and de-emphasizes the importance of regional connections and interaction networks. Research Question 1 uses a decolonized approach to re-frame discussions of Upper Great Lakes communities to better reflect commonly documented outcomes of colonial encounters through a focus on the specific material evidence of multiethnic and hybridized communities. Drawing on current theories of ethnicity in colonial situations, which posit that ethnic identity could be used instrumentally and that interaction often led to ethnogenesis or the formation of multiethnic communities, I suggest that some individual communities were not as homogeneous as previously described and that some archaeological sites may be interpreted as multi-ethnic amalgamations. Below, I synthesize archaeological case-examples of hybridized and multiethnic communities, and then I present specific material expectations related to the archaeological evidence and research questions for the Upper Great Lakes.

2.4.1.1 Discussion: Cultural hybridity and transforming binary models of colonial encounters

The present study examines colonial encounters in the Upper Great Lakes without the use of binary distinctions commonly applied to such situations in earlier literature (e.g. Fitting 1976b; Quimby 1966), including Native/ European (referring both to people and material culture); Colonizer/Colonized; Continuity/ Change, since these distinctions reinforce colonial power imbalances (Said 1979 [2014]; Silliman 2005). Archaeological models of hybridized identities seek to transform or "decolonize" the binary view of colonial encounters into more realistic depictions of the amalgamated communities that result from intercultural interactions in colonial situations (e.g. Bayman 2009; Beaudoin 2013; Card 2013a; Stojanowski 2005).

Some interactions resulted in cross-cultural intermarriage, which often helped bridge ethnic divides through the process of negotiating a "middle ground" in the creation of culturally-hybridized households (Church 2002; Deagan 1996; Sleeper-Smith 2001). Beaudoin (2013) applied the concept of cultural hybridity to a Métis community that emerged from interactions among Europeans and Inuits on the Labrador coast of North America. He argued that by focusing on descendant communities that today self-identify as hybridized, such as the Labrador Métis, archaeologists can better understand how narratives of ethnogenesis transcend the dichotomies of European-Native and colonizer-colonized. However, the Labrador Métis are not a simple equation of Inuit woman + European man = hybrid culture (Beaudoin 2013:13); rather, the Métis community actively negotiated a "gray area" in the ambiguous and permeable space between the two cultures interacting. Cross-cultural intermarriage as economic and cultural partnership was also common in the Great Lakes region (Sleeper-Smith 2001), and at the Fort St. Joseph site in Niles, Michigan, which has been described and contextualized through the lens of post-colonial theory (Nassaney 2008, 2012). Baptismal records show intermarriage between French and Native women, which would have resulted in biologically hybrid Métis individuals whose ethnic identities may have been situationally flexible and representative of the hybrid, multiethnic nature of the community (Nassaney 2008). Although breaking down dichotomies to assess hybrid cultural identity can be "messy," through careful consideration of archaeological data, such as hybrid material culture, one can better explain the actual diversity and complexity of intercultural interaction (Beaudoin 2013).

Hybrid identities do not result only from biological intermixing of cultural groups as a result of intermarriage (Voss 2008). Voss identified behavioral strategies of dress and adornment that individuals of Mesoamerican Indian and African ancestry used to transcend the Spanish *casta* system of racial categorization in order to form a cohesive new identity, the *Californio* (Voss 2005). Binary distinctions of Spanish "colonizer" and Native "colonized" do not apply to this dynamic and hybridized social landscape because of the historically-documented efforts to minimize cultural distinction among the Californios, who were "colonizers" of the Alta region of California, yet descendants of "colonized" peoples in other regions of the Americas. Likewise, Weisman (2007) explored the ethnogenesis of the Florida Seminole people, who drew on long-standing cultural traditions to promote a shared identity during a violent conflict, the Second Seminole War (1835–1842). At this time, the American government sought to remove Indian groups from Florida while at the same gaining control over persons of African descent who had escaped enslavement and taken refuge with Indigenous communities. Through ethnogenesis, these fugitive groups emerged as the Florida Seminole, encompassing multiple culturally and linguistically distinct communities within a shared, hybrid culture of resistance (Weisman 2007:199-200). To address the dynamic and situational nature of hybrid culture and multi-ethnic communities, ethnographic analogies to modern groups that self-identify as hybridized (Beaudoin 2013; Voss 2005; Weisman 2007) may help archaeologists develop explanatory models for the emergence of culturally-hybrid identities identifiable using material culture.

Several case studies of the process of cultural hybridization described material correlates in the archaeological record that help bridge the gap between the human experience of cultural hybridity that developed out of colonial encounters, and archaeological interpretation of material culture. Liebmann assessed the applicability of cultural hybridity and other recombinatory terms, such as syncretism and creolization, to a case study of seventeenth century Puebloan peoples in the American Southwest interacting with Spanish missionaries (2013). Two unique examples of material culture show a blending of ritual practices: a chalice used in Catholic Eucharist ceremonies and from a mission context but fabricated using local clays and decorated in traditional Jemez Black-on-White style, and a Puebloan *katchina* doll styled after colonial depictions of the Virgin Mary from a habitation context associated with Indigenous refugee groups (Liebmann 2013). To describe these objects, Liebmann selected hybridity above other terms to because it emphasized the process of recombining of distinctive religious rituals and symbology to produce new forms of material culture resulting from the blending of Puebloan and Catholic practices (after Bhabha 1994:110; Liebmann 2013). Voss and Beaudoin conducted broader examinations of material hybridity in architecture, foodways, ceramic technology, and personal adornments (Beaudoin 2013; Voss 2008). For example, Beaudoin argued that hour-glass-shaped mend-holes drilled from both sides to repair a chipped ceramic vessel of European origin reflect the long-standing Inuit technological practice of repairing soapstone vessels (Beaudoin 2013) and highlighted the integration of ethnic and gender identity, noting how "female" space of households reflected Inuit foodways and activities of Inuit wives while house forms and external features such as saw pits embodied European "male" practices.

Weisman's "Stress Model" of ethnogenesis described conflict as a catalyst for the active development of a hybrid Seminole identity through a "nativistic movement" of revival evidenced in material culture (2007); he argued that Seminoles deliberately eschewed European-produced vessels in favor of Native-made ceramics. Despite the conflict, availability of European-made vessels did not diminish at this time, and such objects would have been readily available on the black market, if not from European traders themselves (Weisman 2007:204-205). Further archaeological finds of military buttons in Seminole habitation contexts correlate with historical documents that described how Seminoles often wore the uniforms of captured American military personnel into battle, to both confuse the enemy and to demonstrate the successes of their conquests. According to Weisman, the use of these "trophy jackets" mimicked earlier forms of trophy-taking, including scalping and ritual capture of other body parts or whole heads, which were common practices in the pre-contact societies of the Southeast. Using these lines of material evidence, Weisman demonstrated that ethnogenesis resulting from the outside stresses of colonial conflicts produced hybridized a hybrid Seminole identity that drew on existing social and material practices to demonstrate resistance. Although the colonial practices of removal and officially declared warfare were not as pronounced in the seventeenth and eighteenth century Great Lakes region, I argue that the stresses of colonial encounters, albeit not as violent, could have produced parallel forms of ethnicity-as-resistance in personal adornment.

Studies of adornment and foodways at French colonial sites in the Upper Great Lakes also attest to processes of cultural hybridity at these sites expressed in hybrid objects. Based on archaeological and documentary evidence (e.g. Giordano 2005; Malischke 2009; Nassaney and Brandao 2009), Nassaney and his co-authors and students argue that Fort St. Joseph had many elements of a thriving multi-ethnic community, such as the use of utilitarian, locally-made ceramics, production of personal adornments such as tinkling cones, and consumption of local game animals in a "community of French and Indians in which kin relations and political alliances transcended racial and ethnic categories" (Nassaney and Brandao 2009: 27). Faunal analyses indicate "culinary creolization" also occurred in some Fort Michilimackinac households, where wild game was preferred over European imports (Carlson 2012).

2.4.1.2 Material Expectations for Research Question 1: In the region of study, is there archaeological evidence for commonly recognized historically-documented outcomes of colonial interaction, such as multi-ethnicity, hybridity, and ethnogenesis?

To expand the focus of French colonial studies of hybridity and multi-ethnicity to other locations in the Upper Great Lakes, I investigated the personal adornments produced by reworking materials originating in Europe; these ornaments include re-fired glass pendants and copper-based metal artifacts, which are by definition examples of hybridized material culture (see Card 2013a; Ehrhardt 2013:371-372). Since unmodified glass beads were integrated into existing Indigenous ideological and symbol systems (Hamell 1987, 1992; Miller and Hamell 1986; Turgeon 2001b), these objects also may be considered “hybrid” and or can even represent Indigenous cultural identity, depending on their context of use (Silliman 2010). I assumed that glass beads on Upper Great Lakes sites could be representative of exchange and intercultural interaction in addition to hybrid cultural identity, but it would not be possible to distinguish these without further supporting evidence. Variations in the presence and absence of specific types of hybrid objects, such as tinkling-cones, refired glass pendants, or religious paraphernalia like a cut-brass cross-shaped pendant, also serve as evidence of distinct patterns of cultural hybridization among sites because different types of hybrid material culture could reflect the results of diverse intercultural interactions among different historically-documented ethnic groups across the region.

Site locations that were expected to yield additional evidence of hybridized cultural groups or multi-ethnic communities in the current project were historically-documented locales of interaction among particular Native groups and European communities, such as the Tionontate Huron and Jesuit missionaries at St. Ignace (Branstner 1992); French colonial sites like Fort St. Joseph and Fort Michilimackinac; and trading posts, such as the Marina site (Birmingham and Salzer 1984). If a site had sustained interactions among French and Native groups, it would be a potential locale for the formation of new ethnicities or hybridized identities, and I expected a distinct pattern of technological style in metals reworking. However, the stresses of migration as refugees could have led to cultural hybridity in multi-ethnic villages, like the c. 1650s Huron-Petun-Odawa (proto-Wyandot) habitation component of the Rock Island site, which produced a highly diverse ceramic assemblage and was historically-documented as a locale of refuge in the

Huron diaspora (Garrad 2014; Mason 1986). If a site was a multi-ethnic community, I expected to document several distinct technological styles of ornament production or metal-reworking practice. However, using archaeological evidence alone, it may not be possible to distinguish the occurrence or extent of cultural hybridity between Europeans and Native communities or multi-ethnic Native hybrid communities because the presence of European-made trade items does not indicate the presence of European people (Ferris 2009; Gosden 2004; Silliman 2010). In all forms of multi-ethnic communities, I expected to see hybridized material patterns and forms of material culture that integrate various signifiers of ethnic identity, such as multiple forms of adornments and utilitarian items made from metal artifacts, produced using various techniques and exhibiting differences in technological style. If a site was a more homogeneous community attributable to a single, predominant ethnic group, then I expected more standardized technological processes for producing personal adornment across the site.

2.4.2 *Research Question 2*: Do spatial and temporal patterns of variation in the chemical composition of glass beads and the reworking styles of metal objects correlate with present understandings of the locations of ethnic groups on the regional landscape?

This section explains how previous archaeological case studies, which identified patterns of difference in technological style in personal adornment and related their findings to ethnicity, influenced my expectations for identifying the presence and movement of ethnic groups on the Upper Great Lakes social landscape. To address Research Question 2 at a regional level, I compared patterns of variation in chemical compositions of glass beads produced in European workshops and reworked metal artifact technological styles to the existing interpretations of the affiliations of ethnic groups on social landscape. Metal and glass artifacts are complementary lines of evidence to address this research question because although both were used for personal adornments, they were worn and modified in different ways, and the presence of either item might relate to the level of access that a community had to trade items in general. Since availability of items like copper-based metal kettles to use as raw materials would shape the production processes and techniques applied in manipulating metals to produce new forms, trade item availability also probably influenced technological style of copper-based metal reworking. However, I since I have argued that ethnic affiliation may have influenced the accessibility of trade networks, resource availability, and traditions of technological practice in a community, both metal and glass adornments can provide different but related lines of evidence related to the expression of ethnicity during the colonial situation under investigation.

2.4.2.1 Discussion: Linking technology with ethnicity, adornment, and performance

To make the connection between the production and exchange of adornments and the ethnic affiliation of communities, I applied the analytical framework of *chaine opératoire* to trace the entire sequence of ornament production at sites in my study area. Since the methods used in Europe to produce trade items may have differed through time and across workshops, which would affect outcomes later in the *chaîne opératoire,* I included steps of production in both Europe and North America. Once glass beads and trade kettles or other copper-based metal objects entered North American trade networks, these objects were used, modified, reused, and discarded, with possibilities for exchange at most stages of this process. Schematic diagrams of the *chaine operatoire* for reworked metal adornments (Figure 2.2) and re-fired glass pendants (Figure 2.3) illustrate the sequences of these production processes. These schematics provide a foundation for discussing technological style as it relates to the performance of ethnic identity and cultural affiliation. They summarize existing understandings of production processes specific to glass beads, refired glass pendants, trade kettles, and tinkling cones (drawn from Ehrhardt 2005; Kidd and Kidd 1970; Miller 2007; Turgeon 1997; Ubelaker and Bass 1970).

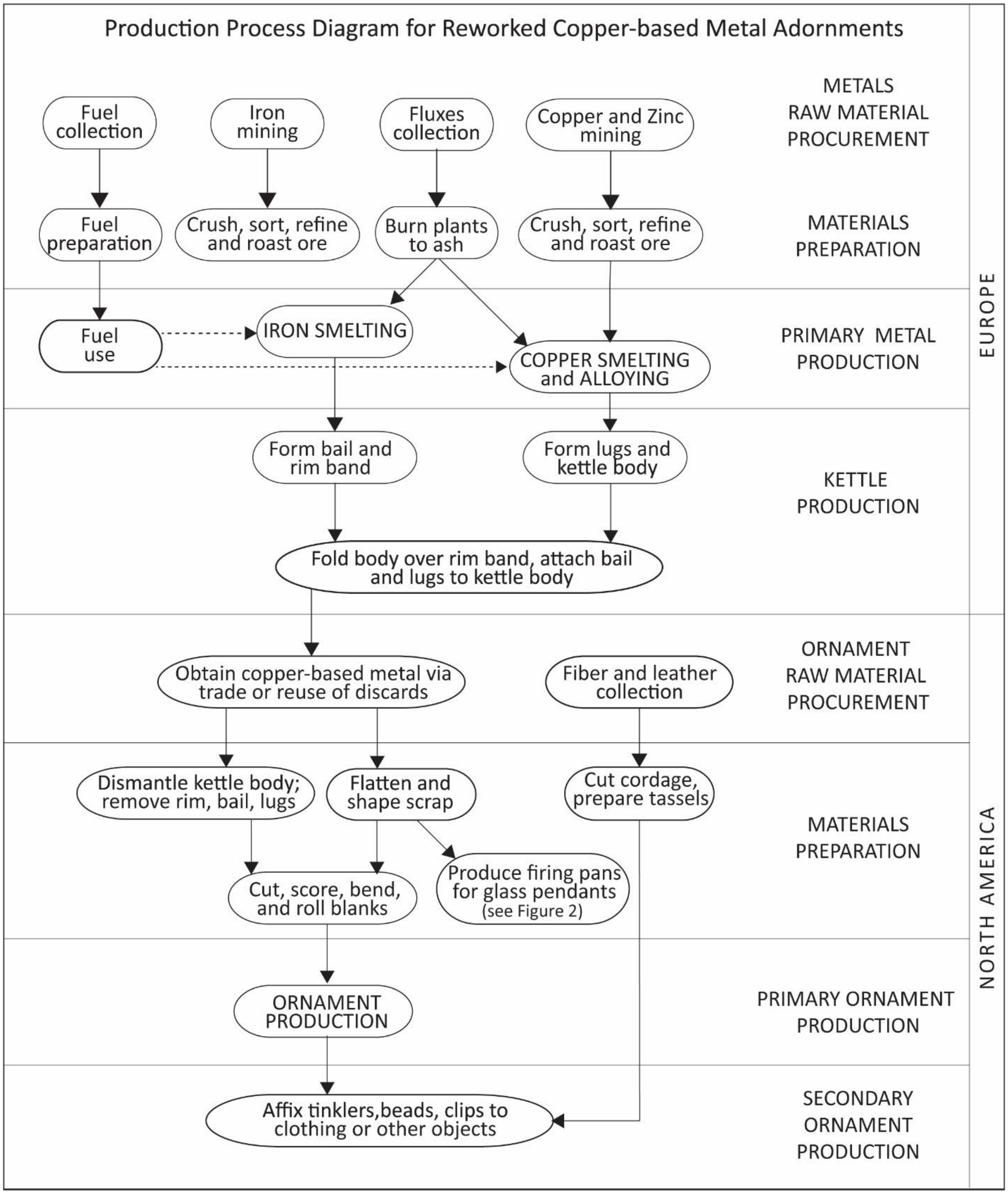


Figure 2.2 Metal ornament production process (After Miller 2007:144-146; Ehrhardt 2005; Turgeon 1997). Variations in technological style useful for interpretation of ethnic identity are most important in the North American stages of raw material procurement and materials preparation.

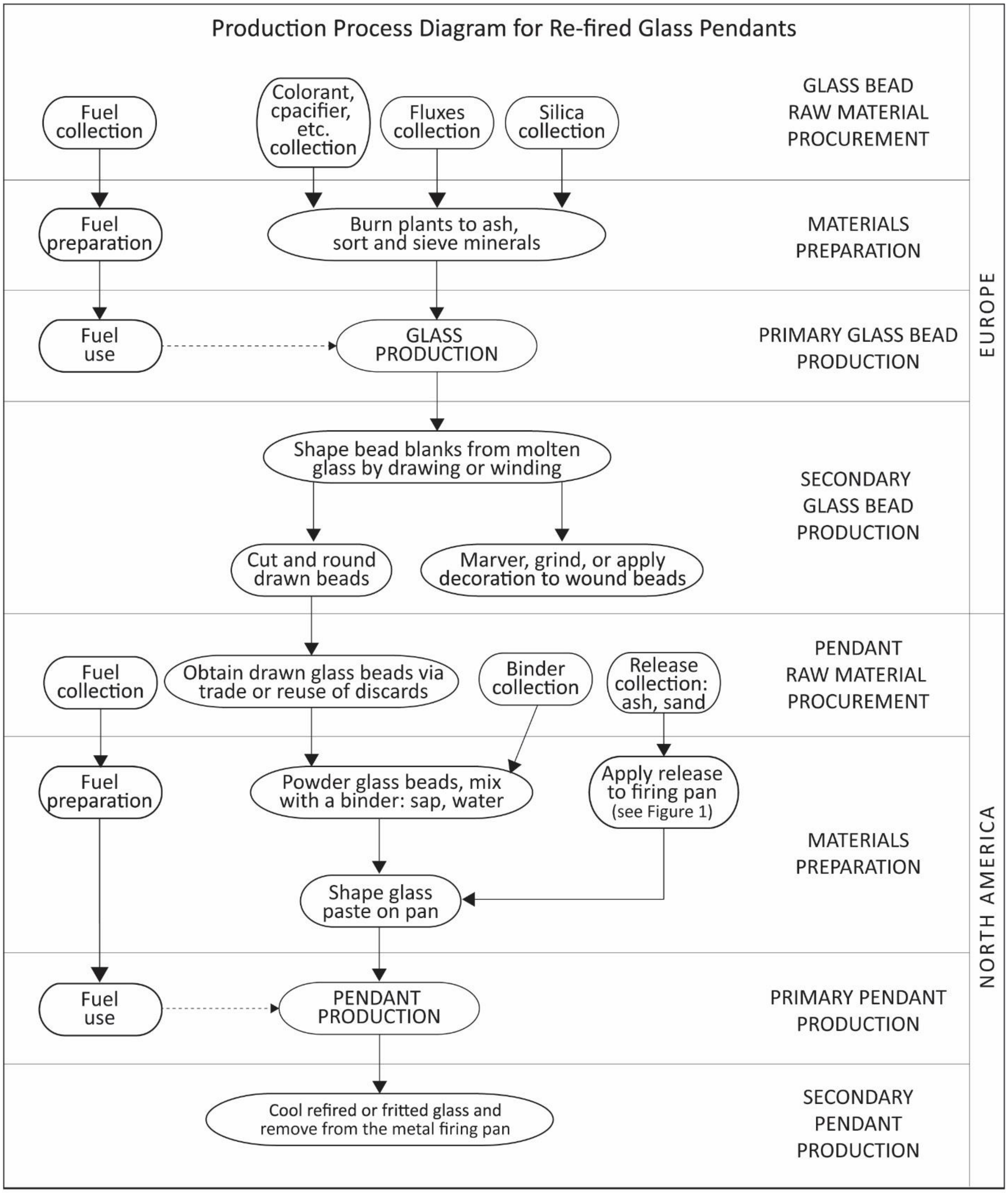


Figure 2.3 Production process diagram for glass pendants (After Miller 2007:131; Kidd and Kidd 1970; Ubelaker and Bass 1970). Variations in technological style in European raw materials procurement and preparation, as well as raw material selection and preparation in North America would affect the outcomes of compositional analyses of pendants, which would be used in interpretations related to the ethnic affiliation of producers of reworked glass pendants.

Throughout the production process, crafters make particular technological choices based on both material constraints and stylistic or aesthetic preferences during training or enculturation (Creese 2013; Ingold 2001: 24-25; Pfaffenberger 1992:507-508). Those variations are considered technological style, and can represent ethnic affiliation or participation in a shared technological tradition (Lechtman 1977; Ehrhardt 2005:1-35). In a colonial context, learned technological styles within a community may be more stable than other markers of shared identity because unconscious habits and routines related to daily practice, such as craft-working styles, might remain consistent (Bayman 2009; Lightfoot et al. 1998) while the outward performance of identity, which is "symbolically constituted, fluid, situational, malleable, and contested" (Nassaney 2008:314), could be "put on" as necessary by using adornments, language, and correct behavior in a given situation (e.g. White 2008). Crafting practices related to technological style would be less likely to shift situationally because of the material constraints of production processes (Lechtman 1977), making technological style a possible line of evidence for assessing ethnic affiliation (Bayman 2009).

High levels of interaction and population mobility can result in increased emphasis on material representations of identity, particularly ethnicity, and ethnogenesis may be most likely to occur at social boundaries or frontier regions (Bahrani 2006:57; Emberling 1997: 316-320; Hu 2013:389-391; Jones 1997; Naum 2010:126). In the Upper Great Lakes, interactions among Europeans and diverse local-and non-local Indigenous groups may have disproportionately emphasized social difference in material practices during the colonial period and fostered processes of "new cultural production" (Deloria 2006:17 discussing White 1991:52) or cultural hybridity. Ethnicity was especially important to the European traders, since they were in exchange or fictive kinship relationships with some Native groups while in conflict with others

(White 1991; Witgen 2012). These situations would require outward means of signifying ethnic affiliation, such as ornaments.

Archaeologists have examined ornaments in almost every imaginable context and interpreted them as markers for social status, age, gender, ideology, ethnic affiliation, and other important aspects of individuality (e.g., Bellina 2003; Ceci 1989; d'Errico et al. 2003; Donley-Reid 1990; Hammett and Sizemore 1989; Kenoyer 1992; Lankton 2007; Malischke 2009; Mann 1995; Nassaney 2008; Sciama 1998). In colonial-era North America, ornaments were desirable objects that people actively used to signify aspects of identity during intercultural exchanges (Silliman 2009:213; Turgeon 2004; White 2005; 2008), and both archaeologists and ethnohistorians have demonstrated that adornments such as glass beads, and the copper kettles from which ornaments were made, evoked long-standing meanings related to the power of materials or representations of the natural world, which predate European arrivals (Bradley 1987; Turgeon 1997; 2001b; 2004; Fox et al. 1995:288-289). Those meanings would have added value to ornaments made from repurposed trade items, or even to unmodified items such as glass beads (Panich 2014:742-743). My research examined the production and exchange of portable ornaments because adornments could have been useful as gifts and signifiers to foster trading relations such as fictive kinship (e.g., Thwaites 1890 [2000]:42), and because the materials for adornments or ornaments themselves were traded over long distances from Europe, which could have made them a novel and symbolically significant class of objects in the Upper Great Lakes region (c.f. Miller and Hamell 1986). Material uniqueness of ornaments could have afforded power and social status to individuals or groups who could produce or modify them in technologically sophisticated ways and to those that facilitated or controlled the exchange of raw materials and finished ornaments (Appadurai 1986:38; Dillian and White 2010; Helms 1993).

The widespread practice of Indigenous North American people "dismantling" European objects for use as personal adornments (e.g., Bradley 1987) represents an active engagement with the materials in an effort to assign new meaning to unfamiliar materials, or recognizable materials in new forms (Hamell 1983; Loren 2009; 2010). Because adornments are symbolic objects, and turning kettles into beads and glass beads into pendants took place for social purposes (Hamell 1983; Panich 2014; Turgeon 1997), understanding where and when glass beads were available (and sometimes modified) and how metal ornaments were produced can provide insight about social and ideological practices of expressing identity, along with trade item availability, population movement, and technological practices, which in turn may reflect the presence of archaeologically visible ethnic groups at the site-level of archaeological analysis. Studies of ornament style at Fort St. Joseph have provided insight into how hybrid material culture, in the form of ornaments, developed as a way to signify French and Indigenous aspects of identity in a multiethnic community (Nassaney 2008; Nassaney and Brandao 2009). I attempted to examine the construction of general ethnic identity as reflected by specific ornaments used in the performative aspects of dress and adornment (Joyce 2005:143; Keane 2005; Miller 2005) by examining the range of technological styles observable in the archaeological assemblages of ornaments and production waste at each site.

In colonial-era North America, shell, glass, metal, and other materials were often integrated into the same necklace or sewn onto the same garment (Loren 2010), but when adornments enter the archaeological record through loss or discard, the combination of diverse materials in the context of use may be lost. Since glass beads and tinkling cones or other metal ornaments are usually recovered individually, studies of re-worked copper-base metal personal adornments and glass trade beads have often been conducted separately by researchers specializing in archaeometallurgy (Ehrenreich 1991; Ehrhardt 2005; Lechtman 2014) or glass materials analyses (Dussubieux 2009; Hancock 2013; Shugar and O'Connor 2008). Investigating multiple material types has the potential to reveal multicrafting practices (see Ehrhardt 2013:386) that overlapped in glass and metal reworking, even if these examples were rare, like refired glass pendants. In the past, crafters may have been skilled at beadwork, metalworking, and production of glass pendants. Therefore, the technological system of creating personal adornments extended beyond individual materials and their arrivals via trade networks and requires holistic study to address the regional aspects of Research Question 2. Patterns of variation in both the glass bead and reworked metal data sets were expected to correspond to the same geographic distributions of known historic ethnic groups or archaeologically recognizable cultures.

2.4.2.2 Material Expectations for Research Question 2: Do spatial and temporal patterns of variation in the chemical composition of glass beads and the reworking styles of metal objects correlate with present understandings of the locations of ethnic groups on the regional landscape?

I developed two expectations about the relationship between adornment objects in the archaeological record and the existing ethnic attributions of archaeological sites: 1) patterns of variation in technological style of metal ornament production would vary according to the cultural affiliations of archaeological sites because technological style reflects the learned and shared practices within communities 2) glass beads with similar recipes would be found on sites with a shared ethnic affiliation because of the socially-structured nature of trading relationships. I expected that some patterns of variation in the glass and metal data sets would match existing attributions of ethnic identity based on documentary evidence and archaeological interpretations of ceramic typologies because a shared ethnic affiliation could lead to similar access to and reworking of trade items. For sites that excavators or previous researchers considered affiliated with only one predominant historically-known ethnic group, I expected a high degree of similarity in reworking styles and glass bead compositions because of the shared nature of technological practice within communities and because socially-structured trading relationships could have influenced access to trade items. Homogeneity of glass bead recipes among communities would indicate that they were obtaining beads from a single source, perhaps the only available trading partners in contact with that particular ethnic group or community.

The social outcomes of European contact, particularly socially-structured exchange, ethnic group (re)formation and population mobility could result in multiethnic communities, some of which might foster cultural hybridity. For multi-ethnic communities and locations of historically-documented sustained interaction among Europeans and various Native American groups, such as Fort St. Joseph, Fort Michilimackinac, and the Marina Site, I expected that the technological style of metal artifact manipulation and the compositional subgroups present in glass beads at these would be distinctive because of the degree of access that these communities had to European trade items, and the behavioral contexts of these sites as places where intercultural interaction likely occurred regularly as part of daily life. Cultural hybridity may have been a factor at those locations, leading to a distinctive technological style shared across French colonial contexts. For a multi-ethnic community composed of several distinct ethnic groups, such as the refugee community on Rock Island c. 1650, I expected that several different technological styles of working might be recognizable in the reworked metals assemblages. In the glass recipe analysis, the presence of diverse glass recipe patterns for beads of visually-identical styles at a single site might provide evidence of a multi-ethnic community, where community-members were interacting with multiple trading partners who were participating in different socially-structured trade networks because of opportunities afforded to individuals expressing a hybrid identity.

2.4.3 *Research Question 3*: In the Upper Great Lakes, when and where did non-local trade items arrive, and how did economic and social factors influence their distribution?

Patterns of variation in the glass and metal data sets were interpreted as related to chronology, the availability of European-made items, economic considerations, and networks of interaction by framing trade in the Upper Great Lakes as socially structured, not strictly based on achieving economic goals or meeting subsistence needs (after White 1991; Witgen 2012). Early Europeans arrived in the Upper Great Lakes on an intermittent basis and included *coureurs de bois*, who were enterprising but illicit French traders and explorers that traveled among Native trading partners, avoided obtaining permits, and left no records of their trade (Sleeper-Smith 2009: xxxiii; White 1991:58). Consequently, archaeology has the potential to expand our knowledge of early contact through the identification of European trade goods that entered the region through indirect trade networks and direct contact with both permitted traders and the *coureurs de bois* (Brown and Sasso 2001; Walthall and Emerson 1992). The investigation of chronologically sensitive artifacts like glass trade beads can refine the timing of when imported items entered the Upper Great Lakes during the seventeenth and eighteenth centuries. Clearer chronologies makes it possible to delineate patterns of difference linked to socially-structured trade networks by clarifying which sites received beads at the same time; in turn, improved understandings of possible trade relationships aide in assessing the influence of ethnic affiliation on exchange relationships by highlighting links among affiliated communities.

2.4.3.1 Discussion: chronology, timing of trade, and social connections

In places where there are minimal or no documentary records of exchange, archaeologists have developed other strategies, including chemical analysis methods, for understanding the timing and distribution of socially-significant artifacts (Dillian and White 2010: 8-9). Chemical characterization has helped to trace the exchange of personal adornments in South and Southeast

Asia (Carter 2011; Kenoyer 2008; Lankton and Dussubieux 2006) and refined chronologies of trade in northeastern North America (Billeck and Dussubieux 2006; Chafe et al. 1986; Hancock et al. 1994; Hancock et al. 2000; Kenyon et al. 1995a,b; Shugar and O'Connor 2008; Sempowski et al. 2000). These studies of glass trade beads from North American sites showed that workshops in Europe shifted their glass recipes over time, and that chemical analyses of glass trade beads recovered on archaeological sites can be used to link recipe shifts to archaeological chronologies and the geographic distribution of beads across the landscape, clarifying the timing of trading events. Elemental techniques also can differentiate among visually similar but compositionally distinct beads, making it possible to recognize variations in European glass bead recipes both through time and among glass workshops supplying beads without concern about the effects of shifting preferences for visually different beads.

In North America, long-distance trade in rare raw materials and finished objects took place for millennia prior to the arrival of European trade items (Carr and Case 2005; Gibson 1996; Jennings 2011:77-98; Sassaman 2005; Webb 1968), and there is significant archaeological evidence that both indirect and direct exchange networks operated during late prehistory (e.g. Betts 2006; Gibbon 1995; Henning 1995; Schroeder 2004; Shackelford 2007). The Mississippi River, its tributaries, and other rivers in that watershed, linked Mississippian colonies like Aztalan and Fred Edwards to one another as well as to Cahokia, and connections to the Fort Ancient culture in the Ohio River valley likewise followed waterways (Drooker 1997; Finney 2013; Shackleford 2007). Previous studies of the distribution of European trade items on archaeological sites in the Northeast demonstrated that European trade items there first moved along water-based and overland Native trade routes that existed prior to contact (Bradley 1987; 2007; Lapham and Johnson 2002). Late pre-contact trade routes have not been assessed in this way in the Upper Great Lakes, but the locations of many of the sites near waterways as well as the prevalence of riverine travel in historic records have led scholars to infer that waterways remained critical to the distribution of trade items well into historic times (Betts 2006; Shackelford 2007; Sleeper-Smith 2009). Epidemic disease also may have been carried by people moving along Upper Great Lakes waterways in the protohistoric era (Betts 2006; Green 1993), which may have led to depopulation that has been modeled in this area (Milner and Chapman 2010). Down-the-line exchange, direct trade, and migration from eastern North America all took place in the Upper Great Lakes during the historic era (Brown and Sasso 2001; Emerson and Brown 1992; White 1991; Witgen 2012), and may have followed pre-existing overland and water-based routes. However, at the scale of the archaeological data-set in this dissertation, it is not possible to differentiate among various paths and types of exchange and interaction.

Historical accounts of rituals involving exchange can provide a foundation for inferring the how items circulated across the landscape and support the theoretical framework of socially-structured trade by showing how trade items gained social significance through these exchanges. The Feast of the Dead, celebrated by many Huronian groups, exemplifies how European-made trade items were redistributed for purely social and ideological, non-economic reasons. During the Feast, extended family or village groups, as well as visitors from outside "Nations," convened to conduct a burial ceremony that could last several weeks, with communal feasting and gift-giving events and resulting in a mass-grave intermingling the human remains (Hickerson 1960). The Jesuit Jean de Brebeuf recorded the event among the Huron in 1636 (see discussion in Greer 2000:61; Thwaites 1890 [2000]:10: 278-303), and he paid special attention to the presents that relatives of the deceased presented to attendees; these included beaver robes, necklaces of glass beads, axes, knives, and kettles. The communal burial pit was lined with more furs and the dead were interred with kettles and beaded necklaces. Historian Michael Witgen followed Marshall Sahlins in characterizing this ritual as an example of unequal exchange that created social obligations, strengthening existing relationships while creating new ones (see Sahlins 1972:168, 193-195; Witgen 2012:124). In a recent reinterpretation of the Hanson site, in Door County, Wisconsin, archaeologists argued that a mass burial of fourteen women and children, along with lavish or exotic trade items such as an intact conch shell, a shell gorget, a silk-and-silver metallic textile, wampum, glass beads, and a mix of Native-made and European-made textiles indicate the burial may have been performed in a manner similar to that recorded in historical accounts of the Feast of the Dead (Rosebrough et al. 2012: 126). If the Feast of the Dead was celebrated by a Huron refugee group at this site in Wisconsin, mourners would have redistributed European-made items to the attendees, and perhaps local representatives of other ethnic groups in attendance, fostering communities forged from a shared refugee status. Such gifts might not be classified as trade, but they demonstrate the social significance of the exchange of European-made material culture during this period.

Historians of the *pays d'en haut* (White 1991; Witgen 2012) have demonstrated the socially motivated and structured nature of informal exchange and formalized trade relationships during the seventeenth and eighteenth centuries. They involved the development of fictive-kinship relationships that allowed French traders, government representatives, missionaries and various Algonquian groups to maintain alliances facilitating the fur trade (White 1991:36). Witgen reviewed some of the same documentary evidence as White, but Witgen framed Indigenous groups as sovereign nations, with their own political motives and powers; at the edges of the hybridity and accommodation of the *pays d'en haut* stood "an Infinity of Nations" who were forming a "Native New World" that was "created by formal rituals like the Feast of the Dead, and by the ritualized meaning attached to the everyday exchanges that made the inland trade work" (2012:138). The Dakota and Anishinabeeg actively resisted French authority by blatantly trading with illicit *courers de bois* and only conditionally accepting French gifts (Witgen 2012:261). In specific situations of conflict, such as the 1706 altercation among Odawa [Ottawa] groups and the French at Detroit, resolutions were structured specifically using "language of kinship" (White 1991:84). According to Indigenous practices, the French would "cover" deaths of individuals killed in conflicts with gifts of both human captives, which would represent the lives lost, and gifts of beads, furs, and material items. The material gifts were meant to maintain the fictive kinship relationships and complex social networks linking French traders to their "children," their Indigenous hosts and guides on an unfamiliar social and physical landscape. The elaboration of existing rituals and the application of Indigenous meanings to the exchange of everyday objects exemplify the inherently social nature of trade networks in the Upper Great Lakes at this time.

2.4.3.2 Material Expectations for Research Question 3: In the Upper Great Lakes, when and where did non-local trade items arrive, and how did economic and social factors influence their distribution?

Using the conceptual framework that exchange was motivated by socio-economic factors in the Upper Great Lakes (after White 1991; Witgen 2012), and the knowledge that chemical compositional analyses had been successful in delineating chronologies and geographic patterns of trade item distribution (e.g. Hancock 2013), I developed material expectations for the glass and metal data sets in this dissertation. Based on initial investigations of glass bead compositions in Wisconsin (Walder 2013b), I expected that chronological periods and patterns of interaction among sites participating in the regional exchange networks of the Upper Great Lakes would correspond to the geographic distribution pattern of chemically similar glass beads. Ritual practices of redistribution, such as the Feast of the Dead, and the common practice of gift giving to seal alliances would have affected the distribution of objects, but these behaviors would be difficult to distinguish from other forms of exchange because of the equifinality of different social motivations for trade. For this reason, I have structured the expectations for patterns present in the glass and metal data sets as related to both social and economic influences on exchange, but I acknowledge that it not necessarily possible to separate the effects of these influences based on the archaeological record alone.

I tested the premise that ethnic affiliations, as attributed by previous excavators, structured availability of European trade items to peoples in the Upper Great Lakes. For example, Rock Island was noted as an important trading location, the "*Island of the Pouteouatamis*," on numerous French maps and travel-logs of the time (see Mason 1986:17-20), while the Bell Site has been identified as the historically documented Grand Village of the Meskwaki (Behm 2008). Two general ceramic types, Butte de Morts ware and Algoma Modified Lip have been respectively affiliated with Meskwaki (Behm 2008) and Potawatomi (Mason 1986; Naunapper 2010), based on their majority presence on the Bell Site (for the former) and and Rock Island's Period 3 (for the latter). It is important to note that a minority of identifiable ceramics at both sites differ from the most common types, and these might be attributed to exchange, intermarriage, captives, or other activities related to intercultural interaction. To explicitly test if archaeological sites affiliated with Meskwaki and Potawatomi on the basis of ceramic types linked with historically-known locations (as in R. J. Mason 1976), were obtaining trade items from the same source(s), I analyzed the chemical composition of glass trade beads from contemporary archaeological sites attributed to the Meskwaki and the Potawatomi.

If the Meskwaki, who were constantly at war with the French for much of the late seventeenth and eighteenth century, did not have had access to the kinds of materials that were traded to Potawatomi groups by La Salle or other French explorers at the stopping-off point at Rock Island (see Mason 2015), then I expected to find differences in the chemical composition of glass beads between Meskwaki and Potawatomi sites. However, if the Meskwaki and Potawatomi were accessing the same trading networks, I expected to identify beads of similar compositions across those sites. Following the Meskwaki and Potawatomi example, the expectations for glass bead compositions can be further generalized. In the glass bead data set, expectations for chronology and ethnic affiliation were related. I expected that if a single location had several successive temporal components, then glass bead recipes would shift over time, which I would interpret as a shift in European glass workshop recipes or a shift in the workshop supplying beads that reached that location at different points in time. If previous archaeological interpretations assigned a group of sites the same chronological period and ethnic affiliation, then I expected that visually indistinguishable glass beads recovered from those sites would have a similar chemical composition. I also expected that if sites were from the same chronological period, but had been affiliated with different ethnic groups, then compositional patterns in glass bead recipes might vary according to the ethnic affiliation of site occupants as a result of participation in different exchange networks at the same time.

Resource availability and differential access to trading partners also would have shaped the technological processes of modification and use of reworked copper-base metals. If an ethnic group was historically documented as involved in a conflict with Europeans, I expected that trade items might have become scarce, leading to a different pattern of reworking. Distance from trading centers could also cause scarcity, and for sites farther away from the Upper Great Lakes trading centers, I expected that if copper-based metal resources were scarce, then communities would apply a different technological style of metal reworking than in other locations, such as more recycling of scrap and fewer unfinished objects in those assemblages, but equifinality would prevent identifying a specific reason for scarcity. I expected that increased patching of kettles might also reflect resource scarcity, but "new" kettles still nested for transport from Europe have been recovered already patched, and "seconds" from European workshops could have made their way to North America in already partially repaired forms (Wheeler 1975). Since local repair of kettles by Native groups or Europeans could not be differentiated from kettles patched in Europe, equifinality is a factor in the interpretation of patching as related to resource availability. In the Upper Great Lakes, it may not be possible to differentiate between the influences of material availability and culturally-constructed trading relationships as a cause of resource abundance or scarcity on an individual assemblage of copper-based metal adornments and production waste, but exchange and reworking practices may be considered socio-economic activities, and patterns of difference may relate to socially-structured resource availability.

The material expectations for the timing and geographic of distribution of trade items rely on the theoretical framework of socially-structured exchange networks, which I have argued included multi-ethnic communities where individuals or groups may have developed culturally-hybrid identities through intercultural interaction among diverse Native groups as well as Europeans. The culturally-complex of the situation in the *pays d'en haut*, with gift-giving, fictive kinship, direct and indirect exchange, shifting social and ethnic identities, and migration of non-local Native peoples all affected the timing of trade item arrival and the distribution of these items across the Upper Great Lakes landscape. Although it may not be possible to separate the socio-economic factors that influenced the final distribution of trade items recovered on archaeological sites, the glass and metal artifact analyses were expected to reveal patterns in the distribution of these materials that corresponding to previously published interpretations of chronology, population movement, and ethnicity in the Upper Great Lakes region drawn from historical documents and other lines of archaeological evidence.

2.5 Summary

This chapter has defined concepts that form the theoretical framework for this dissertation research, including ethnicity, hybridity, multi-ethnicity, and ethnogenesis, and described how the analytical approach of *chaîne opératoire* can connect material culture to social practices through the study of technological style. The theoretical framework was used to contextualize each of the research questions, using case studies from other situations of colonial interaction worldwide. Based on the discussion of the theoretical framework and case studies of other situations of intercultural contact, material expectations for glass and metal artifacts were presented for each of the three research questions. Equifinality in the archaeological signatures of various methods of exchange was acknowledged. Chapter Three summarizes the archaeological and historical background of the ethnic groups and archaeological assemblages investigated in this dissertation project.

Chapter 3. Historical and Archaeological Contexts

This chapter summarizes relevant background information used in the development and implementation of this research program. It does not constitute a complete history of European involvement in the Great Lakes region, but rather it synthesizes information for readers unfamiliar with this time period or geographic area. First is a discussion of documentary evidence and historic maps, which record mapmakers' perceptions of a past social landscapes. Second is an overview of historically-documented tribes and archaeological cultures relevant to the investigation of ethnicity, population movement and trade in the seventeenth and eighteenth centuries. The third major section of this chapter presents summary and contextual information about each archaeological assemblage that was examined in the course of the research.

I define the Upper Great Lakes region as the general area surrounding Lake Michigan and south of Lake Superior, bordered by the Mississippi River to the west and the Kaskaskia River in Illinois (Figure 3.1). Here, most archaeological projects, particularly those focused on the early colonial period, have investigated individual sites, while synthetic approaches to the broader social landscape have been the topic of historical investigations (e.g. White 1991; Witgen 2012). This dissertation specifically examines the historically-contingent situation of colonial influence and accommodation that took place during the seventeenth and eighteenth centuries in present-day Wisconsin and Upper Michigan and adjacent regions, which were included for broader comparison with peoples who interacted with communities of the Upper Great Lakes. Present archaeological narratives of this locale and time period do not completely address the intensive interactions among diverse Native peoples; therefore, this project applies new lines of archaeological evidence to better understand the complicated networks of trade and interaction structuring social relations at this time.

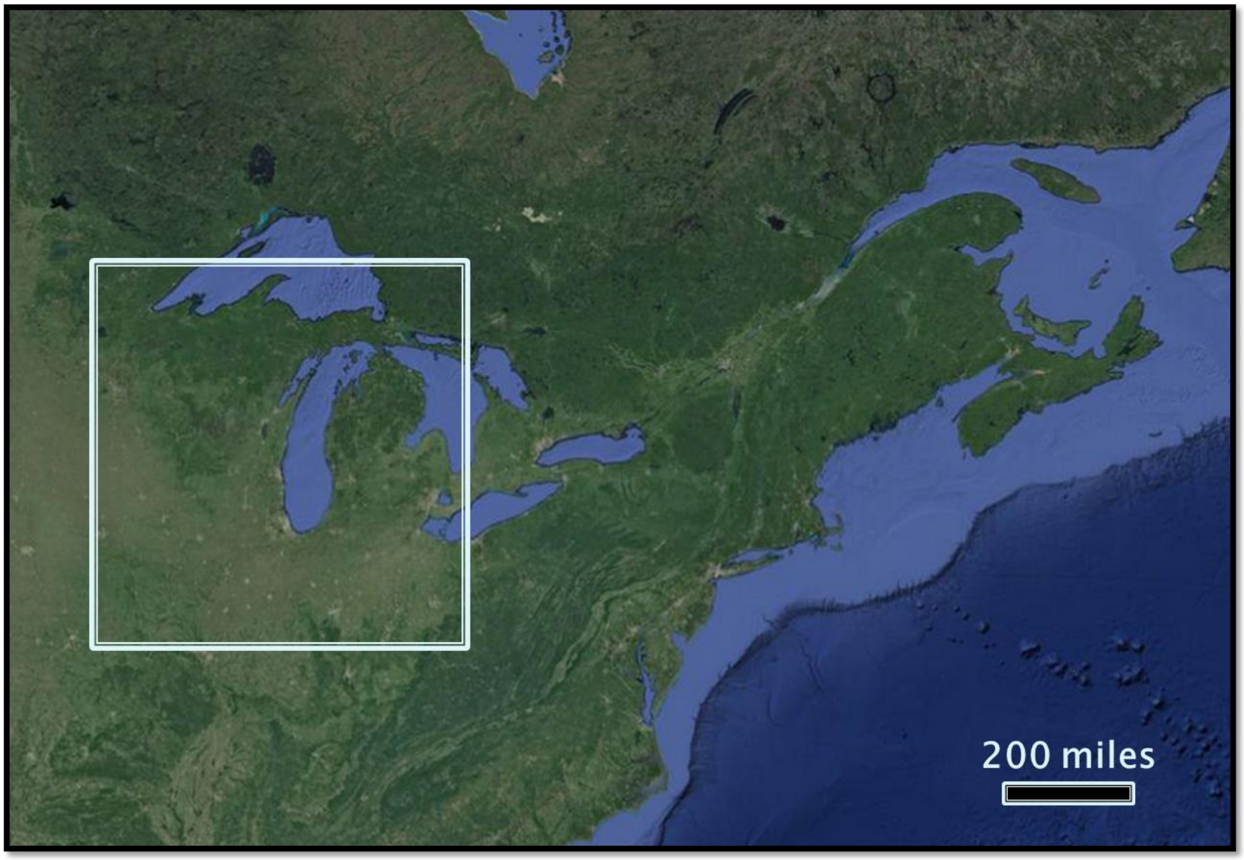


Figure 3.1. The Upper (Western) Great Lakes Region (adapted from Google Maps)

3.1 Historical Background and Documentary Evidence

In this section I summarize relevant literature for considering the historically documented economic and social landscape as perceived by European (predominantly French) explorers and cartographers from c. AD 1600 – 1730. Both historians and archaeologists apply the documentary records, but they do so in different ways, so I have chosen to artificially separate them. In this review, I begin with documentary evidence such as the *Jesuit Relations* and historic maps, followed by an overview of how ethnohistorians and archaeologists working in the Upper Great Lakes have interpreted and challenged these accounts. I follow this with discussion of the perspective of modern Native groups as accessible in published literature. The information reviewed in the below sections has influenced the interpretation of the archaeological record.

3.1.1. Documentary evidence as a tool for archaeological research

First-hand documentary evidence can enhance archaeological investigations of Indigenous peoples' trading activities during historic periods because contemporary texts record particular events and dates when they occurred, provide accounts of the habitation locations, movements, and technological practices of Native peoples, and describe activities not represented archaeologically. Because these texts are written from Western perspectives and were not prepared or developed as ethnographic records, readers must consider both the context in which the texts were produced as well as the biases of the individual authors (Cleland 1999, 2001; Orser 2010). Contexts of writing usually included exploration of new territories for the purposes of expanding trade relationships or spreading Christianity, and biases of authors reflect those goals. This dissertation uses a decolonized archaeological approach to interpreting past social landscapes (Gosden 2004; Orser 2010:136; Rizvi 2008) in order to better understand and account for the biases inherent in documentary evidence. Such evidence includes historians' interpretations of the well-known firsthand accounts like those included in the *Jesuit Relations* (Thwaites 1890 [2000]), particularly the narrative of Father Jean Claude Allouez, who explored Wisconsin in 1669 (Allouez 1917a, 1917b), and supplementary texts such as the detailed secular French trade records that catalogued the sequence and quantities in which incoming European goods arrived in New France, particularly for eighteenth century fur trade sites (Anderson 1991, 1992, 1994; Kent 2001, 2004). Documentary evidence of the movements of trade items can aide in the interpretation of material assemblages by providing possible sources of origin for certain diagnostic material culture types, such as lead bale seals and some types of kettles. Historical texts and maps are especially useful for examining the archaeological evidence at French-controlled fur-trade locations such as Fort St. Joseph and Fort Michilimackinac, where historical investigations have identified named individuals associated with the sites.

The most important primary sources for most histories of New France are the *Jesuit Relations* (Thwaites 1890 [2000]. This is a 72 volume compilation of annual reports produced by French Jesuit missionaries in North America between 1632 and 1673. They recorded detailed information on the travels, interactions, and daily lives of French Jesuits in eastern North America and the Great Lakes regions during the seventeenth century. The accounts describe the interactions between the French and the peoples they encountered, rituals such as the Feast of the Dead, as well as the exchange of trade items and furs so common in cross-cultural interactions. The depictions of Native Americans reveal as much about the biases of the French Jesuit authors as their subjects. For example, the French term *sauvage* (savage, other) is used throughout to refer to the peoples that the Jesuits encountered (Greer 2000:vi), and modern historians who revise the translations of Thwaites, like Greer, are aware of the connotations of the original Jesuit authors. Jesuits focused their attention on the difficult travelling conditions, hostile exchanges with greedy or violent Natives, and opinions of local subsistence practices and daily life as primitive, filtering of these perceptions through a deeply-religious lens that routinely attributed suffering or hardships to “God’s will.” The *Jesuit Relations* therefore reflect the contexts of French interactions with Indigenous peoples that they encountered, as well as noting the locations of specific named peoples on the unfamiliar landscape that they were trying to map.

Jean Claude Allouez was one such missionary, and he provided some of the earliest and most detailed accounts of interactions the peoples of present-day Wisconsin. Father Allouez’s entries in the *Jesuit Relations* come from the report for the years 1665-1667, which recounts

Allouez's travel to Chequamegon Bay, and the 1669-1670 relation, in which he reports his further westward travels to the Green Bay area of present-day Wisconsin, including descriptions of peoples living there. For example, the latter account describes a winter visit to a multi-ethnic village near present-day Oconto, Wisconsin, which the translator suggests included Potawatomi, Sauk and Fox (Meskwaki) and Winnebago (Ho-Chunk) individuals (Allouez 1917b:146). Such accounts of multi-ethnicity attest to the complicated social landscape of this period, which makes archaeological attribution of sites to particular ethnic groups problematic. Other documentary evidence, such as the trade records, are discussed in greater detail later in this dissertation, when they are relevant to the discussion of particular material culture types.

3.1.2 Historical documentation of archaeological sites in the study sample

In my research, I examined archaeological materials from two historically documented French Colonial archaeological sites, Fort Michilimackinac and Fort St. Joseph, where known *Métis* communities were present. French forts were built with colonial intentions of controlling trade and winning converts to Catholicism and served as locales of intensive trade and interaction among many different Indigenous peoples as well as the French inhabitants. Because of the hybridizing processes influencing individual identities and social connections of Indigenous peoples living in close proximity to French fortifications, I briefly address the French Colonial enterprise as described in the historical literature. Individual site descriptions in section 2.4 below include more specific information about each site.

The French presence in North America began in the early sixteenth century, with explorations of the Labrador and Newfoundland coasts; approximately 100 years after the first French claims to territory, the explorer Samuel Champlain founded the city of Quebec in 1608 (Eccles 1998). The sustained French presence in eastern North America, which intensified in the mid-seventeenth century, has been explored in depth in Trudel's *Introduction to New France* (1968 [1997]). Numerous critical histories have been written about the exploits of French colonial powers in New France during the seventeenth and eighteenth centuries. Eccles' *The French in North America* (1998) is a straightforward, traditionally-written history from the perspective of the colonial power. Native American control of trade networks is dismissed and they are portrayed as acquisitive and simplistic people who were "desperately eager to obtain the European metal goods that were starting to revolutionize their Stone Age culture" (1998:12). Such outdated technological models do not advance understanding of the complexity of trade during early years of European presence in North America, particular further inland at the edges of French influence. Although archaeologists have been challenging the acculturation model for several decades, it seems to persist longer in historical narratives of contact and colonialism.

Like documenting the founding of cities, identifying the landing-spot of the "first" European visitor in a particular region, and marking these locations with monuments, plaques, and similar memorials has been something of a quest for professional and avocational historians alike. The French explorer Jean Nicolet is commonly identified as the first European to land in Wisconsin, specifically at "Red Banks" near Green Bay in 1634 (e.g. Risjord 2001). However, there is no archaeological evidence directly linked to this particular encounter, and the historic record is complicated and possibly equivocal, leading scholars to critique various aspects of the Nicolet narrative, proposing landing-spots ranging from the southern shores of Lake Superior to near Chicago, Illinois (Hall 2003; Lurie and Jung 2009, 2015; C. I. Mason 1976; R. J. Mason 2014; McCafferty 2004; Richards 2003). Identifying the particular location this specific historical event is difficult because the archaeological record of such an interaction would be unlikely to include material culture that could be specifically attributed to Nicolet himself. In general locales of early direct interaction between French explorers and Indigenous peoples cannot be differentiated archaeologically from sites where trade items were present as a result of down-the-line exchange with other Indigenous groups serving as intermediaries in trade.

A recent summary of probable locations for Nicolet's landing is Lurie and Jung's 2009 *Nicollet Corrigenda*, which critiqued the continuing perpetuation (e.g. Risjord 2001) of apocryphal details of this story, like the idea that Nicolet had packed a silk robe to impress the Natives when he reached the "Orient." Lurie and Jung provided an extensive review of all the previously-proposed possible landing spots for Nicolet and his group, and they argued that "Red Banks" might refer to more than one location or that various sources use the term to refer to several different places. Citing evidence from early maps, the *Jesuit Relations*, original documents by Wisconsin archaeologists including Increase A. Lapham and Charles E. Brown, and Paul Radin, an ethnographer of the Ho-Chunk and folklorist with whom Lurie worked for years, Lurie and Jung argued that Nicolet might have landed among the Menominee in Marinette rather than a few miles to the south among the Winnebago at Red Banks. On the basis of a lack of archaeological evidence supporting their claim, and in agreement with Mason's recent response (2014), I do not support Lurie and Jung's interpretation; based on current understandings of the historical record and available material evidence, it is not yet possible to pinpoint the landing spot of Nicolet and his party at Green Bay, Lake Superior, or elsewhere (but c.f. Lurie and Jung 2015).

3.1.3 Historic maps

Archaeologists interested in understanding the spatial distribution of trade networks and people in the Upper Great Lakes in early historic times have relied on maps that delineate the geographic location of distinct social groups and label these socio-spatial places according the identity of the politically or numerically dominant peoples as understood by the mapmakers. According to Eccles (1998:283), there are several comprehensive historical atlases and compilations of maps covering the seventeenth and eighteenth centuries in the Great Lakes and French interaction in this region: the *Historical Atlas of Canada* (Harris and Matthews 1987); *Atlas de la Nouvelle-France. An Atlas of New France* (Trudel 1968) and *Atlas of Great Lakes Indian History* (Tanner 1987). European cartographers published maps of this region throughout the historic period (Table 3.1), indicating locations of Native groups on the landscape as Europeans understood it through primary exploration and the descriptions of Native informants. Historic atlases (e.g. Bellin and Prévost 1774) and annotated compilations (Winsor 1894) are available digitally, allowing easy access to these records.

Table 3.1 Summary of Historic Maps that include the Upper Great Lakes region

Year	**Title**	**Author**	**Source(s)**
1616	*La Nouvelle France*	Champlain, S.	(Champlain et al. 1922-1956; Wroth 1954)
1632	*Carte de la Nouvelle France*	Champlain, S.	(Champlain and Association of Canadian Map 1980; Risjord 2001)
1650	*Amerique Septentrionale*	Sanson, N.	(Sanson et al. 1976; Winsor 1894)
1673	*Autograph map of the Mississippi or Conception River*	Marquette, J.	(Thwaites 2000); WHS
1680	*Carte des lacs Tracy ou Supérieur, des Illinois et des Hurons*	Joliet, L.	(Joliet 1893)
1687	*Partie occidentale du Canada ou de la Nouvelle France*	Coronelli, V.	(Coronelli 1980)
1698	*A Map of a Large Country Newly Discovered in the Northern America*	L. Hennepin	(Hennepin et al. 1903)
1718	*Carte de la Louisiane et du cours du Mississipi*	de l’Isle, G.	(de l'Isle 1733)
1755	*Partie Occidentale de la Nouvelle France ou du Canada*	Bellin, J. N.	(Bellin and Prévost 1774)
1757	*Carte du Lacs du Canada*	Bellin, J. N.	(Bellin and Prévost 1774); WHS
1785	*Etats Unis De L'Americque Septentrionale*	Delamarche, C.	(Delamarche 1785)

Historic maps artificially reify social boundaries or territories as the mapmakers perceived them. For example, in Guillaume DeLisle’s 1718 map, *Carte de la Louisiane et du Cours du Mississipi* (Figure 3.2), the locations of villages and their inhabitants are clearly labeled and the complex social landscape is neatly parsed into distinctive and non-overlapping bounded areas of influence (Balash 2008:47-48).

Figure 3.2 Detail of DeLisle 1718 map showing the Upper Great Lakes region, reproduced and modified from a public domain image from the Library of Congress <http://www.loc.gov/item/98685731>

Archaeologists must be critical of this and other maps because they capture only a single point in history and transform a dynamic network of seasonal movement, complex kinship relationships, and shared linguistic heritage into a static and timeless representation of the perceived cultural geography. Many of places of habitation on DeLisle’s map have been investigated by archaeologists, most of whom have made an attempt to identify the ethnicity of site inhabitants on the basis of stylistically distinctive ceramics in concert with documentary evidence. The social designations on the map (e.g. *Riviere aux Renards* or *Isles des*

Poutouatomi) have been applied as one line of evidence to link particular archaeological sites to historically-named ethnic groups (e.g. Behm 2008:33-34; Mason 1986). However, during periods of population movement and social upheaval, ceramic-based evidence of social affiliation may become less certain because potters may be producing pots of a style or technology that is not representative of the predominant tribe or social group in a multi-ethnic village, or pottery-making traditions may change or disappear entirely as new forms of technology replace old forms. For archaeological sites that lack a corresponding location on any historic map, and especially those with small or mixed assemblages, the uncertainties about ceramic style and ethnicity are problematic for excavators attempting to assign sites to any particular tribe. My dissertation research investigates the usefulness of maps like deLisle's as a way to build and test archaeological hypotheses rather than as a source of information for identifying the ethnic identities of individuals living at particular locales during the early years of French involvement in the Upper Great Lakes region.

A recent cartographic presentation of French colonial encounters addresses the problems of linking particular cultural groups to geographic locations by making maps interactive and allowing overlaying comparisons of maps changing through time, effectively synthesizing cartographic information to provide a clearer representation of change over time. Since its original publication, (Harris and Matthews 1987), this text has been expanded to a three volume set, much of which is now online at <http://www.historicalatlas.ca/website/hacolp/index.htm>. The digitized version of the Atlas includes significantly expanded features including zooming to selected areas and toggling layers that include waterways, present-day geographic boundaries and cities, and other features that allow the user to trace trade routes and the paths of particular explorers and understand the development of modern geopolitical unites. One portion of the site geographically illustrates estimated Native population densities of the early seventeenth century mapped by linguistic family (Figure 3.3). Users can zoom to their area of interest, in this case, the Upper Great Lakes region. This map represents a composite of information that cartographers compiled from various historic maps, census records, and other documentary evidence, making the maps richer, non-static resources.

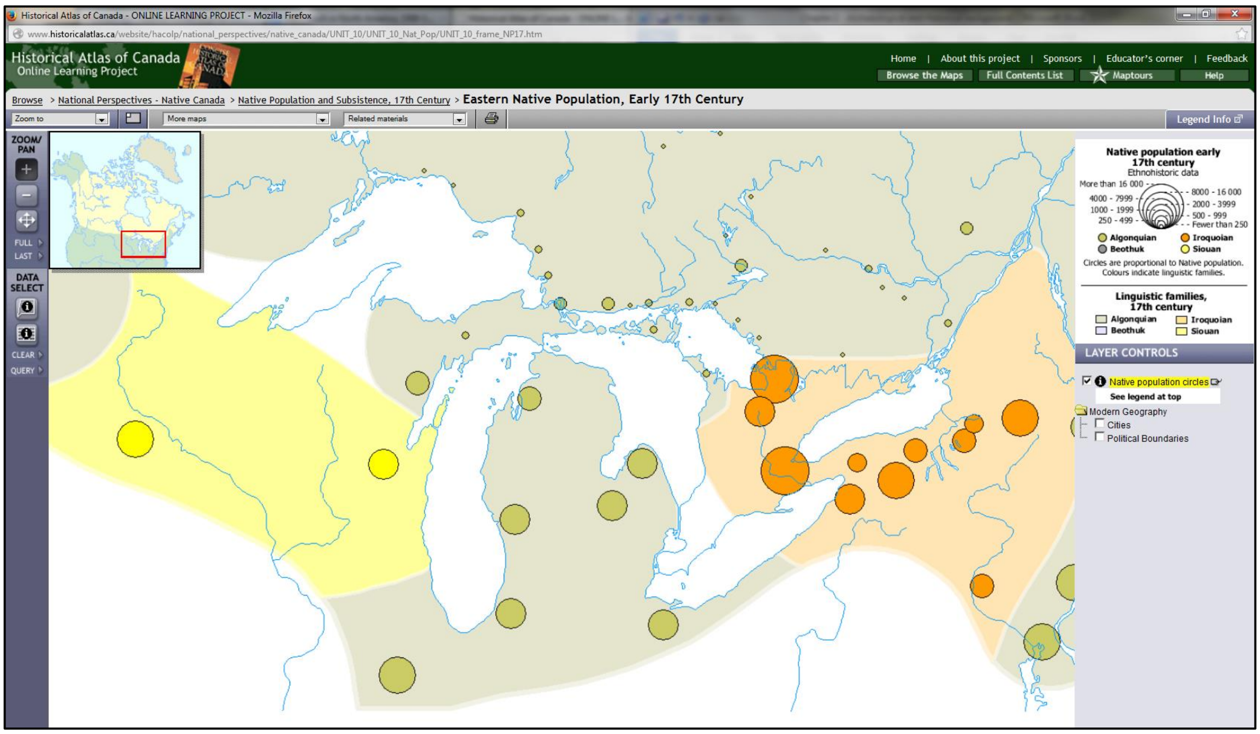


Figure 3.3 Map of Eastern Native Populations, early seventeenth century, color-coded by linguistic families: Yellow = Siouan, Green = Algonquian; Orange = Iroquoian <http://www.historicalatlas.ca/website/hacolp/national_perspectives/native_canada/UNIT_10/UNIT_10_Nat_Pop/UNIT_10_frame_NP17.htm> Accessed 1/24/14

Redrawn versions of original maps of the French Exploration period are also available at the online *Historical Atlas of Canada*, and include several of the maps listed in Table 3.1. An interactive map of French Exploration, 1603-1751 allows users to view historically documented routes of French exploration and visualize how areas of cartographic interest changed over time and were mapped with increasing frequency and detail (Figure 3.4). This map demonstrates that

French cartographers paid particular interest to mapping the waterways that would be useful to traders and missionaries. According to this map, large portions of the interior of Wisconsin and Michigan remained "unexplored," or at least, unmapped by 1751 (these areas are shaded in dark green; areas shaded in yellow are labeled as having been explored between 1657 and 1751). Unshaded areas mapped before 1656 in the Upper Great Lakes region included the most important waterways and trade routes: Door and Garden peninsulas, the Straits of Mackinac, and the shores of Lake Huron bordering the Lower Peninsula of Michigan.

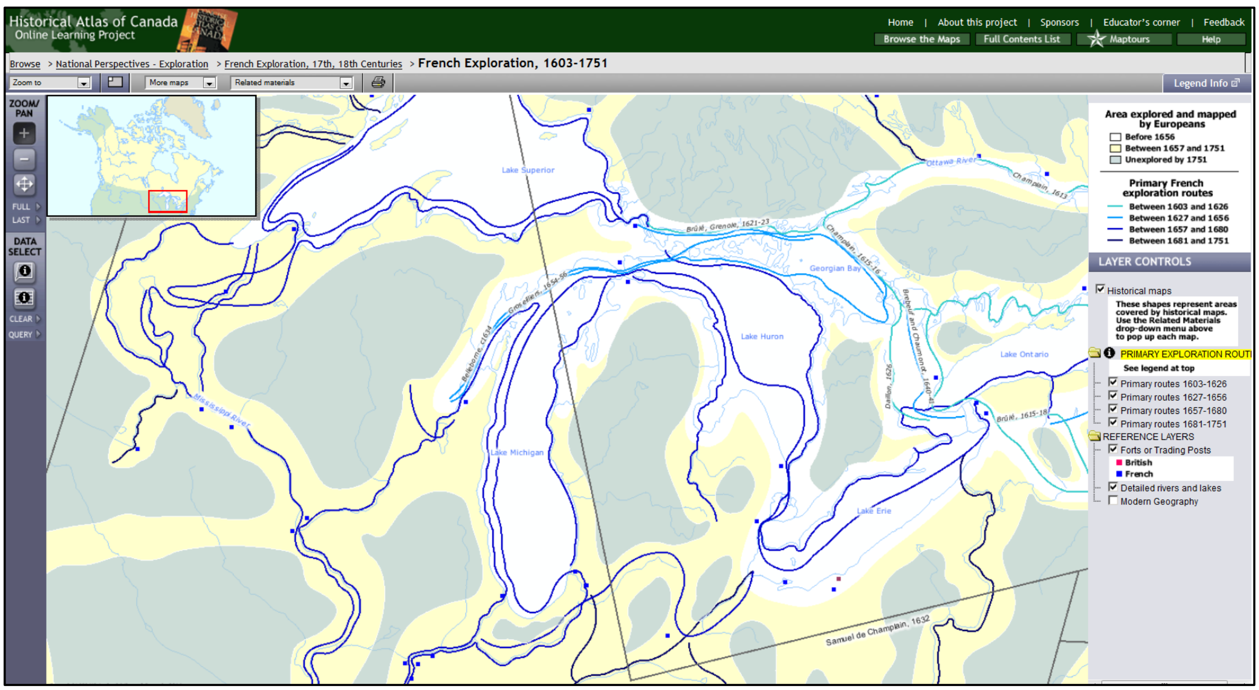


Figure 3.4 Interactive Map of French Exploration 1603-1751; <http://www.historicalatlas.ca/website/hacolp/national_perspectives/exploration/UNIT_06/UNIT_06_French_exp_1751/UNIT_06_frame_FE1751.htm> Accessed 1/24/14

A classic historical atlas also mentioned in Eccles (1998) is *Atlas de la Nouvelle-France An Atlas of New France* (Trudel 1968). Like Trudel's comprehensive text from the same year (*Introduction to New France*), his atlas provides an overview of developments in French Colonial organization, economic influence and power, in this case using a data set of cartographic representations of new France from the 1500s through the "fall of New France" in

1763 (1968:7). Unlike the *Historical Atlas of Canada*, Trudel's atlas reprinted maps originally published over the history of French and European interaction in North America, beginning with the controversial "Vinland" map dated prior to AD 1440, which is suggested to represent the east coast of northern North America (Trudel 1968:15). Trudel did intersperse new cartographic representations to illustrate later events in the history of New France, such as English campaigns against the French in the French and Indian War (1968:147). *An Atlas of New France* remains a useful reference because it compiles nearly all known cartographic representations of the Upper Great Lakes region chronologically in a single source, allowing the recognition of change through time in the ways that French cartographers represented this region. Increasing westward expansion through time is reflected in more accurate geographic representations and more detailed labeling of recognizable Indigenous groups on the landscape. The eighteenth century maps in this volume emphasize the eastern regions of New France, which were becoming more heavily colonized and consequently mapped at smaller scales with greater detail. However, Bellin's 1755 map of *Le Pays d'en Haut* illustrated the "Upper Country" and emphasized the various territories of Native influence and village encampments, and European influence is difficult to recognize, especially in the region west of Lake Michigan (see Trudel 1968:120-121).

Finally, Helen Hornbeck Tanner's *Atlas of Great Lakes Indian History* (1987) compiled previous cartographic knowledge with a distinct emphasis on tracing the movements of Indigenous peoples and correcting the biases of earlier mapmakers toward locating European "frontier" settlements and missions. Tanner recognized a need to specifically focus on Native movements and locales of habitation in the interior of the continent, which many standard historical maps produced in the 1970s referred to as a 'little known area' (Tanner 1987:xiii). This cartographic resource acknowledges that multiethnic villages were part of the landscape, and

Tanner includes a summary discussion with each map, retelling the historic narratives of population movements in tandem with the geographic representation. Tanner's maps tend to rely more on historic texts and maps of this period rather than the archaeological record, but principal historic documents and sources of the information used are included for each map. Tanner attempted to map the distribution of Late Prehistoric Cultures (Map 5) based on distribution of ceramic vessel styles, but she was sensitive to the limitations of this practice, noting that "while it is widely recognized that there is no necessary correlation between the mode of decoration applied to a ceramic vessel and the specific ethnic or linguistic identity of the pottery maker, most archaeologists believe that at least broad relationships exist between the material and the social and ideological aspects of society" (1987: 24). Once historic records are available, Tanner uses these preferentially over the archaeological record to produce maps for the seventeenth and eighteenth centuries.

Tanner's maps of the Iroquois Wars (Maps 6 and 7) provide a geographic summary of locales of conflict and the movements of Huron refugee groups as they appear in the historical record. Maps 6 and 7 trace historically-documented movements of Odawa, Huron, and Tionontate groups through the Great Lakes; these groups dispersed through present-day Wisconsin from 1657 to 1671. Map 6 covers the entire Great Lakes region and shows locations of conflicts and village sites, while Map 7 (Figure 3.5) chronologically tracks the movements of the Huron groups, placing them on Rock Island from 1652-1657, across the state on "Pelee Island" south of the confluence of the St. Croix and Mississippi Rivers from 1657 to 1660, at the headwaters of the Black River from 1660-1661, and on Madeline Island from 1661 to 1671 before their return to St. Ignace (Marquette Mission) at the Straits of Mackinac. Only Rock Island, Madeline Island, and the Marquette Mission have produced archaeological evidence, in the form of Huron-style pottery, to support these movements, and the actual dates of Huron archaeological materials found at these locales are difficult to pinpoint to specific years unless one refers back to the historic record.

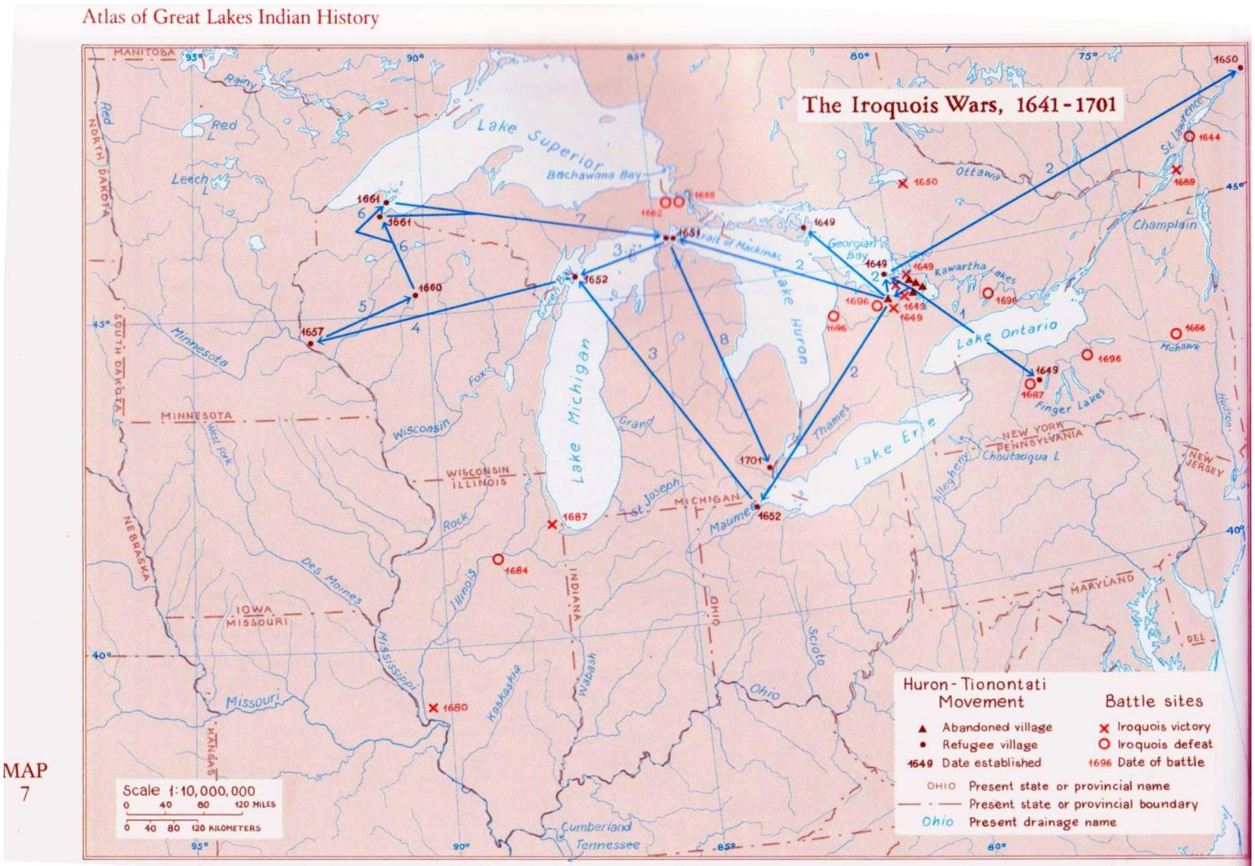


Figure 3.5 Tanner's map of the movements of Tionontate Huron groups during the Iroquois Wars (Tanner 1987:34)

3.1.4 French and Native American interactions in the "Native New World" at the edges of colonial power

In recent decades, historical research documenting colonial expansion has investigated the lives of non-European peoples living in the Upper Great Lakes at the time of contact, using primary sources of historic maps, the *Jesuit Relations*, and other first-hand accounts and records. The below section reviews historical interpretations that have taken a balanced approach to the power-structures shaping French and Native interactions. The now-classic history of these interactions in the interior of North America is *The Middle Ground* (White 1991). White highlighted the importance of cooperation and accommodation in interactions among Europeans and Native Americans, and his text remains a definitive narrative of the French Upper Country or *pays d'en haut,* which completely encompassed the study area examined in this dissertation research. Trading relationships in the *pays d'en haut* were structured as fictive kinship relationships between a French "father" and his Native "children" who would exchange "gifts" of furs and European-made trade items. Rather than an economically-driven market system, the social nature of trade fostered exchange based on mutual benefit and trust. Such a system flourished in the Upper Great Lakes, where long-distance exchange of high-value goods along socially or ideologically structured networks had a long history prior to European involvement (see Shackelford 2007 for a possible connection to Mississippian exchange networks).

White's concept of a "Middle Ground" has become a key element in global discussions of colonial encounters because it explicitly recognized the agency of all parties of the exchange system. Gosden (2004) incorporated the Middle Ground into a theoretical framework of colonial encounters used to compare cultures in contact for the last several thousand years. Following White, Gosden argued that the North American middle ground was not idealized or peaceful but rather a pragmatic solution that served all participants, without the cultural and material values of any one group dominating the situation (2004:113). Deloria cautioned that the "middle ground" concept cannot be broadly applied in every instance of colonial interaction, and it is not a stage of colonialism that can be distilled to simple "cooperation" (2006). As long as items like beaver furs and glass beads maintained one set of meanings for Europeans and Indigenous people incorporated them into their own existing value systems (e.g., Turgeon 2004), with all parties attempting to understand but not adopting the value systems of other groups as their own, the exchange was mutually beneficial. For this reason, the "process of middle-grounding" was an evolving situation and practice as well as a physical place (White 1991:50-51; Deloria 2006:21).

The historically specific conditions of mutual dependence in the *pays d'en haut* made a middle ground and balance of power possible until the French lost their hold on trade in the Upper Great Lakes by 1760, in the aftermath of the Seven Years War between France and Britain (White 1991: 240-263). The British did not understand the complex fictive kinship relationships that French governors had fostered through gift-giving. Seeking a market-driven economic trading relationship with Indigenous groups, the British quickly collapsed the "middle ground" into a more typically one-sided version of colonial exploitation under a vast power differential (White 1991: 315-366). Scholarly attempts to apply the middle ground concept in other colonial situations are successful only when they recognize that the example of the *pays d'en haut* involved mutual dependence, collaboration at the individual and group levels, and processes of hybridization to create new structures or relationships that were meaningful to all involved parties (e.g., Bayman 2010; Gosden 2004).

Michael Witgen, a student of White and a member of the Red Cliff Ojibwe nation, revisited the "middle ground" metaphor in his text *An Infinity of Nations* (2012), in which he argued that Indigenous groups of the Great Lakes region retained relative autonomy and political control over the region into the nineteenth century by creating a "Native New World" (2012). Witgen demonstrated that kinship relationships and shifting identities allowed historically-documented Native peoples such as the Anishinaabeg and the Dakota to control the political economy of the Upper Great Lakes at the end of the seventeenth century (Witgen 2012:30-69). In this work, I accept Witgen's reading of the documentary evidence, in which he describes the Upper Great Lakes region as:

> … a vast indigenous space knit together by multiethnic Native alliances and exchange networks. It was not a Native empire, but then neither was it part of any European empire. This was instead a Native New World created by indigenous social formations in response to the emergence of a global market economy, and the expansion of Atlantic World empires onto North American soil (2012:118).

In this situation, Native peoples recognized the need to adapt to European newcomers and political structures, but they did so in ways that resulted in the construction of a new and predominantly Native-controlled "world" structured by fostering fictive kinship and new alliances, innovative uses of material culture, and a strategic understanding of trade networks (Witgen 2012). Witgen's re-reading of primary historic documents and his retelling of the narrative illustrate how calculated political moves on the part of numerous Indigenous groups countered French efforts to influence what he calls "an infinity of Nations" connected through traditions and social relationships indecipherable to Europeans (Witgen 2012: 195-200).

Other regional or wider ranging histories offer additional insight on the economic ramifications of European contact. Eric Wolf provided an anthropologically informed history of the Fur Trade in his seminal volume, *Europe and the People Without History* (1982: 158-192). White and Witgen both drew on Wolf's main thesis, that Indigenous peoples had not been properly represented as active agents in the complicated socio-economic systems that drove European colonial endeavors of the sixteenth to nineteenth centuries and beyond. In his discussion of the Fur Trade in the Great Lakes region, Wolf emphasized the social and economic effects of eastern populations moving westward motivated by a desire to participate as middlemen in the fur trade (1982:170), but glossed over other motivating factors such as a desire to escape areas to the east ravaged by violence and epidemic disease as well as more direct

European colonial and military power. In his more recent pan-North American review of the roles of Indigenous people in shaping early American history, *Facing East from Indian Country* (2001), Daniel K. Richter also took an economic approach. Although less explicitly than Wolf, Richter examined the consequences of the influx of European trade items and their incorporation into existing economic and ideological systems.

Historians have specifically addressed the material value of European-made objects circulating through Native trade networks. Drawing on both historic documents and archaeological evidence, a widely cited article by Miller and Hamell (1986) argued that Native people incorporated trade items such as glass beads into pre-existing ideological value systems by associating beads with familiar material types. Hamell analyzed ethnohistoric documents to demonstrate that glass beads took on meanings of materials already imbued with ritual power, such as berries, shell, and rock crystals (1983, 1987, 1992). Laurier Turgeon pursued a similar intellectual thread in his research tracing exchange networks and value systems associated with glass trade beads, in particular French glass beads entering Eastern North America in the earliest periods of interaction (2001a,b; 2004). Turgeon wrote, “Following the movement of objects through time and space, from one culture to another, allows us to understand better how value is acquired and expressed through exchange. I also compare the uses Amerindians made of beads in the late prehistoric (15th c.) and early historic periods (16th and 17th c.) to evaluate better the impact of contact on the culture of reception" (2004:21). Turgeon demonstrated that various meanings were connoted by the wearing of glass beads among different members of society, noting that all community members used beads as adornments for purposes of social identification (Turgeon 2004:36-40). Hamell likewise argued that traditional meanings for particular colors influenced trading activities and again perpetuated long-standing systems of meaning through objects that Native peoples did not perceive as “new” (1987:76).

Scholars have also examined the timing and interaction of trade and exchange networks, especially in the distinctive red copper Basque kettle found at early Basque sites on the Northeast coast of North America (e.g. Fitzgerald et al. 1993; Turgeon 1998) as well as the meanings attributed to kettles, which become “intercultural objects” (Turgeon 1997). Turgeon traced the changing role of trade kettles, illustrating their roles in burial ceremonies such as the “Feast of the Dead,” in healing rituals developed to mitigate new epidemic diseases, and in solidifying political negotiations (1997). The deconstruction of European-made trade items and recycling of copper-based metal to produce ornaments has been described as a “New Copper Culture” that maintained continuity with technological systems extant for thousands of years in the Great Lakes region (Fox et al. 1995). Therefore, the desire for trade items could be recognized as a desire to perpetuate Native ideological systems, rather than a craving for “superior” European technologies and materials leading to acculturation. Turgeon used documentary evidence to reconstruct trade networks in Eastern North America predating European influence and recognized that early encounters did not suffer from the asymmetrical power relationships that characterize later interactions. However, Turgeon perpetuated an outdated framework of active agency of colonizers contrasted with passive “reception” of materials (Turgeon 2004: 21; c.f. Gosden 2004). Nevertheless, these scholars have demonstrated that in Indigenous value systems, glass beads became magically linked to berries and other local materials, and copper readily fit into the worldview and technological system already applied to native copper in the Lake Superior area. Therefore, European-made trade items alone cannot be construed as evidence of colonial influence in the Upper Great Lakes. Rather, in some situations, blue glass beads and copper-based metal adornments could have been viewed as appropriate material representations of an Indigenous ethnic identity for many of the diverse peoples interacting in this region.

3.1.5 Native Histories

Historians of the late twentieth century recognized that Indigenous peoples' perspectives of history offer unique information about the past because of their non-Western views and different priorities than traditional European historical narratives. Nabokov noted that "Native pasts" are unlikely to be concerned with specific chronologies, people, or locations (1996), the topics of greatest interest to historians and archaeologists. Because of this, there is certainly a danger in trying to interpret literally the events recounted in Native American oral tradition or accounts of the past (Mason 2006). Understanding Native histories requires contextual information about the events being presented, and Nabokov has provided examples of Native American legends and oral traditions that preserve different elements of the past: traumatic events, moral lessons, or processes, but not necessarily outcomes or detailed narratives similar to those that Western historians produce (1996:24-28). Nevertheless, understanding the complexities of population movements and interactions among dispersed peoples, Indigenous inhabitants of Wisconsin, and the various Europeans they encountered along the way requires including the perspective of Native peoples in their own words. Histories of the tribes of Wisconsin and their stories of "first contact" have been included in *Wisconsin Indian Literature: An Anthology of Native Voices* (Tigerman 2006). Treating such knowledge as "literature" rather than "oral history" seems problematic since literature connotes fiction, but the volume does provide interpretations from the contributing authors assessing the historical implications of each story.

In Tigerman's volume, Waioskasit of the Menominee Nation retold the story of an initial encounter with Europeans who brought liquor, flour, guns, kettles, and the cultural misunderstandings that came along with the introduction of these materials (Tigerman 2006:14-15). An anonymous Ho-Chunk tale associated the arrival of the French with Thunderbirds, and again materials and information were exchanged; the Ho-Chunk taught the French to smoke tobacco, the French demonstrated how to fire guns. However, the exchange extended beyond goods in this tale: the daughter of a Winnebago chief was married to the leader of the whites, and the oldest son of this marriage was sent to Europe, but he eventually returned to the Winnebago and made the tribe's first drum (Tigerman 2006: 60-61). Stories from the Menominee and the Ho-Chunk, who were probably the first inhabitants of Wisconsin to encounter European people, illustrate the complex material and social negotiations of gift-giving and social exchange that make it challenging to understand trading networks of this era using archaeological methods.

In a recent issue of the *Wisconsin Archeologist* devoted to Meskwaki history and archaeology during their seventeenth – eighteenth century period of residence in Wisconsin (Alex 2008), two elders and tribal historians weighed in on the matter of "history" in the introductory and concluding chapters of the volume. In his retelling the Meskwakis' creation story, Johnathan Buffalo, the director of the Meskwaki Tribal Museum noted,

> We have always insisted that we met the English first, but it is the French that recorded us first in 1650. So that is more or less our contact date, when we became a tribe, because when anthropologists pronounce you a tribe, that is when you become a tribe. Before that you are a conflict. We do not become real until someone can say, 'The Meskwakis were here in 1640.' That is when we become real. But we were already real from the East

> coast, and we remember little things of our migration--who we fought and who we still hate because of that. (Buffalo 2008:4)

Buffalo's observation that the pronouncements of anthropologists have inaccurately reified the Meskwaki people and contradicted their own stories of movement and conflicts directly relates to the central problem of this dissertation project: archaeological data and investigation can trace exchanges of material culture, but inferring the migration and relationships of peoples is much more complicated. Connecting material types, such stylistically-distinct ceramics, with the presence or movements of peoples requires multiple additional supporting lines of evidence of the kinds that I investigated in glass beads and metal objects.

Also in the Meskwaki volume, Donald Wanatee, Tribal Council member of the Sac & Fox Tribe, further assessed the impacts of Euroamerican influences on Meskwaki culture. He expressed deep concern over the loss of tribal knowledge, language, and history that took place when Meskwaki children attend(ed) programs like Head Start and boarding schools. He wrote:

> I've been involved in a lot of things with the tribe and learned its history when I went to the University of Iowa in 1956. There I asked one of my archaeology friends to help me look for the history of the tribe. As you know, American Indians have been deprived of knowing their history since the very beginning of the making and creating of America. At the University of Iowa library, I found a tremendous amount of information on American Indians, and in the Meskwaki case, two full files. At no time were we told by the State of Iowa, by Tama County, or by the United States Congress that all this information could have been made available to the Sac and Fox. In day-school, the students should have been taught their history from the very beginning of their lives. This

> is the reason why I concentrated on looking for the history of the Meskwaki tribe, the Sac and Fox Nation, and anybody who's affiliated with the tribe (Wanatee 2008:200)

As Wanatee described, the Meskwaki Nation (officially the Sac and Fox Tribe of the Mississippi in Iowa) has taken an active role in researching and presenting information about their past and they have produced a number of resources for scholars and the interested public. These include a Meskwaki History CD for use in schools (Bennett et al. 2004), a map of migration history (Gearing 2009), and an active Facebook page associated with the Meskwaki Tribal Museum, which opened on the Settlement in 2011. Including Native histories in my dissertation research is one way of de-colonizing my interpretations of the material culture recovered from archaeological sites in my study-sample.

3.2 Native American groups of the seventeenth and eighteenth centuries in the Upper Great Lakes

This section describes the historically-documented ethnic or tribal groups present in the Upper Great Lakes region during the seventeenth and eighteenth centuries by reviewing existing sources about these social groups and their location(s) on the past social and physical landscape, including: material evidence, particularly associated ceramic types; mentions of the ethnic group in the historical record; and relationships to other tribes or communities present in the region. This region was a locale of complex and ever-changing interactions among original inhabitants and many diverse Native people who were moving from previous homelands further to the east, and eventually European explorers and traders (White 1991; Witgen 2012). Turgeon illustrated these relationships well in his 2004 article tracking the preexisting trade and valuation networks that connected Native groups prior to and during initial European contact (Figure 3.6). In this map, Turgeon artificially bounded "traditional" territories, but the map should serve as a useful reference to readers unfamiliar with the social geography of this region in the seventeenth century. Material evidence for the "protohistoric" period and the relationship between archaeologically-defined cultures, language families, and historically documented social groups remains elusive in Wisconsin but is clearer in nearby regions, such as Illinois and northeastern Iowa. For example, a long-standing and often-quoted assertion states that the prehistoric Oneota peoples of eastern Wisconsin are "traditionally but not empirically linked to the Winnebago (Ho-Chunk) tribe" (Overstreet 1997:287). Such assertions are discussed critically below.

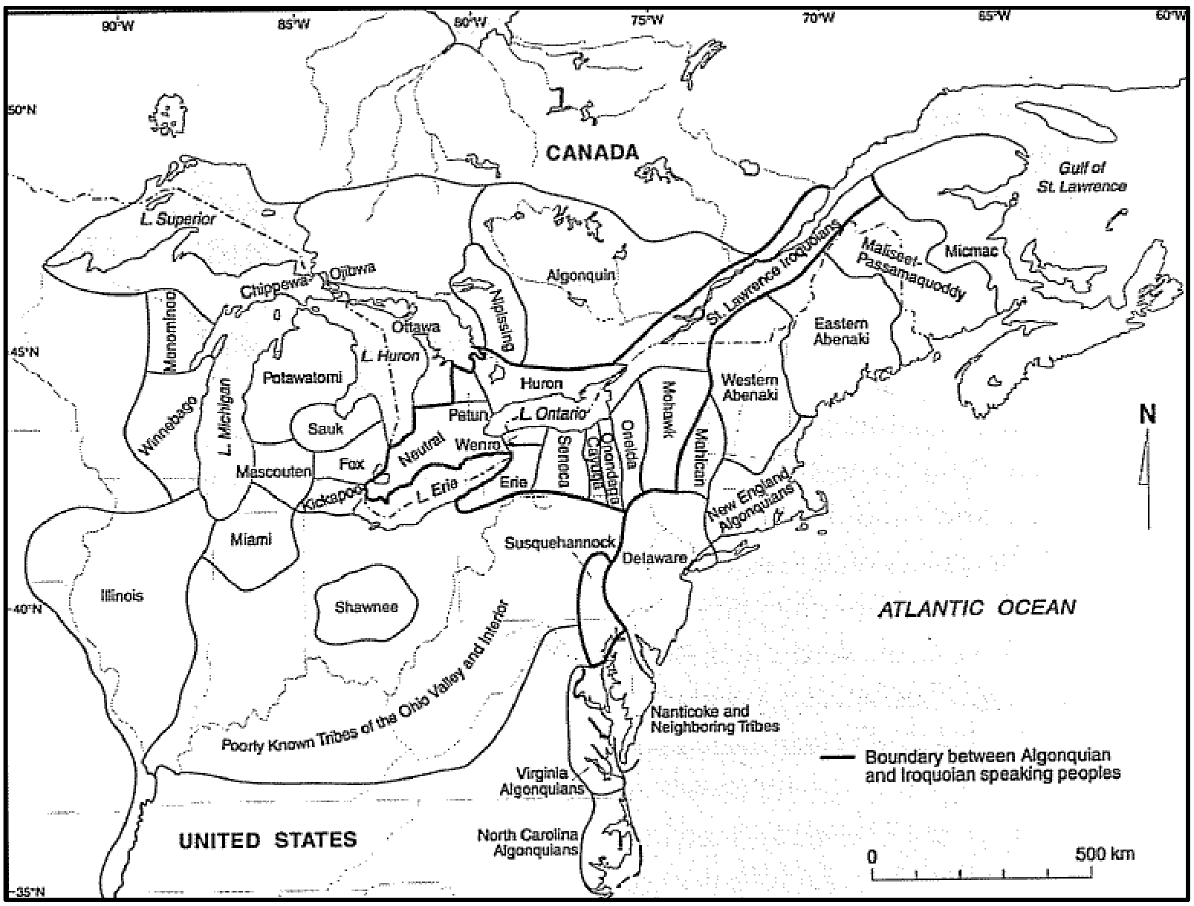


Figure 3.6 "Map of the tribal territories of Northeastern North America" (Turgeon 2004:30)

General resources for information on the early historic-era cultural groups of the Upper Great Lakes include succinct overviews of historically and archaeologically documented

Indigenous peoples in Wisconsin by Carol I. Mason (1997; 1988), and David Overstreet's summary of the scant evidence for a historic Oneota connection (1997:287-292). The more general *Handbook of North American Indians*, Volume 15 (Trigger 1978) remains an additional starting-point for research on particular groups, with much of its content focused on linguistic relationships among each of the groups followed by the extrapolation of linguistic affinities to economic and social interactions. An older but still useful classic historical overview is W. Vernon Kinietz's text, *The Indians of the Western Great Lakes*, which is a compilation of early ethnographic and historical accounts relating to "Huron, Miami, Ottawa, Potawatomi, and Chippewa tribes" (1965). All of these texts were consulted in preparing the following overview.

Archaeologists interested in the initial interactions between Native American groups and European newcomers have invested considerable energy in trying to link historically-documented ethnic groups with distinctive forms of material culture, usually decorated pottery. However, the multiethnic and dynamic interactions of the seventeenth century have largely obscured archaeological distinctions among closely affiliated groups. The Ho-Chunk (Winnebago) and the Menominee have the strongest claims as descendants of those peoples who occupied Wisconsin prior to the seventeenth and eighteenth centuries (Hall 1995; C.I. Mason 1997; Overstreet 2009; Richards 2003). Other Native American groups known to have been in Wisconsin in the seventeenth and eighteenth centuries are the Potawatomi, Anishinaabe (Ojibwe), and Odawa, but the time depth of their residency in Wisconsin is less clear (Mason 1986; Naunapper 2010; Witgen 2012). Huronian peoples took temporary refuge in this region during conflicts with Five Nations Iroquois during the mid-seventeenth century (Garrad 2014; Mason 1986; Trigger 1987). Likewise, the Meskwaki, who today reside in Tama, Iowa, passed through Wisconsin in the seventeenth and eighteenth centuries during a conflict with the French (the "Fox Wars") but did not stay (Behm 1993; 1998; 2008; Stelle 2008; Stelle and Hargrave 2013). To the south, the Illinois peoples who used Danner-style ceramics and were recorded by the French are probable descendants of Sandusky tradition and Whittlesey peoples from northern Ohio and southwestern Ontario (Ehrhardt 2010 and personal communication 2015). To the west, Ioway and Oto groups are thought to be descended from Western (Orr) phases of Oneota (Sasso 1993; Wedel 1981). Other tribes mentioned in historic literature but less visible archaeologically in this region include the Dakota, Sac, Kickapoo, Mascouten, and Miami (Kinietz 1965; Mason 1988). Still other groups such as the Oneida and Stockbridge Munsee are linked to archaeological sites dated later than the early-eighteenth century boundary of my investigations (Mason 1988). The next sections identify points of debate about the origin, movements, social connections, and archaeological signatures of the groups most relevant to this project.

3.2.1 Original Residents: Ho-Chunk (Winnebago) and Menominee Archaeology and Ethnogenesis

The seventeenth century territories of the historically-documented Ho-Chunk (Winnebago) and Menominee tribes in Wisconsin and their connection to earlier, archaeologically-documented groups has been a long-standing research question for Wisconsin archaeologists and ethnohistorians. As discussed in the previous overview of theoretical concepts applied in this dissertation (in section 2.3.2), there is an ongoing debate both in this region and in archaeological theory in general about what kind of evidence is necessary to connect a historically documented tribe or ethnic group to an archaeologically documented culture. See R. J. Mason (1976; 1997; 2014) and Overstreet (1993; 2009; 2014) for recent discussion in Wisconsin and Jones (1997) for broader discussion of ethnicity. Ronald J. Mason has argued for a more rigorous "site-unit" ethnicity, while Overstreet is more willing to accept a broader premise of "territorial ethnicity" that traces the locales of ethnic groups at a broader regional scale on the basis of shared material culture.

3.2.1.1 Ho-Chunk

Ethnographic, archaeological and historical evidence links the Ho-Chunk to previous cultural-groups of Wisconsin, particularly the eastern Oneota. The key ethnographic reference for the Ho-Chunk people has been the work of Paul Radin (1923). Radin was an early twentieth century ethnographer and historian of the Ho-Chunk (Lurie and Jung 2009:142-143), whose works (especially Radin 1923 [1970]) are widely cited in discussions of Ho-Chunk origins and ethnogenesis (e.g. Griffin 1960; Hall 1993). Radin conducted most of his fieldwork in Nebraska, with descendant communities of Winnebago peoples there; he concluded that the Ho-Chunk had moved into Wisconsin from the Southeast (Radin 1923 [1970]). Reviewing additional ethnohistoric evidence, Lurie and Jung argued instead for a Mississippian connection and Aztalan-based ancestry for Wisconsin groups of Ho-Chunk (2009: 112).

The origins of the Ho-Chunk remain equivocal in oral traditions, but archaeologists have generally considered the Ho-Chunk to be descendants of peoples who used eastern Oneota-style ceramics, especially the Lake Winnebago Trailed type (McKern 1945; see critical discussion in C. I. Mason 1976; and an overview in Overstreet 1993:120-121). R. J. Mason continues to reiterate the lack of clear material evidence linking prehistoric Oneota groups to any historically documented Ho-Chunk sites (2014:72). R. J. Mason's earlier overview of the long-standing debate about Winnebago origins (1993) is the still the clearest and most up-to-date comprehensive summary of this topic. Staeck (2000) presented a model for tracing Ho-Chunk origins through the archaeological record of the past 1,000 years while Hall (2003) examined the relationship of the Ho-Chunk to the Red Banks locale, which seems to have been at the heart of their original territory, and the complex interactions among many historically-documented groups during the early seventeenth century. Historians and archaeologists generally identify the "*Puant*" or "*Puan*" people who met Jean Nicolet as Ho-Chunk or Winnebago living in the Green Bay area or specifically Red Banks at the time of contact (Lurie and Jung 2009; see Hall 1995 for more critical discussion). Mason has recently reconsidered the archaeological and documentary evidence regarding the encounter between the Ho-Chunk people and Nicolet, arguing that Ho-Chunk territory in the seventeenth century could have extended to seasonally-occupied locales near Lake Superior (2014).

3.2.1.2 Menominee

The Menominee People are also considered to have the deepest historical and archaeological connections to territories in eastern Wisconsin. Lurie and Jung argued that Nicolet actually encountered the Menominee, not the Ho-Chunk, near Marinette, Wisconsin, on the basis of their reading of the historical record and ethnohistoric reports (2009:51), but a recent review of evidence for the meeting of the Winnebago and Nicolet challenged Lurie and Jung's interpretations (Mason 2014). Overstreet (2009) has synthesized the long history of archaeological and ethnohistoric attempts to connect the Menominee people to pre-contact cultures of the archaeological record, arguing that the Mero complex of ceramic styles (Mason 1966) might represent a link to this past. To support this assertion in the absence of direct archaeological evidence of association between trade items and Mero-style ceramics, Overstreet worked from the premises of ethnohistoric references to Menominee origins and traditional territories. He has recently argued that the Peshtigo Point site (47MT165) may meet the final three of Mason's stringent criteria for site-unit ethnicity of a Menominee site (Overstreet 2014:51). However, since trade items have not been located in direct-association with Mero-complex ceramics at the site, but rather were recovered in surface collections, ambiguity remains. Excavations at the intact portions of the site could clarify this connection, and there is some agreement about the link between late-prehistoric Mero sites and Overstreet's hypothesized connection to the Menominee (Bruhy and Egan-Bruhy 2014:48).

With debates among past and present archaeologists and historians notwithstanding, the Ho-Chunk and Menominee people of the present consider themselves to be the original inhabitants of Wisconsin, as reflected in their oral traditions (compiled in Tigerman 2006:11-88), and these groups remain the best candidates for long-term cultural continuity in Wisconsin.

3.2.2 Population movements of other ethnic groups in the Upper Great Lakes

Beginning in the seventeenth century, deteriorating trade relationships and increasing conflict east of the Upper Great Lakes led to the westward migration and diaspora of many different groups of Native peoples. These movements and conflicts are documented in historic texts as well as archaeologically, but these population movements often resulted in the dispersal of cultural groups and the re-formation of new multi-ethnic communities, making it difficult to identify particular ethnic groups solely on the basis of archaeological evidence. Nevertheless, archaeologists have documented locales of possible Potawatomi, Huron, and Meskwaki residence in Wisconsin, mainly by connecting archaeological site locations to places identified in historic texts and maps that named the predominant ethnic identity of Native groups. The distinct ceramic types of these sites become associated with particular peoples. The direct historical approach seeks to link present-day tribes to past peoples, and this has been used as well, particularly by Meskwaki scholars tracing their peoples' past migration through the Upper Great Lakes (Buffalo 2008; Gearing 2009). These approaches allow a general understanding of the link between past and present peoples in the region, but they may conflate multi-ethnic villages or misidentify locales of hybridized cultural groups as affiliated with the single, predominant group. Such one-to-one identifications also gloss over the effects of trade in ceramics, or the production of multiple ceramic types within a single village.

3.2.2.1 Potawatomi

The Potawatomi presence in Wisconsin seems to have begun in the early-mid seventeenth century, and Mason places their late prehistoric-protohistoric location in western lower Michigan (1986:15-20). The historical record first mentions the Potawatomi in the *Jesuit Relations* as the group that Nicolet met in 1634 in the Green Bay area (Clifton 1977, 1998; Kinietz and Raudot 1965), but Lurie and Jung note that the Potawatomi were more likely still in Michigan in 1634 (2009:11-12). The Potawatomi also appear periodically in the historical record in descriptions of other sites of early interaction, including Sault Ste. Marie and Rock Island (O'Gorman 2007a: 391-392). Based on ceramic evidence from both Western Michigan and Wisconsin sites, scholars have long argued that the Algoma Modified Lip (formerly Bell Type II) ceramic style represents Potawatomi group ethnicity during the early historic period (Mason 1986; Naunapper 2007, 2010; Quimby 1966; Wittry 1963).

In a comparative regional survey of grit-tempered ceramic types with the distinctive “pie crust” lip-notching of Algoma Modified Lip vessels, Naunapper tested the hypothesis that Algoma Modified Lip pottery can be used to trace the Potawatomi “forced migration” (2007:156) westward and then north into the Green Bay region from the lower peninsula of Michigan during the seventeenth and eighteenth centuries (2007:141-183). Naunapper identified Algoma Modified Lip pottery similar to that at the Bell Site at some, but not all of her study sites associated with the Potawatomi, and she suggested that the description of modified-lip types in Michigan generally differs from the identification of this type in Wisconsin (2010: 36-37). She also suggested that close cultural relationships among the Potawatomi, Odawa, and Ojibwe (Anishinaabe) groups would have structured their migration trajectories, as each group took separate paths into distinct territories in present-day Wisconsin and Upper Michigan (Naunapper 2007:162-164). No protohistoric Potawatomi sites from Michigan have Algoma Modified Lip or similar ceramic types in direct association with European-made blue glass beads or smelted copper objects. Therefore, no potentially protohistoric Potawatomi sites, such as the Moccasin Bluff or Schwerdt sites (see Naunapper 2010; O'Gorman 2007a), were included in my study.

3.2.2.2 Huron

Huron people also were relative newcomers to Wisconsin in the early-mid seventeenth century, as they fled increasingly violent conflicts with the Five Nations Iroquois in the eastern Great Lakes region (Kinietz 1965: 1-4). The movements of related Huron, Petun, and Odawa (proto-Wyandot) groups into the Upper Great Lakes region during the seventeenth century have been traced through the *Jesuit Relations* and other documentary evidence (Trigger 1987). However, Huron people moved in small groups rather than as a single unit, probably joined with other groups or relatives, and dispersed across the landscape in a general fashion, making it especially difficult to use the archaeological record to reconstruct their movements. When "Huron" groups do appear in historic documents as affiliated with a particular location, such as Marquette's mission in St. Ignace (Branstner 1991; 1992), they may be the linguistically or numerically dominant group at the time the document was written. Subdivisions of Huronian groups such as the Tionontate and the ethnogenesis of new groups like the Wyandot further complicate ethnic identifications of the "Huron" using material culture in the archaeological record (Branstner 1992: 177-181; Garrad 2014; Trigger 1987).

Since many different ethnic groups are known to have spent time at a given locations, it is difficult to affiliate particular forms of material culture with distinct ethnic groups. Huron-style ceramics are the basis of archaeological identifications of this group in the Upper Great Lakes. At Rock Island, Huron-incised pottery is the key artifact that leads to the attribution of the c. 1650 occupation as a possibly Huron-Petun-Odawa (proto-Wyandot) site, connecting a historically-documented group of refugees to that site (Mason 1986). Likewise, Huron-style pottery recovered on Madeline Island has been used to propose a pre-1660 occupation there (Mazrim 2011). The archaeological evidence for Huron occupations in eastern North America is extensive (Garrad 2014), but the effects of migration on material practice are poorly understood, making it difficult to identify Huron-affiliated archaeological sites in the Upper Great Lakes.

3.2.2.3 Meskwaki (Fox)

The history of the Meskwaki people also involves seventeenth and eighteenth century migration and removals, beginning with a place-of-origin east of present day Michigan, perhaps as far east as the St. Lawrence River near Quebec, according to traditional accounts (Buffalo 2008; Gearing 2009). The “Fox Wars” between the French and the Meskwaki are the defining events of their time spent in Wisconsin during the late seventeenth and eighteenth centuries until their eventual relocation and settlement in Tama, Iowa today (Edmunds and Peyser 1993; Alex 2008). The rich historical records of Meskwaki and French conflicts has allowed for fulfillment of site-unit ethnicity criterial at the Bell Site.

The Bell Site is the type-site of the historic-era Meskwaki, as they moved in groups into the Lake Winnebago and Fox Valley region, as documented in the ethnohistoric and archaeological record (Behm 2008). Archaeological research of Meskwaki lifeways at the Bell Site, or the Grand Village of the Meskwaki, has investigated many types of material culture, including ceramics (Behm 2003; Wittry 1963) and trade items (Bodoh 2004; Hunter 1997; Lorenzini 1998) and revealed evidence of community organization (Behm 1993, 1998, 2008; Walder et al. 2015) and subsistence practices (Blake and Cutler 1963; Koziarski 2012). Recent documentary and archaeological research has also confirmed the location of the 1730 battle between the French and Meskwaki in Illinois, at the Arrowsmith site (Stelle 2008; Stelle and Hargrave 2013). The distinctive ceramic style of the Meskwaki for their time in Wisconsin is Butte des Mortes ware (formerly Bell Type I), which was originally identified at the Bell Site (Wittry 1963) and has been used to classify other sites in Wisconsin as affiliated with the Meskwaki (Behm 2008).

3.2.2.4. Anishinaabeg (Ojibwe)

The Anishinaabeg, who are also referred to as the Ojibwe or Chippewa, are a group traditionally thought to have resided in northern Wisconsin and the Upper Peninsula during the seventeenth and eighteenth centuries (Kinietz 1965:317-320). “Chippewa” is a Westernized, general term that refers to various peoples who might have been present on the shores of Lake Superior during the fur trade era (Birmingham and Salzer 1984:15-21). Earlier ethnohistorians viewed “Chippewa” culture as a relatively recent phenomenon of ethnogenesis, as small bands of people living in the Sault St. Marie region experienced acculturation after European contact and developed an identity as trade middlemen (Hickerson 1963; 1974 1988; Wolf 1982:172). More recent scholarship traces Anishinaabeg customs and traditions farther back in time. Angel (2002) and Weeks (2009) review evidence of the Midewiwin ceremony as a long-standing cultural tradition. Witgen problematizes writing the history of the Anishinaabeg, whose name he translates as “human beings” or “original people” (2012:44), noting that when used as a self-referent, it refers to a sense of belonging to a diverse range of peoples with particular kinship and clan identities. He argues that Anishinaabeg identity preexisted European contact but became more defined through new alliances and ceremonies promoting group solidarity, such as the Feast of the Dead, borrowed from Wyandot neighbors (2012:31-35). Patty Loew of the Bad River Ojibwe notes that "Anishinabe" refers to a specific alliance between the Ottawa, Ojibwe, and the Potawatomi, and their original home is the Great Lakes region (Tigerman 2006:91).

The processes of Anishinaabeg ethnogenesis, migration, and alliance-building with affiliated tribes make it difficult to identify Anishinaabeg sites in the archaeological record. There are no specific sites included in my research project that are definitively linked to the Anishinaabeg at the level of site-unit ethnicity. However, investigators of both the Cadotte Site and the Marina site have argued on the basis of historic records that Ojibwe groups were a significant population on Madeline Island during the seventeenth and eighteenth centuries (Birmingham 1992, 2005, 2009; Birmingham and Salzer 1984; Mazrim 2011). No single ceramic type is associated with the Anishinaabeg in the Upper Great Lakes, but their presence is hypothesized because of their significant role in the French fur trade, numerous references to this area on maps and in trade records, and according to oral histories of present-day Ojibwe groups who trace their ancestry to Madeline Island. Birmingham and Salzer suggested that two ceramic types documented at earlier sites in the northern parts of Wisconsin and Michigan, Blackduck and Sandy Lake wares, might be the predecessors of the scant ceramic assemblage recovered at the eighteenth century Ojibwe-affiliated Marina site (Birmingham and Salzer 1984:189).

3.2.2.5 Illinois

Illinois identity is likewise difficult to assess and connect to earlier archaeological materials. The earliest mentions in the historical record places the Illinois at war with the Ho-Chunk in 1634, the so-called "Puant Wars" in which the Ho-Chunk population was almost completely decimated by an alliance of tribes including the Illinois (see Rosebrough et al. 2012:20-22). During this period, the Illinois peoples are closely linked with Miami groups, possibly due to shared common ancestry (Mason 1988:93). Hall hypothesized that the Kaskaskia-Illinois people were relative strangers to southeastern Wisconsin and the region surrounding the Illinois River, where European explorers encountered them in 1673 at the "Grand Village of the Illinois" (Hall 1993:55). Danner style ceramics have been conclusively linked with Illinois peoples (Ehrhardt 2010: 265; Hall 1993:25-27). Today, archaeologists generally agree that the cultural group using Danner Ware originated in northern Ohio and Southwestern Ontario, around Lake Erie (Ehrhardt 2010; Mazrim and Esarey 2007). Archaeologists also have made many attempts to connect other ceramic style types found in Illinois to various historically-documented groups during the "protohistoric" (Bird 2003; I. W. Brown 1979; J. A. Brown and Sasso 2001; Ehrhardt 2004, 2010; Mazrim and Esarey 2007; Rohrbaugh et al. 1999). For example, Ehrhardt notes that Huber phase Oneota pottery in Illinois has most recently been linked with the Ho-Chunk (Winnebago) living in Illinois territory (2010).

3.2.2.6 Ioway

Finally, the historically-documented Ioway people are somewhat confidently linked to western groups of Oneota living in the Upper Mississippi Valley in Iowa, western Wisconsin, and eastern Minnesota (Gallagher 1990; Henning 1998, 2004; Sasso 1993; Skinner 1926; Wedel 1981, 1986). In this region, Orr phase Allamakee Trailed Oneota pottery is most frequently linked to the Ioway (Betts 1998; Gallagher 1990:63). Historical documentation likewise places Ioway and Oto groups in this region at the turn of the eighteenth century (reviewed in Wedel 1981). Oneota material culture in conjunction with European trade items is a relatively rare phenomenon in eastern Wisconsin, yet surprisingly common in the seventeenth century in the

Ioway region, for example at Farley Village, Wanampito, and other Ioway sites discussed below (Gallagher 1990; Whittaker and Anderson 2007, 2008). For this reason, Ioway sites were included in the study for comparative purposes, despite their geographic location on the far western boundary of the Upper Great Lakes region.

3.2.3 Summary of significance of historical record for archaeological interpretation

Sections 3.1 and 3.2 have summarized the existing historical interpretations of ethnic groups present and population movement in the Upper Great Lakes region c. 1630 – 1730. Trade records and inventories, journal accounts, and historic maps all provide documentary evidence of the materials and routes important for trade and exchange during this period. Historically-documented patterns of trade can become visible archaeologically through assessments of chemical compositions of glass trade beads from sites across the region. Efforts to connect archaeologically-visible cultures and diagnostic material types to historically-known ethnic groups or other social constructions have met with limited and varying degrees of success in this region because of dynamic population movement, extensive trade, scant archaeological signatures, and the problematic practice of linking historically-documented peoples to particular ceramic types rather than a variety of materials and styles. However, ethnohistoric records and oral traditions attest to the incorporation of blue glass trade beads and ornaments made from modified copper-base metal in Indigenous value systems and have highlighted their importance as socially-significant personal adornments. Since material evidence for addressing ethnicity in the archaeological record of this region has overly relied on ceramic typologies, studying the historical evidence for the significance of personal adornments provides another avenue to address ethnic identity performance in the historic-era Upper Great Lakes. This dissertation project examines the ethnic attributions summarized above to see if or how they are supported in other material contexts: blue glass trade beads and copper-based metal objects.

3.3 Archaeological Background

My dissertation examines archaeological materials that have been recovered at 38 different locales throughout the Upper Great Lakes region, mostly through site-specific projects such as field-schools and cultural resource management (CRM) investigations. I did not identify any relevant sites that were first observed in survey projects but not excavated further; this is probably because the archaeological signature of early interaction sites is often ephemeral and may consist of only a few items from an entire excavated assemblage. However, a few surface collections that produced trade items were included in the study sample. In the Upper Great Lakes region, some archaeologists have developed research programs targeted at identifying all known archeological sites affiliated with a single tribe (Behm 2008), systematically seeking a one to one correlation between specific ceramic styles and ethnic groups (Naunapper 2010; Mazrim 2011), or searching for a direct-historic connection between an archaeological cultural tradition and historically-documented tribes (e.g., Mason, C.I. 1976; Overstreet 1997).

My broader regional perspective is a new contribution to late-prehistoric and early historic era research investigating relationships among the many different Native American ethnic groups present in the Upper Great Lakes at the time of European contact. Developing this dissertation project provided an ideal opportunity to summarize existing knowledge about proto- and early-historic interactions in the Upper Great Lakes and gather a new data-set through methods that may not have been available or accessible to the original site excavators. Because the 38 archaeological sites included in this project were excavated or investigated over a span of at least the last 80 years, techniques of excavation and recovery vary significantly among the sites. The following sections summarize the site selection process, extant archaeological evidence for this region, and the relevant excavation history of each archaeological site.

3.3.1 Summary of Archaeological Evidence

The prehistoric culture-history of the Upper Great Lakes region (Table 3.3) need not be disconnected from archaeological investigations of the historic era. Long before European contact, Indigenous people of the Upper Great Lakes traded and manipulated raw materials in complex ways. The first peoples of Wisconsin, present during the Paleo-Indian period, were migratory bands of hunters and foragers, but post-Pleistocene climate shifts and extinction of megafauna led to technological changes in Native lifeways. Of particular relevance to this dissertation are the metallurgical practices of the Old Copper Industry, which began c. 5,000 – 6000 BC in Wisconsin (Pleger 2000), and continued through to the historic period (Schroeder and Ruhl 1968). The development and applications of native-copper working technology are particularly well-documented (Brown 1904; Fox 1911; Griffin 1961; Martin 1999; Martin and Pleger 1999; Penman 1977; Pleger and Stoltman 2009; Quimby and Griffin 1961; Wilson and Sayre 1935; Winchell 1881; Wittry 1957). During the Archaic period, native copper was primarily used for utilitarian items, but by the end of the Archaic and the beginning of the Woodland Tradition in Wisconsin, emphasis had shifted to personal adornments (Pleger 1998), and the use of copper ornaments in the Upper Great Lakes continued through the Oneota period (Hall 1995; Henning 1995). Although native copper does outcrop in sheet-like formations near the Lake Superior, when copper and brass trade kettles became available, they became another, more accessible source of metal that could be easily formed into ornaments and other objects. Therefore, introducing European smelted copper to this region provided Indigenous people with a new supply source for a technologically well-understood raw material already imbued with social and ideological significance (Fox et al. 1995; Miller and Hamell 1986; Turgeon 1997).

Table 3.2 Culture History of Wisconsin

Tradition or Culture	**Southern Wisconsin**	**Northern Wisconsin**	**Notes and Sources**
Paleo-Indian	10,000 – 8,000 BC	c. 9,000 – 6,000 BC	(adapted from Birmingham et al. 1997; Martin 1999:142) Dates are generally less secure for Northern WI. The Late Woodland tradition may have persisted until historic times in some areas (McPherron 1967).
Archaic	8000 – 500 BC	c. 6000 BC – AD 0	
Woodland	500 BC – AD 1100	c. 100 BC – 1600	
Middle Mississippian	c. AD 1050 - 1200	n/a	
Oneota	AD 1000 – 1600	c. AD 1100 – 1600	
Proto-historic	c. AD 1550 – 1680		as in Illinois (Ehrhardt 2010:257)
Early Historic	AD 1610 – 1670		As proposed for the Western Great Lakes by Quimby (1966), but problematic because of its culture-historical and acculturative implications
Middle Historic	AD 1670 – 1760		
Late Historic	AD 1760 – 1820		

The culture history for the historic period is problematic and not very well defined. George Irving Quimby (1966) used material culture change to delineate a historic chronology in the Western Great Lakes region by assessing the relative degree of acculturation present in Native American archaeological assemblages. Quimby’s broad categories of early, middle, and late historic eras relied on the relatively few type-sites that had been excavated at the time, and he used the acculturation model to argue that as time passed, Native American material assemblages would include more European-made trade items and fewer “traditional” materials like Native-made ceramics or stone tools. Although it is now out of date in terms of known sites and theoretical validity, archaeologists continue to use Quimby’s periods to divide the historic era, probably because no clearer way of discussing the chronology has yet been developed.

Dean L. Anderson proposed an alternative chronology for AD 1600 to 1760, which spans the French Fur Trade period. Andersons designated periods on the basis of the extent of French influence as documented historically and archaeologically, rather than focusing on technological change and acculturation (1992: 11-33). An Early period (1600-1650), a Transitional period

(1650-1715), and an Expansion period (1715-1760) reflect key developments in the expansion of the French trading enterprise in North America (1992: 12). Although primarily delineated by textual references and trade records, Anderson reviewed archaeological signature of each period, making the chronology useful for archaeologists as well as historians. Documentary evidence indicated that some European trade items should have reached the Western Great Lakes by the Early period, primarily through down-the-line trade through existing Native exchange networks rather than directly from French traders, but that little archaeological data supported this (Anderson 1992:16-17.) Anderson noted that “One is hard-pressed to find an example of European trade goods in a solidly-dated, pre-1650 archaeological context in the Great Lakes region west of Lake Huron” (1992:19). This statement is generally true today, although there are some better candidates for the earliest sites in the Upper Great Lakes, such as Goose Lake Outlet #3, New Lenox, and the Hanson site, which have been excavated since Anderson’s publication.

Quimby’s culture history and Anderson’s Fur Trade chronology do not include specific material correlates for the poorly-understood time immediately following late prehistoric Oneota activities in the Western Great Lakes, which might be defined as a “protohistoric” period. In North America, a protohistoric period is identified on the basis of Native archaeological sites with some European-made materials present but lacking historic records, maps, or European travel accounts that describe the site or region (Ehrhardt 2010; Mazrim and Esarey 2007). In Wisconsin, the protohistoric corresponds roughly to Anderson’s Early period, and the first half of Quimby’s Early Historic. Ehrhardt extended the protohistoric era back to AD 1550 for the Illinois region, and it is not unreasonable to do the same for the Upper Great Lakes, given the geographic proximity and extant trading connections in the Midwest. During an assessment of historic archaeological research in Wisconsin, Goldstein noted “the biggest data gap for this period in this region is that early historic Native American sites are essentially unknown – they have not been found, or we have not been able to identify them as such" (1997:152). This statement applies equally well to other areas of the Upper Great Lakes. At the Rock Island site, Lake Winnebago Focus Oneota ceramics (dated to c. AD 1300 – 1600) have been found in association with European trade goods (Mason 1990:123), but otherwise, there are no published reports of "prehistoric" pottery in secure context with European-made items at Wisconsin sites.

Epidemic disease, warfare, and cooler, shorter growing seasons create challenges in understanding the extent of protohistoric and late prehistoric cultures in the archaeological record of the Midwest (Betts 2006; Green 1993; Henning 1995; Overstreet 2009:153-162). The European presence in and expansion outward from eastern North America exacerbated an Iroquois "war of extermination" against Algonquin groups in the Eastern Great Lakes, forcing a wave of refugees westward, likely resulting in new social relationships and conflicts among local and non-local indigenous groups. For example, warfare between the Illinois and the historic Ho-Chunk (Winnebago) reduced the latter group to a single village by 1640 (Hall 1993:17-20). In the Upper Great Lakes region, the results of dynamic interactions and harsh living conditions were the formation of multi-ethnic villages and the development of new trading relationships with local communities and incoming French missionaries and fur traders (Ehrhardt 2010; Hall 1995; White 1991). Milner and Chaplin (2010) proposed that the Upper Great Lakes region was sparsely populated even in AD 1500; therefore, post-contact conflict and epidemic disease in the region may have further reduced the human presence on an already thinly-inhabited landscape. This model of population movement and decline mirrors the archaeological record of Wisconsin: early sites with European trade goods are few in number and tightly clustered, requiring the use of innovative research strategies to examine scant material traces that may clarify the chronology and possibly reflect the fluidity of social and ethnic affiliations and relationships.

The initial historic-era occupations of most sites in my dissertation study sample fall into a period of transition to greater French control of trading networks and more readily-available European-made trade items, which Anderson described as the Transitional Phase of the Fur Trade, AD 1650 to 1715. Conflicts between the French and English as well as among their Native trading partners took place in this tumultuous time between the Huron dispersal and the Treaty of Utrecht (Anderson 1992:24-30). Like Quimby (1966), Anderson noted a significant increase in the availability of trade items coming from archaeological contexts after 1670. French fortifications at Michilimackinac and Fort St. Joseph were constructed in the transitional phase, but increased in importance during the subsequent Fur Trade Expansion phase, AD 1715 to 1760, until the end of the French control over the trade and territory in the Great Lakes region (Anderson 1992: 30-32). Temporally diagnostic artifacts of the Transition and Expansion phases include glass beads, “Jesuit” rings, firearms, other adornments, and other European-made material culture. A revised archaeological chronology that incorporates both historical events and diagnostic material culture types of the Upper or Western Great Lakes region is long overdue; however, I employ Quimby’s and Anderson’s terminologies as needed in my discussion of the archaeological sites in this dissertation since the material culture examined in the project did not extend to all temporally sensitive artifact types.

3.3.2 Site Selection

There is no comprehensive integrated database of archaeological sites for the Upper Great Lakes region of North America. Individual states keep track of site information in different ways, usually through some form of a state archaeologist’s office, as in Wisconsin, Michigan, Iowa, and Illinois. In addition, other institutions maintain comprehensive site records, like the Illinois State Archaeological Survey (ISAS). It is only possible to comprehensively search these databases by visiting each curating institution, though often the local knowledge of curators proved more helpful than the databases themselves. The goals of site selection were:

1. Compile a comprehensive list of known sites in the Upper Great Lakes region with material evidence of European-made trade items occupation prior to c. 1730.
2. Determine if artifact collections from the listed sites included blue glass beads or modified smelted copper-base metal objects, such as tinkling cones.
3. Confirm that relevant assemblages actually would be available for physical study.

The list of archaeological sites included in this project grew organically, beginning with a search of the Wisconsin Bibliography of Archaeological Resources (BAR), now known as the Archaeological Sites Inventory (ASI). The ASI is searchable by time period, ethnic group, material type, and many other criteria. To identify an initial sample of sites in Wisconsin, I searched for locales where glass trade beads had been identified in historic Native American contexts. When searched in 2011, the BAR database did not have a temporal category for late prehistoric or protohistoric sites, just a general "historic" category. Therefore, initial searches for both "historic" and "prehistoric" sites culturally-identified as "Native American" with artifacts identified as "glass bead," "glass," "tinkling cone," "tinkler," "kettle," and "kettle scrap" produced several hundred records, which I then checked through individually. Most sites that met the search criteria were excluded because they contained much later European materials, which were inventoried in the site record but are not searchable terms. The goal of identifying unpublished or unrecognized protohistoric sites via database searches was largely unsuccessful, since smelted European copper objects could be misidentified as native copper in an otherwise "prehistoric" assemblage, and Euro-American occupations overlaying protohistoric sites could have mixed with earlier components, causing me to eliminate a site with a later European-made objects on the basis of the site record alone, which might list "glass beads" but would not always include further analysis or description.

There have been publications on several well-known sites in the region, including Bell, Rock Island, and Marina, which were excavated using modern professional excavation techniques. I used these sites as the starting points for my research project, which helped me make connections with scholars familiar with the early sites of the region. Early in the research process, I also participated in a reanalysis of the Hanson site, which is possibly Wisconsin's earliest excavated burial site yielding European-made trade items (Overstreet 1993; Rosebrough et al. 2012). By working on the Hanson project with Wisconsin Historical Society staff, collaborating with curators of other collections, and tracing excavation histories in published literature, I identified less well-known sites to include in the study.

As funds became available, I expanded the research program geographically to include adjacent regions. The Marquette Mission site was targeted because of its relatively early dates (AD 1670 – 1701), strategic geographic location in the Straits of Mackinac, historic role as a site of cultural interaction, and accessible collection at Michigan State University (MSU). Other early historic collections from Michigan were added as more funding became available, based on suggestions from scholars at MSU and the Michigan SHPO. I included sites in the Illinois region in order to dovetail the data gathered in Wisconsin and Michigan with information from Kathleen Ehrhardt's work with Iliniwek Village, sites where the metals analysis method that I used was originally developed. Metals from Zimmerman and Arrowsmith were analyzed with Ehrhardt over a one-week period in summer 2013 to confirm that our categories of analysis were standardized and ensure the method of metal attribute analysis applied in larger region remained comparable with the data from sites where the method was developed. Since I am confident that the analysis method was standardized, I did not re-analyze metals from Iliniwek Village, where Ehrhardt had already conducted research (2014; 2005), but I use the published Iliniwek Village data for comparison with my data set, integrating Ehrhardt's work into my larger regional study.

There are known early historic or possibly protohistoric locales that were unavailable for study for various reasons. Some of these sites, like Lasanen (Cleland 1971) and the later Fletcher site (Mainfort 1979, 1985) were burial locales and have been repatriated. Other assemblages, from Clay Banks (unpublished, located at Milwaukee Public Museum; see note in Hall 1947) and Summer Island (Brose 1970), were not included because research loans of artifacts were unavailable. Some sites were investigated initially but not fully examined; for example, the Crabapple Point and Carcajou Point sites may have had seventeenth century occupations, but ongoing excavations by UW-Milwaukee and collections-based research of earlier investigations (Hall 1962; Spector 1975) have not identified any early historic component in the Lake Koshkonong vicinity. However, see Birmingham (2014) for a discussion of the possibility of a historic-era Oneota component on Lake Koshkonong. Finally, some collections exist only in private hands or as the result of individual surface collections, though relevant portions that were accessible, as in the case of Gros Cap (Quimby 1963; Nern and Cleland 1974; Martin 1979). Surface collections were investigated whenever possible, but not comprehensively, as there is certainly no master list of the holdings of avocational collectors in the state of Wisconsin or elsewhere. For the sake of completeness and to aid future researchers with a comprehensive list of all known early historic archaeological sites, sites researched but not included in my dissertation research are discussed further in Appendix A, denoted with an asterisk.

In summary, the archaeological sites investigated in this research project are in no way a scientific sample of a known number of total archaeological sites in this region with glass trade beads and copper-based metal items deposited prior to AD 1730. Rather, discussions with curators and other archaeologists led me to include relevant sites that they knew about in their collections or had investigated previously. This method often allowed me to add in very small sites that all too often get lost in the gray literature. This could be described as a "snowball sampling" method (William Lovis 2013 pers. comm), because the list of sites included grew with each additional collection examined, on the recommendation of experts in that particular region.

3.4 Archaeological Sites Investigated

This section briefly describes the excavation history of each assemblage that was fully investigated during the present dissertation research project (Figure 3.7). The sites span five states, 80 years of excavation history, and several geographic area inhabited by different ethnic or social groups historically documented in the Upper Great Lakes region. They include French-occupied trading centers, historically-documented Native habitation sites, and sites not connected to known territories of particular ethnic groups, all of which contribute to understanding the movement of trade items via socially-structured exchange networks. I present and critically evaluate any extant hypotheses or conclusions that original excavators developed regarding the social, ethnic, or tribal identity of indigenous peoples living at the site, and I summarize culturally or temporally diagnostic artifacts recovered. For each assemblage, the archaeological materials investigated a part of this dissertation research are also enumerated in a summary table (Table 3.3). Sites in this section are organized by geographic area and attributed ethnic affiliation (Table 3.4). Since site assemblages differ greatly in size and the number of artifacts analyzed, and decisions on whether to investigate metals, glass artifacts, or both differed based on the nature of archaeological contexts and recovery methods, the overall contribution of each site is summarized to highlight the most important sites for my project (Table 3.5 and Figure 3.8).

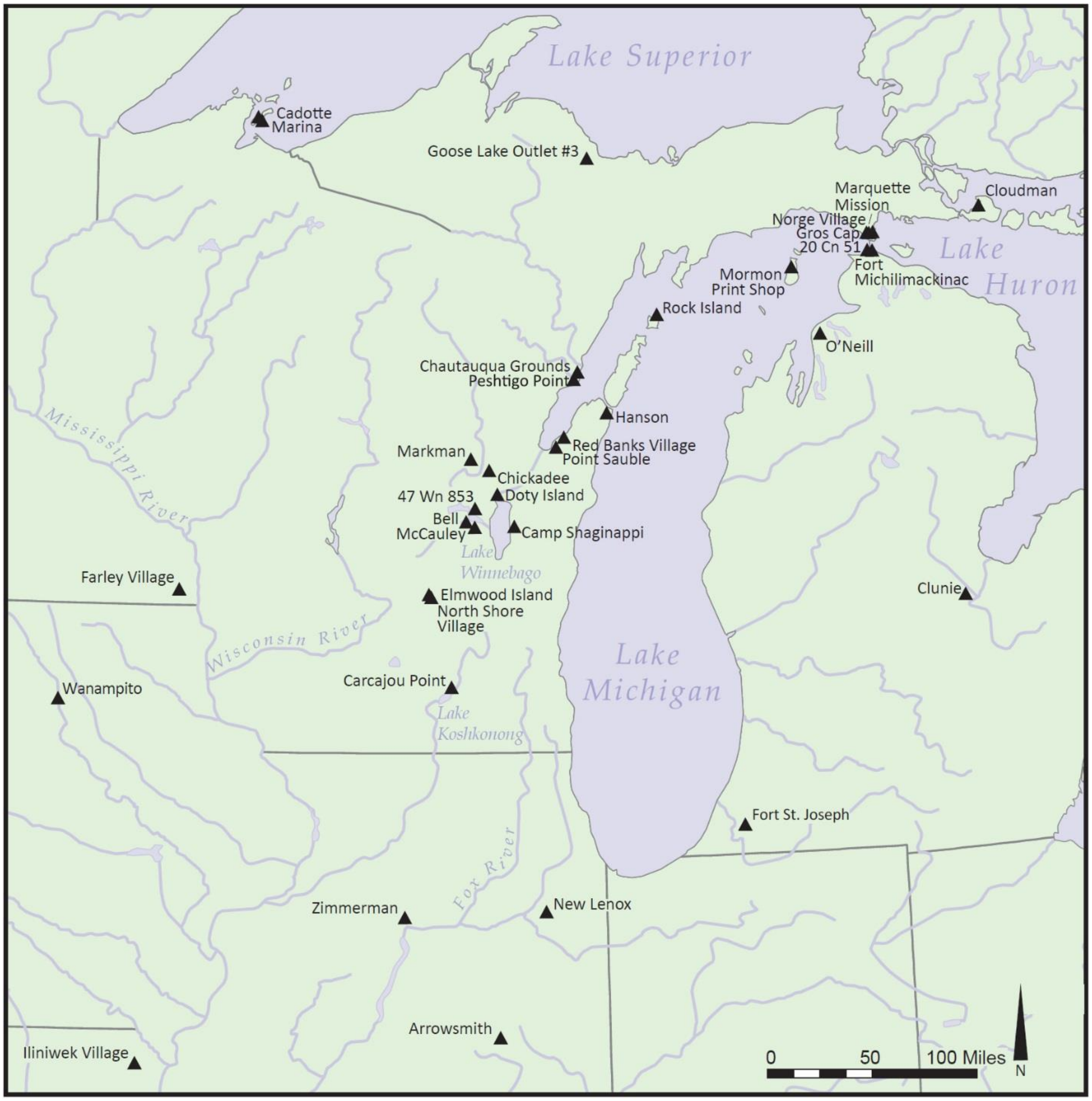


Figure 3.7: Map of archaeological sites investigated, excluding Gillett Grove and Milford in northwestern Iowa and La Salle Shipwreck site (La Belle) and associated on-shore contexts, Matagorda Bay, Texas

Further technical excavation details, extended historical background, additional commentary, and discussion of related and partially-investigated sites can be found in Appendix A.

Table 3.3: Summary of temporal information, areas, curation facilities, artifacts and key literature for study sites. Total metal artifacts n=3,705; total glass artifacts n=876.

Site name	**Possible dates of occupation**	**Curation facility**[1]	**Metal artifacts n=**	**Glass artifacts n=**	**Key literature**
20 CN 51	c.1670 - 1730	MOSA	15	0	Anderson 1992
47 WN 853	17th C?	UWO	8	0	unpublished
Arrowsmith	c 1730	ISM	27	3	Stelle 1992, 2008;
Bell	c. 1680 – 1730	UWO	958	36	Behm 2008; Lorenzini 1995
Cadotte	Mid-late 17th C	MIM, WHS	29	10	Mazrim 2009, 2011
Camp Shaginappi	17th – 18th C.	UW	23	0	Van Dyke and Riggs 2003
Carcajou Point	17th – 18th C	WHS, UWM	0	1	Hall 1962
Chautauqua Grounds	17th – 18th C	E. Pleger	0	4	Pleger 1992
Chickadee	c. 1670 – 1730	WHS	0	9	Reetz et al. 2008
Cloudman	early 17th C.?	MSU	11	16	Branstner 1995
Clunie	early 17th C.?	HSSC	11	1	Sommer 2013
Doty Island	c. 1680 – 1712?	Mason	307	79	Mason and Mason 1993, 1997
Elmwood Island	18th C?	UW	28	0	Salkin 1989
Farley Village	Mid-late 17th C?	UWL	21	3	Gallagher 1990
Fort Michilimackinac	1715-1781	MM	62	74	Stone 1974; Evans 2001
Fort St. Joseph	1691 – 1781	FSJM	81	45	Nassaney 2008
Gillett Grove	17th c.	IOSA	0	16	Shott et al. 2002
Goose Lake Outlet #3	c. 1650	MRHC	2	13	Mason and Paquette 2009
Gros Cap	17th C	MOSA, MTU	75	7	Martin 1979
Hanson	c. 1650 – 1680	WHS	325	23	Rosebrough et al 2012
Iliniwek Village	c. 1640 - 1683	MSP	0	70	Ehrhardt 2005, 2013
La Salle Shipwreck[2]	1683-1686	THC	0	83	Bruseth et al. 2005
Marina	c.1715 - 1775	MIM, LM	33	17	Birmingham and Salzer 1984
Markman	c. 1665-1680	UWO	8	1	Behm 2008
Marquette Mission	c. 1670 - 1701	MSU	536	120	Branstner 1991, 1992
McCauley	17th –19th c?	MPM	33	0	Overstreet 1993
Milford	17th c.	IOSA	0	5	Tiffany and Anderson 1993
Mormon Print Shop	17th c.?	NMU	0	4	Unpublished
New Lenox	Early-mid 17th c.	MARS	0	12	Bird 2003
Norge Village	17th and 18th c.	MOSA	2	1	Fitting and Lynott 1974
North Shore Village	18th c.?	UW	15	0	Salkin 1989
O'Neill	late 17th c?	MSU	4	0	Lovis 1973
Peshtigo Point	17th and 18th c.	Strojny	15	11	Overstreet 2014
Point Sauble	17th c.	WHS	0	5	Freeman 1956
Red Banks	17th and 18th c.	NPM	0	20	Speth 2000
Rock Island	c. 1640 - 1770	LU	946	122	Mason 1986
Wanampito	17th c.	IOSA	0	1	Whittaker and Anderson 2007
Zimmerman	c. 1650 – 1690	ISM	130	64	Rohrbaugh et al. 1999

[1] Public and private curation facilities are listed by common acronyms or these abbreviations: UW = University of Wisconsin, UWL = UW-La Crosse, UWM = UW-Milwaukee, UWO = UW-Oshkosh, UWSP = UW-Stevens Point MTU = Michigan Technical University, MSU = Michigan State U., NPM = Neville Public Museum, WSU = Wayne State U., ISM = Illinois State Museum, MARS = Midwest Arch. Research Services, WHS = Wisconsin Historical Society, LU = Lawrence U., MIM = Madison Island Museum, AVD = AVD Arch. Services, WMU = Western Michigan U., MM = Michilimackinaw Museum, ACS = Arch. Consulting Services, MOSA = Michigan Office of the State Archaeologist, GLARC = Great Lakes Arch. Research and Consulting, HSSC = Historical Society of Saginaw County, Mason = Richard P. Mason private collection, UWL = University of Wisconsin – La Crosse, FSJM = Fort St. Joseph Museum, MRHC = Marquette Regional History Center, MSP = Missouri State Parks; IOSA- Iowa Office of the State Archaeologist, THC = Texas Historical Commission

[2] Includes beads from *La Belle* and associated on-shore sites in Texas; see Ch. 5 and Appendix D for further discussion

Table 3.4: Geographic and ethnic summary table for the site sample. Data from published literature listed in Table 3.3

Site name	**Area**[1]	**County and state**	**Nearby waterway(s)**	**Predominant diagnostic ceramic(s)**	**Ethnic affiliation(s)**
20 CN 51	MI	Cheboygan Co. MI	Straits of Mackinac	None	Indeterminate
47 WN 853	LW	Winnebago Co., WI	Lake Winneconne	Lk. Winnebago Trailed	Oneota
Arrowsmith	LW	McLean Co., IL	Sangamon R.	Butte des Mortes ware	Meskwaki
Bell	LW	Winnebago Co., WI	Big Lake Butte des Mortes, Fox R.	Butte des Mortes ware	Meskwaki
Cadotte	LS	Ashland Co., WI	Lake Superior	Various	Ojibwe/Various
Camp Shaginappi	LW	Fond du Lac Co., WI	Lake Winnebago	None	Indeterminate
Carcajou Point	FLK	Jefferson Co., WI	Lake Koshkonong	Late prehist. Oneota	Ho-Chunk (?)
Chautauqua Grounds	GBDP	Marinette Co., WI	Menominee R.	Mero Complex	Menominee (?)
Chickadee	LW	Outagamie Co., WI	Wolf R.	Butte des Mortes ware	Meskwaki (?)
Cloudman	MI	Chippewa Co., MI	Lake Huron	Iroquoian	Odawa
Clunie	MI	Saginaw Co., MI	Saginaw Bay	Late Woodland	Indeterminate
Doty Island	LW	Winnebago Co., WI	Fox R.	Various	Various
Elmwood Island	FLK	Dodge Co., WI	Fox Lake	Late prehist. Oneota	Indeterminate
Farley Village	W	Houston Co., MN	Riceford Creek, Root R., Mississippi R.	Allamakee Trailed	Oneota/Ioway
Fort Michilimackinac	MI	Emmet Co., MI	Straits of Mackinac	Various	Meti/French
Fort St. Joseph	MI	Berrien Co., MI	St. Joseph R.	Various	Meti/French
Gillett Grove	W	Clay Co., IA	Little Sioux R.	Allamakee Trailed	Oneota/Ioway
Goose Lake Outlet #3	LS	Marquette Co., MI	Escanaba R.	None	Ojibwe (?)
Gros Cap	MI	Mackinac Co. MI	Straits of Mackinac	Various	Huron (?)
Hanson	GBDP	Door Co., WI	Sturgeon Bay	None	Huron
Iliniwek Village	S	Clark Co., MO	Des Moines R.	Danner	Illinois
La Salle Shipwreck	--	Matagorda Co., TX	Gulf of Mexico	None	French
Marina	LS	Ashland Co., WI	Lake Superior	Various	Ojibwe/Various
Markman	LW	Waupaca Co., WI	Wolf R.	Butte des Mortes ware	Meskwaki
Marquette Mission	MI	Mackinac Co. MI	Straits of Mackinac	Various	Huron
McCauley	LW	Winnebago Co., WI	Fox R., Lk. Winnebago	Lk. Winnebago Trailed	Oneota (?)
Milford	W	Dickinson Co., IA	Little Sioux R.	Allamakee Trailed	Oneota/Ioway
Mormon Print Shop	MI	Charlevoix Co., MI	Lake Michigan	None	Indeterminate
New Lenox	S	Will Co., IL	Marley and Hickory Creeks	Langford Oneota	Indeterminate
Norge Village	MI	Mackinac Co. MI	Straits of Mackinac	Various	Indeterminate
North Shore Village	FLK	Dodge Co., WI	Fox Lake	Late prehist. Oneota	Indeterminate
O’Neill	MI	Charlevoix Co., MI	Lake Michigan	Late Woodland	Indeterminate
Peshtigo Point	GBDP	Marinette Co., WI	Peshtigo R., Green Bay	Mero Complex	Menominee (?)
Point Sauble	GBDP	Brown Co., WI	Green Bay	Eastern Oneota	Ho-Chunk (?)
Red Banks	GBDP	Brown Co., WI	Green Bay	Eastern Oneota	Ho-Chunk (?)
Rock Island	GBDP	Door Co., WI	Lk. Michigan, Green Bay	Various	Various
Wanampito	W	Bremer Co., IA	Cedar R.	Unspecified Oneota	Oneota/Ioway
Zimmerman	S	La Salle, IL	Illinois R.	Danner, Huber	Illinois

[1] Areas correspond to those described in sections below: MI = Michigan’s Lower Peninsula and Straits of Mackinac; GBDP = Green Bay and Door Peninsula of Wisconsin; LS = Lake Superior area; LW= Lake Winnebago area and Arrowsmith; FLK = Fox Lake and Koshkonong area; W= Western neighbors; S = Southern neighbors; TX = Texas

Table 3.5 Importance of sites illustrated by number of glass and metal samples and total assemblage size. Sites I considered to have the most secure contexts and reliable samples of greatest significance to the project are printed in bold type. Data come from references cited in Table 3.3 and from investigations of site collections. See also Table 5.1, archaeological contexts of glass artifacts sampled with LA-ICP-MS.

Site name	**Recovery Method:** E = excavation S = surface collection	**Total historic copper-base metal artifacts recovered[1]** (relevant contexts or site portions only)	**Copper base metal artifacts analyzed (% of total assemblage)**	**Total drawn blue glass beads recovered[1]**	**Glass beads analyzed (% of total assemblage)** Includes any non-blue samples.
20 CN 51	E	15	15 (100%)	0	0
47 WN 853	E (disturbed)	8	8 (100%)	0	0
Arrowsmith	E/SC	27	27 (100%)	3	3 (100%)
Bell	**E/SC**	**958**	**958 (100%)**	**77**	**36 (47%)**
Cadotte	E	29	29 (100%, see Appendix A)	10*	10 (100%)
Camp Shaginappi	E (disturbed)	23	23 (100%)	0	0
Carcajou Point	SC	300*	0	1*	1 (100%)
Chautauqua Grounds	SC	0	0	4	4 (100%)
Chickadee	E	1	0	9	9 (100%)
Cloudman	E	11	11 (100%)	16	16 (100%)
Clunie	E	11*	11 (100%)	1	1 (100%)
Doty Island	**E**	**307**	**307 (100%)**	**465**	**79 (17%)**
Elmwood Island	E	30*	28 (93%)	0	0
Farley Village	E	21	21 (100%)	3	3 (100%)
Fort Michilimackinac	**E**	**62* (est. French only)**	**62 (100%)**	**1000s***	**74 (est. 5-10%)**
Fort St. Joseph	**E**	**300***	**81 (est. 20-30%)**	**100s***	**45 (est. 40-50%)**
Gillett Grove	E/SC	Unknown	0 (future research)	Unknown	16
Goose Lake Outlet #3	E	2	2 (100%)	50s*	13 (est. 20-30%)
Gros Cap	**E/SC**	**75**	**75 (100%)**	**7**	**7 (100%)**
Hanson	**E (disturbed)**	**325***	**325** (100 %, qualitative sample only)	**114**	**23** (20%, includes 5 yellow/clear beads)
Iliniwek Village	**E**	**1393**	**0** (see Ehrhardt 2005, 2013)	**100s***	**70 (unknown %)**
La Salle Shipwreck	E	0	0	300,000	81 (0.00027%)
Marina	E	100s*	33 (est. 20-30%)	100s*	17 (est. 10-20%)
Markman	E	8	8 (100%)	1	1 (100%)
Marquette Mission	**E**	**1700***	**544 (32%)**	**1000s**	**120 (est. 5-10%)**
McCauley	E (disturbed)	33*	33 (100%)	3	0 (not permitted)
Milford	E	Unknown	0 (future research)	100s*	5 (est. 5-10%)
Mormon Print Shop	E	0	0	10s*	4 (est. 50%)
New Lenox	E	242	0 (see Ehrhardt 2012)	12	12 (100%)
Norge Village	E	10	2 (20%)	1	1 (100%)
North Shore Village	E	85*	15 (18%)	0	0
O’Neill	E	4	4 (100%)	0	0
Peshtigo Point	SC	100s*	15 (est. 10-20%)	11	11 (100%)
Point Sauble	SC	0	0	5*	5 (100%)
Red Banks	SC	100s*	0	50*	20 (20-30%)
Rock Island	**E**	**946**	**946 (100%)**	**3215**	**122 (4%)**
Wanampito	SC	Unknown	0 (future research)	1	1 (100%)
Zimmerman	**E**	**1000s***	**130 (est. 5-10%)**	**1796**	**64 (4%)**

[1]These numbers are not readily available for many sites, especially very large or surface collections. If a site was investigated by several research programs, not all results of investigations may be represented. Rough estimates are marked with (*) and/or are described as 100s, 1000s, etc. “Blue beads” and “copper-base metal artifacts” refer to only the types examined in this study.

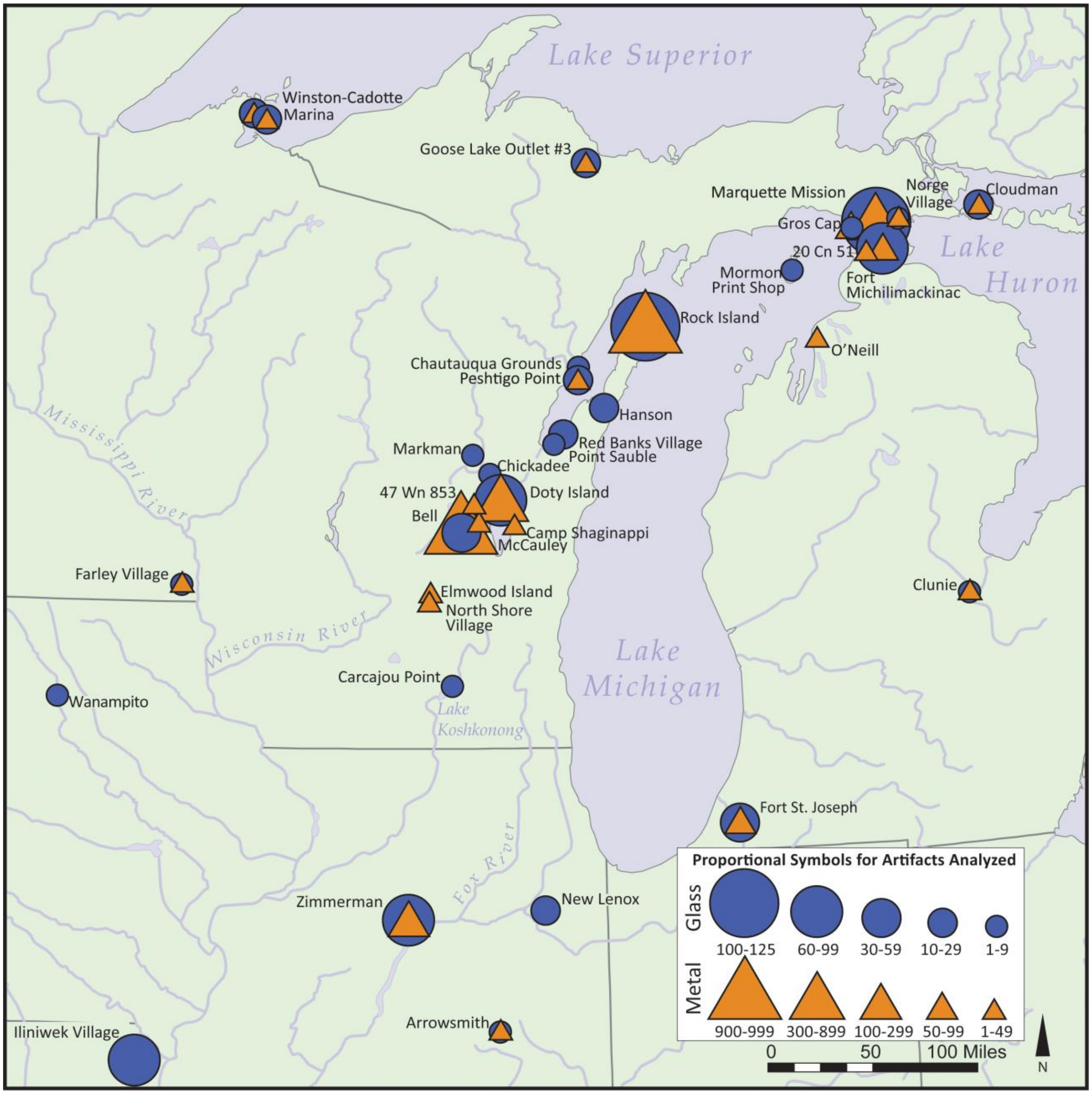


Figure 3.8: Proportional symbol map showing which sites contributed the greatest numbers of glass and metal artifacts analyzed in this project. Map excludes Gillett Grove and Milford in northwestern Iowa and La Salle Shipwreck site (La Belle) and associated on-shore contexts, Matagorda Bay, Texas

3.4.1 The Lower Peninsula of Michigan and Straits of Mackinac

This area encompasses all of present-day lower Michigan, as well as sites located at the tip of the Upper Peninsula at the Straits of Mackinac and sites located on adjacent islands. The physiographic setting of this area is diverse, and varies from the forested northern interior to beaches and sand dune shores of Lake Huron and Lake Michigan. The area was glaciated by the Laurentide Ice Sheet. The Straits of Mackinac divide the Lower and Upper Peninsulas of Michigan. At AD 1600, the northern half of the Lower Peninsula would have been predominantly coniferous woodlands, while the southern part of the peninsula covered in beech and maple deciduous forests (Tanner 1987:14-15). The Saginaw area on the east side of the Lower Peninsula encompasses some wetlands, including those incorporated in the Shiawassee National Wildlife Refuge, which contains at least one protohistoric site in this region.

Strategically-located sites ideally suited to control trade at the Straits of Mackinac sites include: 20 CN 51 and Fort Michilimackinac at the tip of the lower Peninsula; the Cloudman site on Drummond Island; the Mormon Print Shop site on Beaver Island, and the Gros Cap, Norge Village, and Marquette Mission sites near St. Ignace. The Clunie and O'Neill sites represent possible protohistoric components in otherwise Late Woodland contexts in Saginaw Bay and the northwestern Lower Peninsula, respectively. The Fort St. Joseph site, along the St. Joseph River, is a French colonial outpost in the southwestern Lower Peninsula. All of these sites are located near waterways or lakeshore areas; no interior sites dated to the seventeenth century have been identified in Michigan, which demonstrates the importance of watercraft for transport of trade items at this time. Below, I provide more detailed excavation and contextual information for each of the sites. Sites are presented in order of their geographic relationships to one another, roughly from north to south.

3.4.1.1 Marquette Mission (20 MK 82 and 20 MK 99)

This site is located near the shore of Lake Huron, at the center of downtown St. Ignace, Michigan, at the southern tip of the Upper Peninsula of Michigan. The on-site Museum of Ojibwa Culture and a stone monument mark this as the historically documented location of Jesuit father Jacques Marquette's burial. Based historic records, the site occupation dates are c. AD 1671 to 1705. On the basis of texts stating that Marquette placed his St. Ignace mission next to a Huron village, the excavators interpret this as a predominantly Tionontate (Petun) Huron site (Branstner 1992). However, Branstner noted there were no diagnostic Iroquoian-style ceramics recovered and that the dynamics of cultural interactions at this location and the difficulty of linking material assemblages to ethnic groups made the archaeological identification of cultural groups problematic in the Straits area (1992:189-191). Fitting also acknowledged the importance of the St. Ignace locale as a place where numerous groups of Indigenous peoples of the region came to trade with one another and with the French. Although he argues that the Huron and Odawa were the most dominant groups in the region, he notes that "Groups from the West, Potowatomi, Miami, Fox, Sauk, Kickapoo and Menominee visited East Moran Bay [in St. Ignace] to trade" (Fitting 1976a:104). When considering artifacts recovered at the Marquette Mission site, it is very difficult to assign any specific ethnic affiliation to archaeological materials because this area was so frequently described as a gathering place for many Nations.

I selected glass beads for analysis following my standard sampling strategy of choosing beads of several distinct Kidd and Kidd styles from clear feature contexts, but I had to modify my strategy for investigation of the copper-based metal artifacts. To mitigate the possibility that some of these artifacts actually came from within the "Mission" or French-occupied areas of the site, I decided to only include copper-based metal artifacts from feature contexts that had some affiliation to the Indigenous inhabitants: Native-made artifacts (predominantly ceramics) or close proximity to the architectural features interpreted as part of a Huron longhouse. This selection process identified a manageable sample (n= 536), reduced from total of 839 copper based metal artifacts inventoried from all features and eliminating an approximately equal quantity of non-feature context materials. In the course of selecting the sample, I noted that several categories of material were not located in the collections; these include round, perforated copper discs from features, rolled metal beads or "copper mail" from features, and kettle parts from features. Therefore, the makeup of the metal artifact sample cannot be compared to other sites, as some categories clearly listed in the report could not be investigated in my data set. Working methods, relative sizes and attributes of scraps as well as tinkling cone attribute styles are still comparable to data collected for other sites.

I included materials from Fitting's 1973 field season as well as those from the 1980s investigations and the 2001 project, as long as they met the criteria coming from features near the longhouse or in association with Native-made artifacts such as ceramics. I made this determination on the basis of spreadsheets that O'Gorman prepared for her GIS project related to the site (O'Gorman 2007b). This selection method resulted in the final sample of 536 copper-based metal artifacts, listed in my database as HW-00345 to HW-00356, HW-00394 to HW-00417, and HW-02687 to HW-03389. The vast majority of these artifacts come from the later excavations and are curated at MSU, but sixteen artifacts from Fitting's 1973 season were included (HW-02772; HW-02777 to HW-02791) and these are curated at the MOSA. A total of 120 glass beads and refired glass pendants from feature contexts in the MSU collections were selected for LA-ICP-MS.

3.4.1.2 Norge Village (20 MK 53)

The Norge Village site was identified during James E. Fitting's 1972 field survey season in the St. Ignace area and more fully excavated during the 1973 season (Fitting and Lynott 1974). The Norge Village site is located approximately 1000 meters southeast of Marquette Mission, along the shore of Lake Huron. Norge may represent an extension of the Marquette Mission site or a separate and related or unrelated but contemporary encampment of Native people in the St. Ignace area in the late seventeenth century. Fitting and Lynott suggested that the site might be a Potawatomi village, based on similarity of several ceramic sherds to materials found at the Summer Island site (1974:196), which Brose interpreted as a possibly Potawatomi protohistoric site on the basis of a reference to the "Island of the Potawatomi" in the historic records (Brose 1970:27-28). I provide further discussion the Summer Island site in Appendix A, but at this point, the Potawatomi attribution for Norge Village and Summer Island is tenuous at best.

Excavations at Norge Village recovered a small assemblage of items that excavators attributed to the "contact" period: Native-made ceramic sherds, lithic debris, a worked sherd of green bottle glass, ten copper-based metal pieces, a lead seal, and two glass beads (Fitting and Lynott 1974:210). Most of the assemblage was apparently returned to the landowner after the initial cataloguing was completed. However, artifacts photographed in Fitting's report (and only those artifacts) are still retained at the MOSA; in an oversight of curation, it seems that these artifacts were never returned to the landowner. The single blue bead from Norge Village still in the collection was analyzed with LA-ICP-MS, and two artifacts, HW-02792 (a circular scored and perforated disc) and HW-02793 (a small rectangular scrap), were added to the metals database. The other eight "kettle scraps" described in the report were likely returned to the landowner, as they were not present in the collection. Because of time constraints, no effort was made to locate the artifact collection during my brief visit to St. Ignace, but it is possible that the Norge Village artifacts are still in private hands in that area.

3.4.1.3 Gros Cap (20 MK 6)

The Gros Cap cemetery is an early historic burial locale and campsite area also located near St. Ignace, Michigan, to the west of Marquette Mission and Norge Village. Two small, excavated assemblages from Gros Cap were included in the project data set. The larger assemblage of Gros Cap material is curated at Michigan Technical University (MTU) in Houghton, Michigan. Susan and Patrick Martin of MTU surveyed and excavated this site as part of a mitigation project for the widening of U.S. Hwy 2 in 1979 (Martin 1979; Martin and Martin 1979). These surveys assessed the boundaries of the site with a series of test pits, which yielded historic trade items and a few human remains. Archaeologists have not definitively identified the tribal identity of the individuals buried at the Gros Cap site, since trade item assemblages were not diagnostic of ethnic affiliations; Odawa, Huron and Ojibwe (Anishinaabe) groups were all present historically in this region (Nern and Cleland 1974:56). In October of 2007, the culturally unidentifiable human remains from the MTU project were repatriated to the Little Traverse Bay Bands of Odawa Indians and the Sault St. Marie Tribe of Chippewa Indians, both of Michigan.

Artifacts from Gros Cap curated in the MTU collections include both grit and shell tempered ceramics, a clay pipe, bone and antler tools, red-stone or catlinite fragments and a pendant fragment, chipping debris, and triangular projectile points European-made ceramics, European-made spall gunflints, window and bottle glass fragments, and other materials typical of a seventeenth and eighteenth century activity area (see Martin and Martin 1979 for a full inventory). A smaller assemblage was collected by John Halsey of MOSA during further widening of US-2 in 1986. The hand-written field notes and feature photos from this project are on file in Lansing at the MOSA, and were available for review during the analysis process. Tinkling cones, tinkler blanks, metal projectile points, and copper-based metal scrap were all recovered during this excavation. The five features uncovered all appear to be circular or oval shaped pits containing trade items, faunal remains and other cultural materials. Although trade beads were recovered from Feature 3, none were of the types examined in this project.

A total of 7 blue glass artifacts, including a possibly reworked blue bead, and a blue glass pendant (all from the MTU collections), and 75 pieces of copper based metal from the Gros Cap site were included in the dissertation data set. In the metals database, HW-00373 to HW-00393 come from the MOSA salvage excavations, while HW-02456 to HW-02530 were from the earlier MTU work.

3.4.1.4 Fort Michilimackinac (20 EM 52)

Fort Michilimackinac is one of two French-colonial fortified locales included in this dissertation research project as a comparative assemblage. Michilimackinac's history as a meeting point on the southern shore of the Straits of Mackinac seems to pre-date French colonial endeavors, and excavations of the nearby late prehistoric Juntunen site reveal the importance of the Straits to Late Woodland peoples who would have fished and traded there prior to European contact (McPherron 1967). In contrast with other sites in this study, Fort Michilimackinac was not the primary residence of a group of Indigenous people, but rather a location where Native individuals came to trade and eventually live in close proximity with French and later British colonial military personnel (Stone 1974). The French established a fort on a defensible location of the southern shore of the Straits in 1714, and British forces acquired the structure in 1761. A thick level of demolition refuse marks this transition, and most materials recovered at the site cannot be attributed definitively to either the French or the British occupants unless they are themselves diagnostic artifacts, e.g. French military buttons or late eighteenth century ceramics.

Because more than 1 million artifacts have been recovered (and since a significant proportion of them were glass beads) and thousands of meters of earth have been moved to facilitate restoration of the site, I chose to focus on materials coming from levels of known French and whenever possible, Méti-occupied areas. This greatly reduced the available sample, and the majority of artifacts examined come from a few contexts associated with French activities: the Rue de la Babilarde, House D of the Southeast Rowhouse (French “trench” levels), and the general grey sand level that the excavators attribute to French activities (see Heldman and Grange 1981:62). Evans noted that there is more intact grey sand in House D than in other parts of the southeast quadrant of the fort (2001:11). Numerous refired glass pendants have also been recovered from Michilimackinac, both from French and British levels, so I selected several beads from contexts in association with those pendants. I included several opaque white beads in the sample as well, in order to test their chemical similarity to white portions of the pendants. A total of 77 glass samples were included from this site.

To deal with the extensive collections of the Fort Michilimackinac museum and curation facility, I again tried to select only metal artifacts that could be confidently attributed to French occupation levels. As with bead selection, I again relied on Southeast Rowhouse House D as a sound context. HW-02533 to HW-02594 represent a total of 62 copper-based metal artifacts examined during this research project. While they are a tiny fraction of the total collections of copper based metal artifacts such as tinklers, cut or modified kettle fragments, and other objects of interest to this study, they represent the best possible identification of copper-based metal objects coming exclusively from French levels. Evans (nee Morand) conducted an extensive study craft production technologies evident from the copper and brass assemblage of Michilimackinac as part of her dissertation research (Morand 1993:50-72; 1994), finding that tinkling cones were widely used and produced across both French and British areas of the site, which is consistent with the use of these adornments Indigenous, European, and Metis individuals as objects of adornment.

3.4.1.5 (20 CN 51)

20 CN 51 consists of a single deposit of trade-items disturbed during construction activities on South Huron St. in Mackinaw City, Michigan in 1992. This small, unnamed site in Mackinaw City (colloquially referred to as the Mackinaw City Watermain) was investigated in a 1992 salvage investigation conducted by the Michigan Office of the State Archaeologist (MOSA). Recovered historic-era materials include: iron knife blades, a trade axe, a metal harpoon, other unidentifiable iron objects, a rectangular lead piece, French spall gunflints, a bone hide scraper, an antler harpoon blank, leather or textile material, and several unmodified faunal remains. A white trade bead (IIa13/14) was recovered embedded in the surface corrosion of the iron axe, but was not analyzed. Fifteen kettle fragments with similar corrosion levels and patina suggesting that they all came from a single kettle were recovered, including one with a highly deteriorated partial iron lug still attached. These fragments were included in the attribute database as records HW-00357 to HW-00372.

The tight proximity of all of the artifacts, likely removed together in a single scoop of the backhoe, and copper staining on the textile, indicated to the excavators that the deposit may represent a cache originally wrapped in a blanket or textile and buried together (Anderson 1992:9) .The excavators interpreted the deposit as a Native American storage pit dated to c. 1670 – 1730 but no textual information, historic maps, or diagnostic artifacts link this site to other contemporary activities in the area, and no social or ethnic affiliations were identified.

3.4.1.6 Cloudman (20 CH 6)

The Cloudman site on Drummond Island is recognized as possibly the oldest historic site in the present day state of Michigan (Cleland 1999:280), though the newly excavated Goose Lake Outlet #3 site in the Upper Peninsula may be as old or older. Excavations identified initial and late Woodland occupations, a protohistoric occupation dated to tentatively AD 1500 – 1650, and two historic period homesteads, dated to c. 1880 and 1920 (Branstner 1995:2). Investigations of the protohistoric component yielded "non-locally manufactured Ontario-Iroquoian and later Huron vessel types and local 'imitations'….in association with a small amount of European trade goods" (Branstner 1995:12). On the basis of these ceramics and the presence of nearby sites interpreted as historic Ottawa (Odawa) occupations c. AD 1615 to 1630, and Branstner suggests that a similar date and possible ethnic identification for Cloudman are possible, but that further research would be required to address the problem of ethnicity (1995:13).

During dissertation research I analyzed sixteen blue glass beads from the protohistoric feature and unit contexts, and I included a total of eleven copper-based metal artifacts from Cloudman in my dissertation database, identified as HW-00339 to HW-00349. Based on visual appearance and context, some of these pieces seem to represent native copper (e.g. HW-00339 is a rolled copper bead from a feature containing Middle Woodland ceramics), though no chemical analysis was conducted for any of these materials. All copper-based metal from features was included in my dissertation database. See Branstner (1995:97) for further discussion of the two pieces of "scrap" metal as well as a copper bar from possible protohistoric contexts. HW-00340 and HW-00341 are the two pieces that catalogued as kettle scrap, while the rest visually appear more like native copper, on the basis of working methods and thicknesses of the metal.

3.4.1.7 Mormon Print Shop (20CX59)

James E. Fitting first identified this location on Beaver Island, in Charlevoix County, Michigan, as a possible protohistoric campsite during a survey during September of 1973 (Fitting 1973). Fitting labeled it "St. James Site Number 2" according to its position on St. James Bay on the northern end of Beaver Island and records a "rather large collection" of cultural material there, though it is not enumerated in the report (1973:15). Fitting noted that the "Mormon Print Shop" was then serving as the Beaver Island Museum, a role in which it continues to this day. The Mormon Print Shop site is currently being investigated by Scott Demel of Northern Michigan University (NMU) as a summer field school locale, using modern methodologies of excavation, screening and flotation of feature materials. Although the site was predominantly occupied in the nineteenth century by a groups of European settlers who constructed a print shop there in 1850, Native American ceramics were located in the lower levels of several features, along with a probably European-made gunflint (Yann pers. comm 2013) and several glass trade beads. Four beads were analyzed with LA-ICP-MS for comparative purposes in an attempt to provide the project with chronological information about these early levels. The few copper-based metal pieces in the assemblage did not appear to come from trade kettles, nor did they show evidence of reworking of European trade items to fashion tinkling cones or other objects, and these materials were not included in the final metals database.

3.4.1.8 O'Neill (20 CX 18)

The historic-era component of the O'Neill site, near present-day Charlevoix, Michigan, was investigated as part of a larger project examining Late Woodland cultures in the Northern Lower Peninsula of Michigan through a survey of sites in the Grand Traverse Bay area (Lovis 1973). Lovis interpreted the historic component of the O'Neill site as a probable seventeenth or early eighteenth century occupation that could have been occupied continuously from the Late Woodland period through historic times. The protohistoric material assemblage is small, and none of the four glass beads recovered from the site are of the types I investigated. However, there were four copper-based metal artifacts that I entered into my database as HW-00350 to HW-00353, including a unique cut-brass bracelet or armband, which I hoped to find parallels to at other sites. The European trade items recovered at O'Neill also include iron knife blades and gunflint spalls, as well as a presumably Native-made gunflint (Lovis 1973: 199-207).

3.4.1.9 Clunie Site (20 SA 722)

The Clunie site has been investigated with survey and excavation since 2000 by the Saginaw County Historical Museum, as part of an ongoing survey of the Shiawassee National Wildlife Refuge. The principle investigator, Jeffery Sommer, summarized the excavation history in his most recent report (Sommer 2013:13-17), and noted that "Several gunflints, a couple of glass beads, and a possible 'trade axe' offer tantalizing evidence for eighteenth century or possibly earlier Historic period occupations in the project area" (2013:46). A bead not analyzed in this project (type IVb18/19) has been tentatively dated to the early seventeenth century (K. Karklins to D. Anderson, pers. comm 2013). No ethnic attribution has been made for the historic component of the Clunie site. A single blue bead (type IIa40) from the surface of a feature at the base of the plowzone was analyzed, and 11 copper-based metal artifacts were included in the attribute analysis, HW-02809 to HW-02819. The metals were also used in pilot study at the Chicago Field Museum comparing the effectiveness of pXRF and LA-ICP-MS compositional analysis to differentiate between native and smelted copper (Dussubieux and Walder 2015).

3.4.1.10 Fort St. Joseph (20 BE 23)

Fort St. Joseph is located directly on the bank of the St. Joseph River in Niles, Michigan. According to the historic record, the Fort was founded in 1691 by French military powers to maintain trading relationships with Indigenous peoples in the area who were allied with the French (Nassaney et al. 2003). Like Fort Michilimackinac, Fort St. Joseph came under British control after the French and Indian War (Seven Years War in Europe) in 1761. Also as at Michilimackinac, surviving records provide information about individual military personnel stationed at the fort, basic descriptions of the physical setup of the fort, as well as commercial information about fur trading activities. Information about Native American interactions at this locale comes predominantly from the archaeological record; though historic documents do provide a glimpse of intermarriage between at least one French voyageur and an Illinois woman residing near the fort (Brandao and Nassaney 2006: 68). Historic maps and records also indicate that a Native village, attributed to the Potawatomi or Miami, was located near the fort, perhaps on the opposite side of the river. Both Miami and Potawatomi groups are thought to have had close interactions with the residents of Fort St. Joseph, and Brandao and Nassaney suggested that the very survival of the European colonists at times depended on their strong and friendly relationships with Indigenous communities (2006:61-75). The Lyne site (20 BE 10), located on a terrace just adjacent to the area designated as the fort, has produced a mixture of locally-made stone projectile points and ceramics, intermixed with colonial-era European trade items, and two feature clusters interpreted as smudge pits (Nassaney et al. 2012: 62-63). Although Nassaney and colleagues described the Lyne terrace as a locale of Native, Meti or possibly acculturated European occupation, the area is disturbed by later occupations and a heavy nineteenth century plowzone, so artifacts from this context were not included in my study.

Although the artifacts recovered at Fort St. Joseph cannot be attributed to specific Indigenous peoples, French inhabitants, or a Meti community, hybridized identities and individual identity-production strategies are evident in the wider archaeological assemblage at the site (Nassaney 2008; Nassaney and Brandao 2009). Nassaney argued, "The evidence is beginning to suggest that Fort St. Joseph was a multi-ethnic community of French and Indians who depended on each other and closely interacted" (2008: 304). Because so few other clearly multi-ethnic communities have been identified archaeologically, the materials recovered by the

Fort St. Joseph Archaeological Project provide a unique opportunity to study the colonial processes of ethnogenesis and identity formation via material culture of personal adornment. Including the Fort St. Joseph material in my dissertation projects project serves the purpose of representing an instance of inter-cultural interaction not readily apparent at other sites in the study sample. In addition, my analyses of these artifacts may aide in distinguishing temporally or socially distinct occupation areas of the site.

Glass beads selected for sampling with LA-ICP-MS came from feature and unit contexts, while metal artifacts included in the database come from the "occupation zone" stratigraphic layer of the site, which generally appears intact at the 50-55 cm level below the surface of the site. A total of 81 metal artifacts were included in the study sample, HW-02606 to HW-02686. These artifacts come from feature contexts excavated during the 2002 to 2010 field seasons.

3.4.2 Green Bay and Door Peninsula of Wisconsin

The physiographic setting of the Door Peninsula of Wisconsin on the shores of Green Bay and Lake Michigan includes sandy beaches and dunes. Away from the shoreline, vegetation at AD 1600 would have been a deciduous-coniferous forest (Tanner 1987:15-16). The Lower Fox River flows north from Lake Winnebago and empties into Green Bay. A chain of small islands, including Washington Island and Rock Island, extends from the tip of the Door Peninsula and into Lake Michigan, where the island chain connects to the Garden Peninsula of Michigan. Like the Straits of Mackinac, the Green Bay area was a strategic location for the control of trade with groups living in the interior of the Upper Great Lakes region. Many of the archaeological sites along the shores of Green Bay today have been destroyed or buried under projects related to tourist activities and urban developments; some sites may be submerged due to changing lake levels. Sites are discussed from northwest to southeast, tracing a possible path of travel down the peninsula and into Green Bay.

3.4.2.1 Rock Island (47 DR 128)

Rock Island is a small island in Lake Michigan off the tip of the Door Peninsula with Woodland and Oneota components (Mason 1990; 1991). A single shovel test tentatively indicated that human activities date back to the late Archaic period. Rock Island is most famous for its historic-era occupations (Rock Island II), which the excavators Carol I. and Ronald J. Mason divided into four periods that coincide with major historical events and dominant occupation by different tribes (Mason 1986). They interpret the ethnic affiliations and periods of occupation for four distinct stratigraphic layers identified during excavations (Table 3.6)

Table 3.6 Periods of Occupation on Rock Island, with Tribal Affiliations determined by the excavators, according to documentary evidence and ceramic style (Mason 1986)

Period	**Dates**	**Tribal Affiliation**
1	Post 1641-Pre 1650/51	Potawatomi
2	1650/51-1653	Huron-Petun-Odawa, or Proto-Wyandot
3	c. 1670-1730	Potawatomi
4	1760-1770	Odawa

From 1969 to 1973, the Masons conducted the research as field schools for Lawrence University, using flotation, waterscreening, and deep-trenching methods that allowed the recovery of materials from the smallest seed beads to actual pieces of a palisade wall surrounding the habitation area. The clearly defined and often deeply-buried strata of the site were composed of dark, organically-enriched habitation layers separated by generally sterile layers of wind-deposited sand (Figure 3.9). Mason clearly illustrated the complex stratigraphy and made note of areas of post-depositional disturbance (1986), and in 2011, the excavators assisted with my glass bead sample selection process of identifying artifacts from contexts with least disturbance. I remain confident that analyzed beads represent the distinct stratigraphic contexts of their origin and were not intermixed from earlier or later levels.

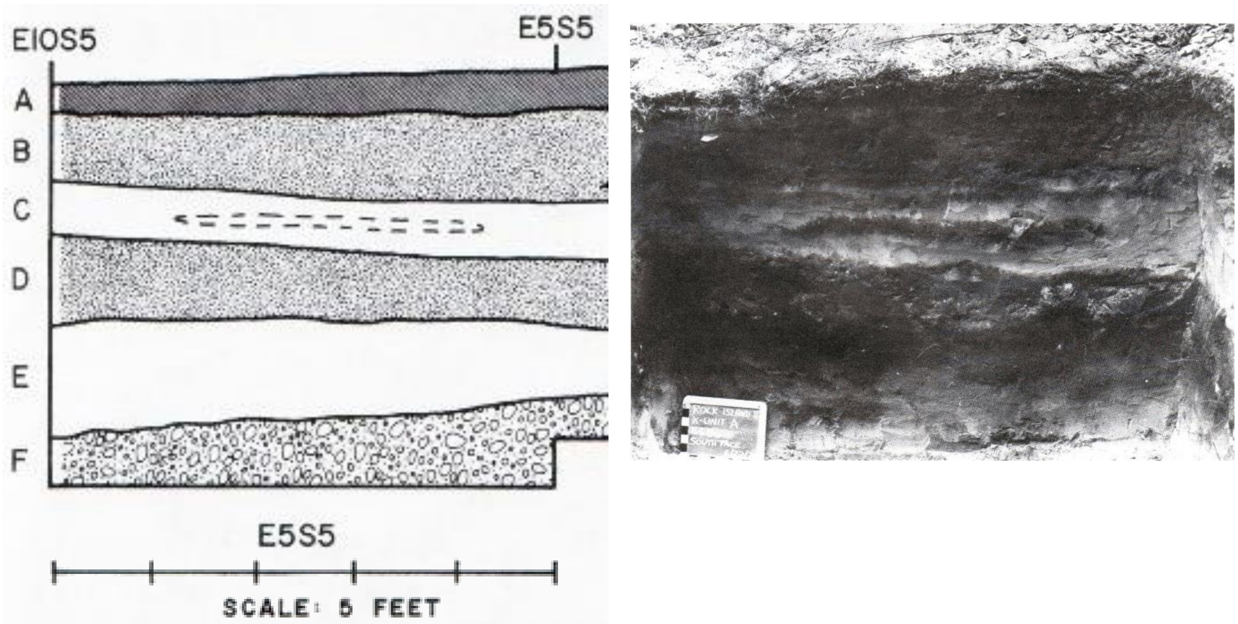


Figure 3.9: Side by side illustration and photograph of the Rock Island south wall profile of Unit A, section E5S5 highlighting the distinct layers of cultural deposits separated by wind-blown sand. Cultural materials were found predominantly in the B and D strata. Images adapted from Mason (1986:27-28).

Based on documentary evidence and materials present, the excavators interpreted the earliest layer of historic occupation as belonging to a small group of Potawatomi people around A.D. 1640 (Mason 1986). In the Period 1 layers, Lake Winnebago Trailed ceramics and some fragments of Late-Woodland style pottery were encountered in contexts with a few scattered pieces of brass, glass beads, and other small European-made items. Historically, Rock Island was a well-known meeting place for people to rendezvous, socialize, and exchange goods and news about activities happening farther away, so it may be possible that these earliest materials arrived on Rock Island as a result of down-the-line trade. The subsequent palisade constructed in Periods 2 and 3 coincides with an intertribal alliance against Iroquoian intrusions at a place called *A'otonatindie*, which may well have been Rock Island, and the burning of the large palisade probably marks the retreat of the inhabitants to a more defensible fort at “Michingan,” located on the west shore of Green Bay, where historical documents state that the Iroquois finally met defeat (Mason 2015).

The vast majority of historic-period artifacts recovered from Rock Island belonged to a group of Potawatomi people who occupied this site from c. 1670 – 1730 (Period 3). These dates, and the identity of the people, are based on evidence from historic documents as well as trade items and pottery (mainly Algoma Modified Lip or Bell Type II) found in the upper layers of the site. Trade axes, firearm parts, iron “clasp” knives, large quantities of glass beads, smoking pipes, and metal arrowheads are common diagnostic artifacts from this period. Ceramics and stone projectile points appear less frequently in the later upper layers, but there are more trade items present. Rock Island again was becoming a key location where Native Americans could exchange furs, foodstuffs, and other local products for European-made objects.

Based on historic evidence, a group of Odawa people were living on Washington Island in 1766, and they may have been be related to the people living on Rock Island at the same time, because the Masons found evidence of both a village and a cemetery from the mid-eighteenth century. The cemetery was located near the historic European cemetery now preserved within the modern campground of Rock Island State Park. The remains of fourteen children and young adults were found there. Epidemic disease, especially smallpox, was very common at this time and may have contributed to the deaths of all the individuals buried in the Native American cemetery (Mason 1986:152). These burials contained many European trade items like kettles, firearms, silver bracelets, woven cloth, knives, and a total of almost 35,000 glass trade beads. Archaeologists also identified one structure (Building 3 in Unit K) that the Odawa likely used during their eighteenth century occupation of Rock Island.

Reworked European trade materials, including glass as well as metal, are well-represented in the assemblages, including three glass pendants recovered from the Period 3 or 4 levels of the site. I conducted a total of 127 LA-ICP-MS analyses of glass materials from the site, including multiple tests of the re-fired pendants and other worked, melted glass in an effort to better understand glass pendant production, which may have been taking place on-site during the later occupation periods (Walder 2013b). I also documented a total of 947 copper-based metal artifacts from the site, but I did not include the copper-based metal artifacts from the Period 4 burials. Their late date was beyond the scope of my project and I did not intend to include any comparable samples from other sites in my larger dissertation project. In the metals database, the Rock Island metals are listed in records HW-01238 and HW-01531 to HW-02477.

3.4.2.2 Chautauqua Grounds (47 MT 71)

The Chautauqua Grounds site is located on the northwestern shore of Green Bay near Marinette, WI, close to the mouth of the Menominee River. While this area has been investigated by avocational archaeologists and collectors, it was never formally excavated. No specific social or ethnic identity is definitively attributed to this locale for the historic period, though Fox and Younger described the locale as "Menominee Land," and they consider a village site at that location to be affiliated with the Menominee (1918:36). Overstreet included Chautauqua Grounds in his summary of Mero-Complex-like sites that may be part of the traditional Menominee territory (2009:184-186). No historic trade items have been excavated from undisturbed contexts at the site. Four blue glass beads from the Ernest Pleger surface collection were subjected to LA-ICP-MS analysis for comparison to surface collections from nearby Peshtigo Point as well as the larger data set. Ernest Pleger's historic materials from the site are not published, but his son Thomas C. Pleger has formally reported on the general site background and the copper artifacts found there (Pleger 1992).

3.4.2.3 Peshtigo Point (47 MT 165)

Peshtigo Point is located in Peshtigo, WI just north of the mouth of the Peshtigo River, on the western side of Green Bay, only a few miles south of the Chautauqua Grounds site. Today, most of the area where cultural materials have been recovered in greatest abundance is now underwater, and the boundaries of the site are not well known despite the surveying efforts. On the basis of historical documentation, Menominee oral traditions, and the types trade items present in the assemblage, Overstreet has suggested that Peshtigo Point may be affiliated with a protohistoric Menominee village known as "Usakewik," though he acknowledges that the site does not meet the stringent "site-unit ethnicity" criteria proposed by R. J. Mason (Overstreet 2014). Overstreet noted that in addition to pre-historic materials, European-made items dating from the seventeenth to nineteenth centuries have all been recovered at the site, providing evidence for long-term habitation and continuity at this locale.

Additional materials recovered from the site over the years include iconographic rings (Mason and Paquette 2009:239-241), firearm parts, gunflints, iron knives and other implements, and other miscellaneous European-made utilitarian and adornment objects, as well as native copper objects, Mero-style ceramics, stone tools and lithic debris. Long-time Peshtigo residents and avocational collectors Ron Strojny and Robert "Cubby" Couvillon provided me with access to their collections, and I ultimately documented a total of 15 copper-based metal artifacts from the Strojny collection, HW-02794 to HW-02808. These come from surface collections and do not constitute a representative sample of copper-based metal from the site, and there is no way to tell if they come from early historic or later activities at the site. I also analyzed a total of eleven glass trade beads, which also come from the Strojny surface-collection.

3.4.2.4 Hanson (47 DR 185)

The Hanson Site is located near Sturgeon Bay, Wisconsin, close to the eastern shore of the Door Peninsula. A commercial gravel-quarrying operation exposed the Hanson burial pit in 1990, and rescue archaeologists from the State Historical Society conducted a salvage and recovery excavation at the site. Although the majority of the human remains had slumped into the quarry, several interred individuals were excavated in-situ at the edge of the pit, which was determined to be too unstable to preserve in place. Remains were initially analyzed by David Overstreet (1993), who suggested a possible protohistoric Lake Winnebago Phase Oneota attribution for the remains, on the basis of the red stone disc pipe, shell gorget, and European trade goods found in the assemblage. No Oneota-style ceramics were recovered at the site. Present hypotheses about the ethnic affiliation of the women and children interred at the Hanson site are based on the historical record of population movements at this time, the whole assemblage of trade items present, and comparison with seemingly contemporary archaeological sites in the local area and region. The burial assemblage is strikingly similar to post-diaspora Huron-Petun-Odawa locales and burial sites including the Ossossane, Grimsby, Lasanen sites. Because of the multiethnic nature of interactions among social groups at this time, none of the ethnic groups who were living in the Door Peninsula region at this time can be ruled out, but a Huronian affiliation is most likely (Rosebrough et al 2012:132-135).

The Hanson site assemblage reflects the changing material culture of the seventeenth century or protohistoric period—there are no lithic or ceramic artifacts associated with the fourteen women and children interred there. Like other historic-era archaeological assemblages, the Hanson site assemblage contains European-made trade materials like glass beads and brass and copper kettles, as well as a unique a silk-and-silver metallic textile. Yet, textiles made from local materials, large shell beads and wampum, and a red stone pipe and beads were also included. No European trade silver was included, which indicates the Hanson site individuals may have had French or Dutch rather than British trade connections. A full re-analysis of the Hanson site assemblage was conducted in 2010 and 2011 (Rosebrough et al. 2012). As part of this re-analysis project I conducted LA-ICP-MS characterization of a total of 23 glass trade beads and analyzed additional artifacts using other archaeometric methods (Walder 2012).

At least three European-made brass kettles were included in the mortuary offerings, but there is no evidence to suggest that the kettles were at all modified or 'reworked' into personal adornments or other objects. The kettles were heavily corroded and recovered in a fragmentary state, so there is no way to know if broken or 'used up' kettles were included in the burial, or if the kettles still had a utilitarian value when they were placed in the burial pit. There was no evidence of metal working techniques such as riveting or patching (which are common at the Bell and Marquette Mission sites) that would indicate efforts to extend the utilitarian life of the Hanson kettles. Tiny metal (brass) beads 1.5 to 2.0 mm in diameter were present in the assemblage, and these could have been fashioned by indigenous people by flattening and rolling tiny slips of European metal. Objects of this form were identified in many assemblages investigated in my dissertation project, but these were by far the smallest. Such beads do not occur in trade records of the time, though they could potentially have been made as trade items in a European workshop. The beads were too small to individually include in the metals database, and are unique in their small size, stringing method, and quantity. Rosebrough counted at least 325 individual beads, which are discussed qualitatively as a whole in Chapter 6.

3.4.2.5 Red Banks (47 BR 437)

The Red Banks area on the southern shores of Green Bay is widely and traditionally cited as the earliest location of direct European contact in Wisconsin, as the landing-spot of Jean Nicolet in 1634 (e.g., Risjord 2001). Although popularly accepted, it would be very difficult to definitively prove that this was the particular point where Nicolet landed without more specific historical and archaeological evidence than is currently (and likely ever will be) available. Archaeologists generally accept that the Ho-Chunk lived near the Red Banks during the early seventeenth century, though not all agree that Nicolet met them there (Hall 1993; 1995; Lurie and Jung 2009,2015; C.I. Mason 1976; 1997; R. J. Mason 1976;1993; 2002,2014; Overstreet 1995; Richards 2003). Historic documents and ethnohistoric accounts recognize Red Banks as a traditional strong-hold of the Ho-Chunk people during the seventeenth century, but an archaeological link between historic Ho-Chunk and Oneota material culture has yet to be definitively documented. Nevertheless, materials recovered from Red Banks tend to be attributed to early historic activities of the Ho-Chunk.

An assemblage of artifacts from Red Banks artifacts is curated at the Neville Public Museum of Green Bay, Wisconsin. All of the objects come from surface collections, many of which are now more than 100 years old (Speth 2000). The provenience of some objects in these collections are referred to simply by county, and while others are labeled “Red Banks,” Lurie and Jung (2009:71-94) pointed out that this terminology has been used in a very general way for an area of red-colored bluffs in this region, and several sites closely cluster there. There is no way to know exactly where early collectors were referring to when they labeled their artifacts with “Red Banks.” I did choose to include 22 surface-collected glass beads attributed to “Red Banks” in my LA-ICP-MS analysis; 20 of these come from collections of Schumacher prior to

1927, while two (RB_01 and RB_02) come from collections "found in the ground near Red Banks some time before December, 1925 and donated to the Neville by Jane Jennings" (Speth 2000: 20). Even if these beads do not come from contexts that fall within the current designated site boundaries, they provide an important link to early historic activities in the Red Banks locale more generally. Given the importance of this site and the general area surrounding it in the literature of early contacts in Wisconsin, I have been willing to accept surface-collected materials from Red Banks as well as the nearby Point Sauble, Peshtigo Point, and Chautauqua Grounds sites. However, this strategy opens the possibility of unintentionally including later eighteenth to twentieth century beads in the sample.

3.4.2.6 Point Sauble (47 BR 101)

The Point Sauble site was investigated by David Baerreis, Robert L. Hall, and Warren Wittry in the early 1950s (Skrivseth 1950). Joan Freeman later reported on these and other excavations at Point Sauble (or Sable) and the nearby Beaumier Farm sites in her master's thesis (1956). The site is located about eight miles north and east of Green Bay, in Brown Co. WI (Freeman 1956:7), and the style of Lake Winnebago Focus Oneota ceramics recovered are conventionally interpreted as a predecessor of the historically-documented Ho-Chunk (Winnebago) tribe in this region (Freeman 1956:39). Freeman also recorded Iroquoian material, possibly either Huron or Neutral pottery, and noted that "Since the Huron pottery was found in association with the Oneota potsherds and the Winnebago were living on Green Bay when the Huron arrived, the two groups probably lived at the site together" (1956:40). Freeman argued that Arthur C. Neville had incorrectly identified Point Sauble as a Potawatomi Village (1956:6; c.f. Neville 1906). Lurie and Jung have recently cited Neville's identification of Point Sauble as a Potawatomi locale in their discussion of the Red Banks area as a possible landing-spot for Jean

Nicolet. However, they seem to accept Neville's identification of Point Sauble as a Potawatomi rather than a Ho-Chunk village, without any reference to Freeman's report of archaeological investigations at the site (Lurie and Jung 2009:60). Although these ethnic affiliations cannot be supported without further investigation, Point Sauble remains an important locale of documented early-historic activities. Point Sauble, Beaumier Farm, and Red Banks are closely related sites with at least circumstantial evidence of seventeenth century proto-historic occupations possibly affiliated with early historic Ho-Chunk groups.

Five glass trade beads from the Point Sauble site were located in the Wisconsin Historical Society (WHS) collections and subjected to LA-ICP-MS. Based on their accession numbers, the beads seem to come from Hall and Wittry's excavations, but none of the beads recovered came from occupation areas; rather, these beads may represent disturbed surface collections in association with an old house on the site (Freeman 1956:34). The bead sample is useful for comparison with beads from larger region, but since both Native groups and Europeans sporadically occupied the site at least into the nineteenth century, the temporal context of the Point Sauble beads is indeterminate. A search of the WHS collections for copper-based metal artifacts from the site revealed only two copper awls, which are probably not trade items but rather pre-historic native copper pieces. Freeman's report lists "many fragments of brass" (1956:33) from earlier excavations, but these objects could not be located in the WHS collections. Therefore, no metal artifacts were added to the dissertation database from this site. The WHS Beaumier Farm collection also yielded no artifacts suitable for my analyses.

3.4.3 Lake Superior area (Ojibwe sites)

There are only three clearly identified early or middle historic sites located in Northern Wisconsin and the Upper Peninsula of Michigan near Lake Superior. Two of the sites, Cadotte and Marina, are on Madeline Island, the largest of the Apostle Island chain located in Lake Superior and just north of Chequamegon Bay, off the east coast of the Bayfield peninsula. The third site in my study sample is Goose Lake Outlet #3, located seven miles inland from Lake Superior near Marquette, Michigan. The site is situated on the original outlet of Goose Lake, where it empties into the Escanaba River system, though the modern location of the lake outlet has changed due to railroad grading activities (Mason and Paquette 2009). The Escanaba River crosses the Upper Peninsula and flows into Lake Michigan at Little Bay de Noc. The physical geography of the Lake Superior area includes drained glacial lake basins and till plains, as well as glacial outwash sediments (Wisconsin Cartographers' Guild 2002: 36-37). At AD 1600, the vegetation was dominated by deciduous-coniferous forest of maple, beech, birch, hemlock, and fir (Tanner 1987: 15-16). Native copper ore deposits are common in the Lake Superior Basin area, especially on the Keweenaw Peninsula and Isle Royale (Martin 1999).

3.4.3.1 Goose Lake Outlet #3 (20 MQ 140)

Goose Lake Outlet #3 (GLO #3) is located in the north-central part of Michigan's Upper Peninsula, several miles west of the city of Marquette. This site was identified by avocational archaeologist James R. Paquette in the 1990s (Paquette 1996). Excavations were conducted by Paquette, the late John Anderton, and professor emerita Marla Buckmaster of Northern Michigan University, with test units in 1999 and 2000 and more extensive fieldwork conducted in 2012 and 2013. Formal publications of excavation research are still forthcoming and excavated materials are currently being analyzed and curated at the Marquette Regional History Center.

Based on the inland location of the site, Paquette has suggested that GLO #3 may have been a winter campsite possibly inhabited by northern Anishinaabe or proto-Ojibwe peoples, since these groups were known to occupy this general locale in the early historic period

(Paquette personal communication 2013). Large quantities of fragmented moose bone and fire-cracked rock initially give the impression that this site could have functioned as a hunting and marrow-processing area, though the ongoing analysis may change this preliminary idea (Buckmaster personal communication 2013). Artifacts recovered from the site include several iconographic rings, a broken French clasp knife, the tip of an iron trade knife, a pair of scissors, glass beads (attributed to the early-mid seventeenth century in various bead typologies), as well as lithic debris, "Woodland period" projectile points, and copper awls (Mason and Paquette 2009). James W. Bradley agrees with Paquette's assessment that the glass bead assemblage is similar to those found on sites dated to c. 1625 – 1630 in Eastern North America (Bradley personal communication 2013). These dates would make GLO#3 the earliest documented protohistoric site in the Upper Great Lakes region. In the course of dissertation research, I analyzed 13 blue glass trade beads from the 2012 season and two copper-based metal fragments, HW-02531 and HW-02532.

3.4.3.2 Cadotte (Winston-Cadotte) (47 AS 13)

The Cadotte site possibly represents the earliest historic-era intercultural trading activities on Madeline Island. Materials examined in this project mostly come from Leeland Cooper's 1961 investigations. The collection is curated at the WHS and recently has been reexamined and published for the first time (Mazrim 2011). I also studied artifacts at the Madeline Island Museum, which houses surface collections gathered by avocational archaeologists, especially Al Galazen, a longtime resident and local historian of Madeline Island.

There is some disagreement about the antiquity and social affiliation of the earliest historic contexts of the Cadotte site, summarized here and discussed further in Appendix A. Birmingham argued that the available archaeological evidence and the documentary record support a mid-seventeenth century date for the beginning of a European (material) presence at the site (1992, 2005). Mazrim placed the date earlier, perhaps as early as the 1620s, making inferences based on ceramic style change and suggesting that Huron pottery found best matches pre-diaspora (c. AD 1649) styles (2011:51). There is no material evidence to independently support this ceramic interpretation, but Mazrim makes a plausible argument for a pre-1650s seasonal Huron and Ojibwe/Odawa presence on the island based on these interpretations of ceramic styles and the existence of pre-contact trading networks. In the absence of further evidence, I use Birmingham's later dates in this project.

I identified some confusion in Mazrim's delineation of "Isolated Component 1" materials that he attributed to the pre-1670 "aboriginal occupation" (2011:34). Mazrim presented only circumstantial evidence to support his further assertion that some materials in Component 1 were deposited prior to c.1650, probably dating from the 1620s to the 1680s (2011:53), but see my Appendix A for more discussion. Further investigation of the Cadotte site could help clarify the timing and social identity of earliest European and Native interactions at the site (Birmingham 2005). Clearly there was a strong multiethnic trading presence with deep history at this locale, but distinguishing different occupations and their social relationships and affinities is beyond the interpretive limits of the extant Cadotte site archaeological assemblage.

A total of 29 copper-based metal pieces are documented in my metals the database, including tinkling cones, metal projectile points, and assorted scraps. The WHS materials are listed in the database as HW-00672 to HW-00697, while two metal projectile points and a tinkler (also from the Cooper excavations) on display at the Madeline Island Museum are HW-00724 to HW-00726. Ten glass beads analyzed from the site do not come from feature contexts, rather from various contexts of the block investigations, but they were included for the sake of comparison with the larger data set, and to try to contribute some additional temporal control to the site. Five more glass artifacts from the Al Galazen collection (discussed next in the Marina site section) may come from either Cadotte or the nearby Marina site. All metal and glass items analyzed from Cadotte probably represent a time frame spanning the seventeenth century to early eighteenth century, but no further temporal delineations are proposed here.

3.4.3.3 Marina (47 AS 24)

The Marina site of La Pointe, Wisconsin, on Madeline Island, was partially excavated in 1975 and 1977 as part of an emergency salvage project and archaeological field school lead by Beloit College of Wisconsin. The key documentation for this work is an unpublished but widely circulated and detailed contract report (Birmingham and Salzer 1984). On the basis of documentary, ethnohistoric, and archaeological materials supporting the concept of "territorial ethnicity," Birmingham interpreted the main component of site as a predominantly Ojibwe (Anishinaabeg) village directly associated with a eighteenth century French fort. The fort was likely occupied from c. AD 1718 to 1775(?) (1992:186). A portion of this fort seems to have been excavated during the salvage project but remained unrecognized until a later reanalysis (Birmingham 2009). Madeline Island was an important meeting place for the Huron and Odawa peoples, as well as others attending seasonal congregations (Birmingham 1992).

The artifacts enumerated in the original report include items of Native manufacture such as bone tools, triangular projectile points and a limited number of grit-tempered ceramics. The excavators described the ceramic assemblage as relatively small, fragmentary, and highly diverse (1984:179-188). Later Birmingham compared some of the identifiable sherds to those used by Potawatomi groups of the eighteenth century (1992:188). Behm noted that several Butte des Mortes (Bell Type I) ceramic sherds have been identified in the Marina site collections, suggesting that they may have been deposited during a historically documented visit of the Meskwaki to nearby Chequamegon c. 1665 (Behm 2008:42-43). Given the roles of La Pointe, Madeline Island, and the Chequamegon Bay area in general as a strategic location for trade and as a meeting place throughout the seventeenth and eighteenth centuries, it is unsurprising that a variety of ceramic styles are present among the artifacts of Native manufacture.

Trade items from the habitation area include a diverse array of eighteenth century materials, catalogued in categories including clothing items, adornments, grooming, smoking, food preparation and consumption, and structural materials (Birmingham and Salzer 1984). I examined a total of 33 copper-based metal artifacts from Marina, HW-00722 to HW-00757, including tinkling cones, projectile points, rolled beads and unfinished or scrap pieces. These materials came from non-burial feature contexts that seemed most likely to be related the earlier eighteenth century occupations of the site, based on provenience information in field notes and the CRM report; however, there is no comprehensive list of "early" features is published or documented. A total of 17 blue glass trade beads and pendants from the Marina site vicinity were examined with LA-ICP-MS. Twelve of these come from the excavated feature contexts and the remainder (including 2 refired glass pendants) from the collections of Al Galazen, local historian and avocational archaeologist of Madeline Island.

3.4.4 Lake Winnebago area and Arrowsmith site (Meskwaki sites)

The area around Lake Winnebago includes several additional smaller lakes or pools of the Fox River, including Lake Butte des Morts, Lake Poygan, and Lake Winneconne. The Fox River in this area known as the "Middle Fox River Passageway" (C. L. Mason 1994) from its headwaters near Pardeeville, Wisconsin to its outlet into Lake Winnebago in Neenah, Wisconsin. The Lower Fox river extends from Lake Winnebago to its drainage into Green Bay. This area is located in a glacial till plain, with oak grassland forests (Tanner 1987:14-15). The Bell Site is the most widely investigated and well-understood site in this region, and it is recognized as the "Grand Village of the Meskwaki." From c. 1680 to 1730, the Meskwaki people controlled much of the Lake Winnebago area and only migrated from this territory after sustained conflicts with the French. Therefore, even though the Arrowsmith site is in the plains of the "Illinois country," it is discussed in this section because of its direct connection to Meskwaki groups who had been present in the Lake Winnebago area just prior to their occupation of the Arrowsmith site.

3.4.4.1 Bell (47 WN 9)

The Bell Site, located near Oshkosh, Wisconsin on the southern shore of Big Lake Butte des Mortes, is one of the most extensively excavated sites in the sample. It was investigated by professional archaeologists, field school students, artifact collectors, and avocational archaeologists for close to 90 years before it was developed for residential use in the early 2000s. Development led to the destruction of most of the site. Bell has been widely used as a comparative assemblage for late-seventeenth to early eighteenth century assemblages, ever since G. I. Quimby identified Bell as the most completely reported "Middle Historic" site in his chronology of historic sites (1966: 118-125). The most recent investigations of the site confirmed that Bell is the locale of the historically documented "Grand Village of the Meskwaki," which was probably inhabited continuously from A.D. 1680-1730 (Behm 2008).

The Bell Site assemblage contains the diverse variety of trade items and Native-produced materials that are consistently present on "Middle Historic" sites; these include both an abundance of metal scrap and tinkling cones as well as glass trade beads. In my dissertation research, I examined materials from the UW-Oshkosh field school, Warren Wittry's 1959 excavations, and 1970s surface collections from metal detectorist James Peterson's collection. A total of 958 individual metal artifacts were documented in the metals database, as a whole constituting the largest metals sample from any individual archaeological site in the study. The metal artifacts are listed in the database as HW-00001 to HW-00242; HW-000248 to HW-00316; HW-00420 to HW-00431; HW-00448 to HW-00484; HW-00515 to HW-00525; HW-00599 to HW-00671; HW-00758 to HW-01237; and HW-01239 to HW-01275. The numbering is non-consecutive since database entries were added as objects were recorded and other assemblages were entered into the database while the Bell site materials were being examined. Thirty-six blue glass beads from feature and unit contexts were analyzed in this project.

3.4.4.2 McCauley (47 WN 222)

The McCauley site is located in Oshkosh, Wisconsin, along the Middle Fox River Passageway where the Fox River flows into Lake Winnebago. The site was excavated by Arthur Kannenberg of the Milwaukee Public Museum, who began preliminary investigations in 1929 and further conducted exploration 1930 and 1931, which makes it the earliest excavated collection in my dissertation dataset. Overstreet suggested that McCauley is one of three archaeological sites in a provisional "Dandy" phase linking eastern Oneota groups to the historically document Winnebago or Ho-Chunk (Oversteet 1993; 1997). The other two sites in the proposed "Dandy" phase are Hanson and Astor, which I discuss respectively in the Green Bay and Door Peninsula section above, and in Appendix A. Overstreet rehabilitated and re-catalogued the McCauley collection in 1987-88 (1993:123), and his work with these materials made it possible for me to more readily access the collection. Materials present in the collections include trade goods from throughout the seventeenth – nineteenth centuries, Native-made ceramics, lithics, and other tools, faunal remains, as well as human skeletal remains. Many of these materials are jumbled together in the upper levels of the site. All human skeletal material and potentially associated artifacts are now curated in the NAGPRA collection of the Milwaukee Public Museum. Kannenburg's original records, inventory ledgers, and typed notes and sketches are on file there, and I had access to these during my research.

I identified minor discrepancies between Overstreet's published report and the original accession records, and I was unable to isolate a definitive seventeenth century component in the collection. These findings and problems are presented in further detail in Appendix A. Nonetheless, I did include a total of 33 copper-based metal artifacts from the McCauley site excavations in my dissertation research: HW-00418 to HW-00419, HW-00485 to HW-00514, and HW-00698. These artifacts seemed to be the best candidates for materials from seventeenth or early eighteenth century activities at the site. None of the three blue glass beads from McCauley that were suitable for LA-ICP-MS were analyzed due to restrictions from the curating institution. I strongly agree with C. L. Mason's and Overstreet's assertions that further excavation of intact areas of the McCauley site could confirm the relationship among the site contexts and identify the presence or absence of trade items in undisturbed contexts with Lake Winnebago Trailed ceramics (see Mason 1994:47; Overstreet 1993:130).

3.4.4.3 (47 WN 853)

The 47 WN 853 site (informally known as the Lake Winneconne Park site) is located on the shore of Lake Winneconne, in the town of Winneconne, near Oshkosh, Wisconsin. The artifact assemblage is the result of a single tree-tip event that took place in 2001. Large quantities of fresh-water mussel shells were recovered along with shell-tempered Lake Winnebago Trailed Oneota ceramics, a small amount of culturally modified lithic debris, and a total of 8 small rolled metallic beads. The beads appeared to be cut sheet metal of the thickness and patina present in copper-based metals cut from trade kettles; they are documented in the database as HW-01523 to

HW-01530. Four of the eight recovered beads were tested informally with LA-ICP-MS at the Chicago Field Museum in 2013, and the test confirmed that the beads were made of European smelted copper, not native North American copper.

No additional archaeological investigations have been undertaken at Lake Winneconne Park, so it is impossible to determine if the beads and Oneota ceramics were originally deposited in association with one another or if the tree-tip disturbance jumbled two separate components at the site. If the beads and ceramics were deposited in a single event by the same people, this would support long-standing arguments that the eastern Oneota peoples may have been ancestral to historically documented Winnebago groups (as summarized in Overstreet 1995:56-67, 1997). Otherwise, trade goods in clear association with Oneota ceramics only appear on Rock Island (see Mason 1986; 1990). Further investigations at the Lake Winneconne Park site could provide significant insight into long-term cultural continuity in this region.

3.4.4.4 Markman (47 WP 85)

The Markman site assemblage comes from 2004 and 2005 field-school investigations conducted by Jeffery Behm of UW-Oshkosh in the New London area of eastern-central Wisconsin. Behm has reported on the initial findings of this project (2008:65-68) and suggested that Markman is presently the most-likely archaeological site to represent the historically documented Meskwaki village of "*Ouestatinong*" on the Wolf River, dated between 1665 and 1680. He considers it possible that the site also served as a winter camp during the period 1680-1730, when the Meskwaki summer villages were in the Middle Fox River Passageway, but at this time it is not possible to verify those dates (Behm personal communication 2014).

Relevant artifacts recovered from the field school investigations include: steel-knife blade incised Butte des Morts Incised (Bell Type I) pottery attributed to the Meskwaki, along with eight fragments of copper-based metal (HW-005326 to HW-00531), a single blue bead (type IIa40, tested with LA-ICP-MS), and an iconographic ("Jesuit") ring. In her analysis of iconographic ring style, Mason designated the Markman ring as representative of a distinctive "Markman" style, which is a variant of the more common L-Heart motif (Mason 2009; Mason and Paquette 2009). The Markman-style rings belong to an early iconographic series that Mason dates to the time of the Huronian diaspora, c. 1650; this style seems to have been replaced by more ornate iconographic styles by the 1680s (Mason 2009:384).

3.4.4.5 Chickadee (47 OU 251)

The Chickadee site is located adjacent to the right-of-way of U.S. Highway 45 near New London, Wisconsin. The Museum Archaeology Program of the Wisconsin Historical Society identified and partially excavated this site during Phase 1 and Phase 2 mitigation of a proposed bypass and highway expansion project. Initial investigations only uncovered Late Woodland and Oneota components, but the Phase 2 work conducted in summer of 2008 revealed additional features containing historic trade goods. Three trade axes (including 2 from pit feature contexts) were recovered, and comparative research suggested that they were of a style made for the fur trade in France from 1608 to 1760, with makers' marks generally identified at other mid-seventeenth century sites in North America (Reetz et al. 2008: 69). A small copper fragment was recovered from feature 6, and the excavators note that it was thin, flat, roughly square shaped and about 6mm in maximum length. This was the only copper-based metal artifact from the assemblage, but the piece was not added to the dissertation metals database. I analyzed a total of nine blue glass beads from the site using LA-ICP-MS.

Based on the hypothesized presence of other Meskwaki sites in the New London area, excavators identified the site as a "Middle Historic" seasonal campsite possibly associated with the Meskwaki people. Diagnostic ceramics from the site included a rim sherd from a La Salle Filleted type vessel, which is traditionally associated with Illinois groups (see discussion of this type at the Zimmerman site). La Salle Filleted ware has also been recovered on other Wisconsin sites, including the Bell Site and at Rock Island, neither of which is predominantly an Illinois or Iliniwek-affiliated locale. Two other rim sherds were recovered from Chickadee, one grit-tempered and one shell-tempered, but neither was identified to type in the report. The majority of recovered body sherds are of a fine grit-tempered character that the excavators interpret as consistent with Butte des Mortes (Bell Type I) wares found at Bell and other Meskwaki sites (Reetz et al. 2008:62). Given the historic documentation of Meskwaki groups in this area, and the predominance of Butte des Mortes style body sherds in the assemblage, a Meskwaki attribution following the assignment of the site excavators is not out of the question for this site, though a multi-ethnic village or seasonal meeting place could also be proposed.

3.4.4.6 Doty Island (47 WN 30 and 47 WN 671)

The Doty Island historic sites, located in Wisconsin on the northern shore of Lake Winnebago, on Doty Island, were investigated by Carol L. and Richard P. Mason during the 1990s in order to investigate early historic occupations (Mason and Mason 1993; 1997). The two site numbers represent two excavation areas adjacent to one another, with 47 WN 30 officially known as the Doty Island Village portion and 47 WN 671 documented as the Doty Island Mahler portion of site. Both excavations revealed plentiful historic trade items, including glass trade beads and copper based metal artifacts and adornments. Lead shot and trade silver artifacts in the assemblages attest to the strong eighteenth century presence at this locale. Window glass, whiteware and other later materials from upper midden levels of the Mahler portion site were suggested to belong to the latest (c. 1830) Winnebago occupation (Mason and Mason 1997:230).

The documentary record indicates that there was an early eighteenth century Winnebago (Ho-Chunk) village on Doty Island, but no excavated materials specifically support this identification, and no specific features are assigned to this occupation. Two Huron-incised-like rim sherds were recovered, and may possibly represent some of the earliest historic ceramics at the site (Mason and Mason 1993: 227; Figure 20 o-p). Behm also suggested a possible Meskwaki presence c. 1680 – 1711 on the island based on Butte des Morts Ware (Bell type I) ceramics recovered during the Masons' excavations (Behm 2008:61). Historic documents also record a Winnebago presence in the 1730s and through to the 1830s (Mason and Mason 1993:198-199). Both excavation reports document significant mixing of prehistoric and historic materials, especially in upper levels, making it difficult to definitively assign dates or attribute ethnic affiliations to the historic components of the site. Based on the documentary record as well as composition of the assemblages, Mason and Mason suggest a c. 1720 – 1780 Winnebago occupation for the Village Portion (1993) and a c. 1680 – 1710 Fox (Meskwaki) occupation at Mahler (1997) as the most likely ethnic identifications. A total of 307 copper-based metal artifacts from both site portions were included in the database, HW-00534 to HW-00598 and HW-01276 to HW-01522, and 79 glass beads from features were subjected to LA-ICP-MS.

3.4.4.7 Camp Shaginappi (47 FD 13)

A small collection from the Camp Shaginappi site, on the eastern shore of Lake Winnebago, is now curated at UW-Stevens Point. It was excavated by AVD Archaeological Services who conducted Phase 2 investigations to mitigate sewer line construction in 1997. They discovered Woodland and historic period occupations, but on the basis of a seventeenth century trade ax in context with a copper tinkler (HW-00721), some grit tempered pottery, and faunal remains, excavators dated one feature, Feature 22, to the seventeenth century (c. AD 1620 –

1700). No other historic-era Native-made ceramics were found at the site, and the feature may be the only representation of seventeenth century occupations. Because eighteenth and nineteenth century occupations at the Menominee village of Calumet are also documented nearby, it is possible that some historic materials represent later activities (Van Dyke and Riggs 2003: 122-129). No specific social or ethnic affiliation is suggested for the possible seventeenth century component of Camp Shaginappi.

Other features and contexts at the site also included probable early and/or middle historic era materials, but most of the historic deposits were heavily disturbed when they were run through by a drain pipe. Nevertheless, I recorded 23 copper-based metal artifacts in the dissertation database, HW-00699 to HW-00721. Some of these metal artifacts may actually be intrusive from the later occupation periods of the site, but they were included because of their comparative value, their possible seventeenth century attributions, and the relatively unpublished nature of the Camp Shaginappi excavations. Eleven glass trade beads also were recovered, representing nine different Kidd and Kidd types. In the report, Michele Lorenzini identified these beads as typical Middle Historic types (Van Dyke and Riggs 2003:97-102). No blue beads of the types examined in this project were present and therefore none were analyzed with LA-ICP-MS.

3.4.4.8 Arrowsmith (11 ML 6)

The Arrowsmith Battle Ground site is not located in the Lake Winnebago area, but rather in McLean County Illinois, positioned at the headwaters of the Sangamon River, between Champaign and Bloomington-Normal. However, this site is directly linked to Meskwaki occupations in the Lake Winnebago area by both archaeological and historical evidence. The site was excavated by students from Parkland College in the 1980s and early 1990s. An extensive historical record kept by the French, as well as a single Bell type I (Butte des Mortes) rim sherd attributed to the Meskwaki have led to its identification as the probable location of the historically documented 1730 “Fox Fort,” where Meskwaki and French forces clashed during a battle of the Fox Wars after the Meskwaki had fled Wisconsin (Stelle 2008; Stelle and Hargrave 2013). Other relevant historic-era artifacts contributing to this interpretation include artillery fragments, gun parts, Native-made gunflints, musket balls, and a French military button. The copper-based metal artifacts from this site were highly corroded and of limited use in the technological and attribute analysis. However, 27 copper-based artifacts were examined in the course of the study, records HW-02820 to HW-2846. In addition, three blue beads of the types relevant to my investigation were recovered and analyzed using LA-ICP-MS for comparison with beads from other known Meskwaki sites.

3.4.5 Fox Lake and Koshkonong area

This section discusses three sites located on the shores of Fox Lake and Lake Koshkonong in south-central Wisconsin. Limited archeological materials have provided circumstantial evidence for seventeenth and early eighteenth century occupations at these sites. The lakeshore environments of central Wisconsin in the seventeenth century were found in a grassland with oak forest environmental setting (Tanner 1987: 14-15). The physiographic setting of central Wisconsin is a glacial till plain created by the Green Bay lobe of the Laurentide Ice Sheet during the last Ice Age (Wisconsin Cartographers' Guild 2002:36-37).

3.4.5.1 Elmwood Island (47 DO 47)

The Elmwood Island site covers an entire 20 acre island situated near the center of Fox Lake in Dodge County, central Wisconsin. It was investigated by Archaeological and Consulting Services (ACS) in the 1980s to mitigate a sewer line and water treatment plant project (Salkin 1989). Along with a range of components dating back to the Archaic period, excavators found evidence of a historic-era Native American habitation. Features, including house floors, storage pits, and burials were identified, but none dated to the historic era. Salkin listed 147 eighteenth and nineteenth century artifacts, including British and French (flintlock) firearm parts, two French clasp knives, two trade axe heads, five “French” trade beads, a brass bead, a “glass pendant” and “23 brass kettle fragments” (Salkin 1989:214-215).

The materials are consistent with a “Middle Historic” occupation, especially in excavation Block B at the southern tip of the main terrace of the island (Salkin 1989:240). According to documentary evidence, the Ho-Chunk (Winnebago) were present in the Fox Lake area by the 1820s but no artifacts recovered support this specific ethnic identification (Salkin 1989:243). Salkin further suggested that the Fox (Meskwaki) presence in the Lake Winnebago and Fox River Valley areas prior to the 1820s may have extended to Fox Lake (Salkin 1989:243), but no archaeological evidence recovered either supports or falsifies this interpretation. Twenty-eight copper-based metal artifacts were included in the database, HW-00243 to HW-00247, HW-00317 to HW-00338, and HW-00432. A few of the artifacts may be native copper, including a tinking cone. No glass trade beads recovered during the ACS investigations were of the types being investigated in the present study.

3.4.5.2 North Shore Village (47 DO 39)

The North Shore Village site is located on the northern shore of Fox Lake in Dodge County, Wisconsin. As at the nearby Elmwood Island site, a sewer line dug through the North Shore Village site required archaeological mitigation; excavators found this locale to be much more disturbed than on the Elmwood Island (Salkin 1989). Although the area was disturbed, it was targeted for excavation because earlier ACS surveys had identified historic materials possibly associated with the historically documented Ho-Chunk (Winnebago) village in the area.

European-made materials recovered include firearm parts, native-made and European gunflints, lead balls, clasp knives, and assorted other trade items. The materials are identified as spanning a range of historic periods, but Salkin predominantly identified them as Middle and Late Historic, from the early part of the eighteenth century to the early nineteenth century (Salkin 1989:510-511). As at Elmwood Island, the ethnic affiliation of the historic Native American habitation is unclear, but could be related to the Meskwaki (Fox) in the eighteenth century and/or the Ho-Chunk (Winnebago) in the nineteenth century (Salkin 1989:578-582)

Salkin's report lists a total of 70 brass kettle fragments, but despite extensive searches of the UW-Madison collections during the spring 2012 academic semester, only a few of these were located. Fifteen copper-based metal artifacts were identified from the ACS investigations of this site, HW-00433 to HW-00447 in the database. The site report provides further information on the now-missing artifacts, including some metric data on the tinklers. These sections are reproduced in the North Shore Village section of Appendix A. The ACS project recovered 16 glass trade beads, which were located, but none were of the types examined in my analyses.

3.4.5.3 Carcajou Point (47 JE 2)

Based on the archaeological evidence of fifteenth and seventeenth century materials, Carcajou Point and the Lake Koshkonong locales should yield archaeological evidence for a connection between the historically documented Winnebago tribes in this region and late-prehistoric Oneota activities, yet no "protohistoric" component has been identified in excavations there (but see Birmingham 2014). Robert L. Hall connected the historic materials that he recovered at Carcajou Point to the historic Winnebago tribe, and he called the historic features the "White Crow component" to recognize the historically-known leader of the village documented on that location in 1828 (Hall 1962:147). Hall suggested that the White Crow component could extend back to perhaps c. 1730 at Carcajou Point, noting that historic maps including DeLery's 1730 map locate the Winnebago on Doty Island at that time (1962:149). Hall projected this Winnebago identity back onto the earlier Oneota occupation at Carcajou Point, which he refered to as the "Carcajou Component," stating that "the Carcajou Component may be an archaeological expression of Winnebago culture at this time, making Carcajou Point the location of one of the earliest as well as the last Winnebago villages in southern Wisconsin" (1962:159). If this is the case, and there is cultural continuity between the two components, despite their temporal separation of several hundred years, then there ought to be archaeological evidence of occupations in this area during the intervening period.

Archaeological investigation at Carcajou Point has taken place since Robert L. Hall's pioneering work in the 1960s (Hall 1962). Ongoing projects conducted by UW-Milwaukee have periodically re-examined portions of the site (Goldstein and Benchley 1990; Jeske 2003; Richards et al. 1998). These investigations also have not yielded any clearly seventeenth century trade items. However, avocational collectors also have frequented the Lake Koshkonong area, and Birmingham has recently proposed that the James Bussey collection from nearby Crabapple Point (47 JE 93) may contain protohistoric materials (2014). I was unable to analyze the Bussey collections materials in my research; however, there are surface collections from Carcajou Point curated at the WHS. A search of the WHS material revealed a few glass trade beads, as well as several hundred worked kettle metal fragments, including tinkling cones, metal projectile points, partially worked blanks, and scrap pieces. I elected not to conduct attribute analyses of the copper-based metal artifacts in the WHS collections because many of them likely were produced by inhabitants of the eighteenth and nineteenth century Winnebago villages, which are outside the bounds of the present study. The provenience of many of the copper-based metal artifacts in the WHS collections attributed to Carcajou Point are vague. I included one tubular blue bead (Ia19) in my LA-ICP-MS study for comparative purposes. This artifact came from the surface collections of a Mr. H. L. Skavlem, and it was donated to the WHS on March 18,1916, but no further provenience information exists beyond the site-level. There is potential for further research with the Carcajou Point material, but significant archival and collections-based research will be necessary to first isolate any seventeenth century artifacts.

3.4.6 Western neighbors (Ioway sites)

The physiographic setting of Iowa and southeastern Minnesota is similar to that of the Illinois country discussed in the "Southern Neighbors" section (3.4.7). Glaciers formed flat expanses, and riverine settings include both upland and floodplain environments. The Mississippi River is the dominant waterway in this area, though the Missouri River forms the border of Western Iowa. At AD 1600, the area was covered in flat grassland plains and forested waterways, with predominantly hickory and oak growth (Tanner 1987:14-15).

Three archaeological sites selected from Iowa (Gillett Grove, Milford, and Wanampito) yielded artifacts suitable for limited comparative analyses with Upper Great Lakes sites. NSF funding remained after analyses of Upper Great Lakes materials were complete, so at the suggestions of John Doershuk and Joseph Tiffany, I expanded the geographic scope of my project to include glass beads from the three protohistoric assemblages in Iowa. These are curated at the Iowa Office of the State Archaeologist. I included these sites because of their mid-late seventeenth century dates and the possibility that they could provide useful comparative regional information. I have not included the western Iowa sites on my regional map because the preferential selection of glass beads from these sites ignores other find-spots of early historic trade items from sites west of the Mississippi River and could distort a reader's perception of the extent of early and proto-historic sites in the greater Midwest region.

3.4.6.1 Farley Village (21 HU 2)

The Farley Village site near County Highway 4 in Houston County, southeastern Minnesota was investigated by the Mississippi Valley Archaeology Center (MVAC) in 1989, during mitigation of the re-grading of the road. This site is one of many identified sites in the area, though most of the others are attributed strictly to the Orr Phase Oneota and have not yielded European trade items. The ceramics are of the Allamakee Trailed type, associated with Orr Phase Oneota peoples, who are linked with the protohistoric Ioway (Gallagher 1990: 63).

A total of three glass beads from Farley Village were subjected to LA-ICP-MS. The copper-based metals assemblage of 21 pieces is documented in the database as HW-03390 to HW-03410. Five of these artifacts come from a larger batch of 22 fragments of B-shaped tubing found in the same feature and which may or may not at one time have been connected. Gallagher speculated that it formed a "bracelet" though refitting was not possible. Based on the discussion of B-shaped tubing at the Utz site in Missouri (Bray 1978:33-34), Gallagher also suggested that the B-shaped (or "butt convoluted) tubing is possibly machine made in Europe, and he noted the widespread distribution of this type of material on protohistoric sites (1990).

3.4.6.2 Wanampito (13 BM 16)

Wanampito is one of the three seventeenth century occupation sites in Iowa included for comparative purposes when surplus funds became available. It is located in northeastern Iowa, in Bremer County, near the Cedar River. This site is only known through surface collections made by avocational archaeologists. On the basis of a limited amount of trade items in conjunction with Late Woodland and very late prehistoric Oneota ceramics, it is interpreted as a protohistoric

Ioway settlement. “Wanampito” means “blue beads” in the Ioway language (Whittaker and Anderson 2008:4), and the site name refers to artifacts spanning prehistoric and historic times: blue beads of stone and glass were recovered at the site. This site is represented in my study sample by a single surface-collected blue glass bead. Other materials recovered from Wanampito include: triangular points, shell tempered pottery, and even a crushed tinkling cone, which may be made of either native copper or recycled metal from a trade item.

3.4.6.3 Milford (13 DK 1)

Milford is located just north of the Gillett Grove site in the Little Sioux River Valley, in Dickenson County, northwestern Iowa. Both sites were probably occupied at roughly the same time during the seventeenth century by Oneota groups using Allamakee Trailed, Orr focus style ceramics, attributed either to the Ioway or the Oto (Tiffany and Anderson 1993; Anderson 1994). Like nearby sites, Milford has been heavily collected since the early twentieth century, and many artifacts remain in private collections. According to the investigators, trade items recovered at this post-contact Oneota site include metal fish hooks, firearm parts, gunflints, kettle fragments and scrap metal, copper points, red stone or catlinite pipes and pendants lead shot, triangular stone points, iconographic (“Jesuit”) rings, and glass trade beads. On the basis of spatial distribution and types of materials present, the excavators suggested that a wide range of activities took place during a relatively short period of occupation, possibly as a pedestrian hunting camp occupied during late summer or fall.

Anderson conducted a detailed typological study of glass and metal artifacts recovered on the site during the 1978 excavations (Anderson 1994). Excavations revealed a total of 54 glass trade beads, 5 of which were selected for LA-ICP-MS analysis. All five analyzed beads are small cobalt blue seed beads recovered at different depths of Feature 3. Anderson suggests that the 22 glass beads recovered in this feature come from a beaded object discarded in the midden fill (Anderson 1994:15). Although relatively few copper-based metal objects including tinklers, rivets, and worked pieces of metal apparently cut from kettles were recovered during the excavations (n=19), time and budgetary constraints did not allow me to analyze these artifacts. Many more copper-based metal artifacts from the Milford site are in private collections and constitute a productive line of future research.

3.4.6.4 Gillette Grove (13 CY 2)

The Gillett Grove site is located in the Little Sioux River valley, south of the Milford site and across the county line in Clay County, Iowa. The site was recognized and recorded in the 1920s, but professional and systematic investigations were conducted in the 1990s (Shott et al. 2002; Titcomb 2000). Recent investigations included a detailed study of surface collections and the reliability of this sampling technique, as well as test pits. Investigations recovered Allamakee Trailed Oneota ceramics, triangular lithic points, glass beads, worked copper-based metal, and other trade items. Two statistically indistinguishable radiocarbon dates from the site yielded an average date of 1538 +/- 46 at the 2-sigma level (Shott et al. 2002:167), but the investigators propose a late seventeenth century date on the basis of the styles of trade items present. I analyzed the composition of sixteen glass artifacts, including a two-toned re-fired blue glass fragment, all from excavated site contexts. As with the Milford site, time and budget constraints did not allow detailed examination of the re-worked metal artifact assemblage. Gillett Grove provides an example of protohistoric western Oneota site likely in communication with the same trading networks as Milford site residents.

3.4.7 Southern neighbors (Illinois sites)

Three sites were included from the Illinois region, on the basis of their protohistoric affiliations and the presence of blue glass beads, refired glass objects, and modified copper-based metal artifacts. While early seventeenth century sites are absent from the archaeological record, the New Lenox site is confidently dated to the first half of the seventeenth century, and both the Iliniwek and Zimmerman sites may be nearly as old. The physiographic setting of the southern neighbors in "Illinois Country" is a plains environment, with most of the area encompassed by glacially tilled flat landscape (Illinois State Geological Survey 2014). Waterways include channels that feed in to the Mississippi River, including the Illinois River, on which the Zimmerman site is located, and the Des Moines River, where the Iliniwek Site is situated close to the confluence with the Mississippi. At AD 1600, oak and hickory forests grew along the channels of the rivers, while the spaces between the major waterways were open grassland interspersed with oak and hickory (Tanner 1987:14-15).

3.4.7.1 New Lenox (11 WI 213)

Midwest Archaeological Research Services, Inc. (MARS) excavated a cluster of sites on the Sanctuary Golf Course in New Lenox, Illinois during the early 1990s, and the New Lenox Site represents a likely protohistoric component. A final site report in *Illinois Archaeology* is expected by the end of 2015 (Michael Connor, pers. comm. 2015) though materials-specific studies of ceramics (Bird 2003), glass beads (Billeck 2010) and the copper-based metal assemblage (Ehrhardt 2012) have taken place in the years since the initial investigation. Langford tradition Oneota ceramics are the predominant Native-made type recovered at the site (Bird 2003), but no further ethnic affiliation has been proposed in published literature on the site. Based on four radiocarbon dates and the styles of beads present in the assemblage, Billeck suggested a possible date range of c. 1609 – 1630 for the assemblage, placing it within the later portion of the Eastern North American Glass Bead Period 2 (Billeck 2010; see Bradley 2012; Kenyon and Kenyon 1983). Billeck also noted that the types and proportions of beads present in the New Lenox assemblage are distinct from those of Zimmerman and Iliniwek Village, arguing that these sites are not contemporary, placing New Lenox earlier than either one (2010). This would make New Lenox the earliest protohistoric site in the region. Because Ehrhardt previously analyzed the copper-based metal artifacts, I did not re-examine these materials. The copper-based metal assemblage that Ehrhardt examined includes a total of 242 artifacts classified as beads, tubes, clips, tinklers, coils, bracelets, tubing and assorted scrap. Ehrhardt tested 62 artifacts using ED-XRF and found no native copper in the assemblage, and that the ratio of brass to smelted copper artifacts was nearly 2.5 to 1 (Ehrhardt 2012).

3.4.7.2 Iliniwek Village (23 CK 116)

The Iliniwek Village Site (Haas/Hagerman Site), located in Clark County, northeastern Missouri, near the Des Moines River, is associated with the seventeenth century Illinois people, on the basis of historic records and Danner-style ceramics. Specifically, it seems to be the village of the "Peouarea" (Peoria) recorded in a visit by the Jesuits Marquette and Jolliet in 1673 (Grantham 1993). Although this locale is relatively distant from the Upper Great Lakes region, the location of the site on a tributary of the Mississippi River connects it to the Great Lakes via inland waterways. I included the glass beads from this site to compare them with those circulating through Great Lakes trading networks. Kathleen Ehrhardt has extensively examined the copper-based metal artifact assemblage (n=1393) from Iliniwek Village (Ehrhardt 2004; 2005; 2013) and I used her methodology and theoretical orientation in my own metals investigation. Therefore, the metal attribute data collected in my project are comparable with

Ehrhardt's work, and including glass beads from Iliniwek allowed me to explore possible connections among the trade networks moving these artifacts farther into the interior. The Iliniwek Site is most comparable to other seventeenth century Illinois sites in the region, particularly the Zimmerman site. Ehrhardt has recently summarized the ongoing research problems and unanswered questions about the movements of the Illinois people during the "protohistoric" period (2010).

I analyzed a total of 70 blue glass beads using LA-ICP-MS; I did not analyze the metal artifacts, but see Ehrhardt (2005:105-172) for a detailed discussion of the metal assemblage, attribute analysis, chemical characterization, and copper-working practices observed at this site. Ehrhardt's recent work with the Iliniwek artifacts examined the spatial distribution of crafting and activity areas within the site, and she argued that domestic production and skilled crafting were both important in the technological system that Illinois people developed to transform European-made copper-based metals into socially-significant objects of adornment (2013).

3.4.7.3 Zimmerman (11 LS 13)

The Zimmerman site is located in La Salle County, Illinois, on the north bank of the Illinois River, near Starved Rock (Brown 1961; Brown 1975; Mazrim 2015). Like the Iliniwek Village site, Zimmerman is associated with protohistoric seventeenth century Illinois peoples. Zimmerman site represents one of the most clearly attributable sites with an ethnic affiliation in my dissertation data set because it meets R.J. Mason's criteria of site-unit ethnicity (see Mason 1976) as the village of the Illinois called "Kaskaskia" that Jesuit Father Jacques Marquette visited and recorded in 1673 (reviewed in greater detail in Rohrbaugh et al 1999:13-18). Ehrhardt has summarized the problems and progress made in linking ceramic styles with historically documented groups at this site (2010). In my dissertation research, I examined a total of 130 copper-based metal artifacts from the Zimmerman site, listed in the database as HW-02847 to HW-02977. The specific protohistoric feature contexts contributing these copper-base metal artifacts are: 38, 39, 42-45, 61, 62, 70-70, 100-109, and 130-140. I also analyzed a total of 65 blue glass beads and re-fired glass fragments from the site using LA-ICP-MS. Additional relevant artifacts at Zimmerman include Danner-style and Huber-style pottery in association with seventeenth century trade items such as iron implements, firearm parts, and other materials.

3.5 Summary

This chapter summarized background documentary and archaeological evidence consulted during the research project. Sections included a review of historically-recorded Native American tribes present in the Early Historic era in the Upper Great Lakes, texts, maps, and oral traditions relevant to the period, and a synthesis of relevant information for each archaeological site that contributed materials to this project. The most important archaeological sites for the purposes of comparison with others in this study were highlighted in Table 3.5 and include Bell, Doty Island, Fort Michilimackinac, Fort St. Joseph, Gros Cap, Hanson, Iliniwek Village, Marquette Mission, Rock Island, and Zimmerman. These foundational sites were qualitatively distinguished based on the completeness and quality of excavations, extent of post-depositional disturbance, sample size of recovered metal and glass artifacts, and certainty of occupation dates and ethnic affiliations based on historical records and diagnostic artifacts. The next chapter presents artifact analyses methods for metal and glass artifacts from sites in the study sample.

Chapter 4. Research Methods

In this project, I investigated two broad material categories of artifacts: glass and copper-base metal, in order to understand the routes and timing of socially-structured trade networks through which various groups of Native people in the Upper Great Lakes region acquired European-made objects, and how reworked metal and glass artifacts may reflect hybridization and multi-ethnicity resulting from intercultural interactions. The specific techniques employed to investigate metal and glass differ, but chemical and attribute analyses were applied in both categories. Much previous archaeological research investigating these artifacts has focused on single material types. At times, a single-material focus can gloss over the fact that while metal and glass artifacts usually are recovered individually in the archaeological record, they come from similar use-contexts, generally composite adornment objects. Wearers of glass beads, tinkling cones, and glass pendants combined these with other material types not included in this study, such as quillwork, shell, red stone or catlinite, crafting unified designs on clothing, or adornments such as necklaces (see Loren 2009, 2010), which are not usually recovered intact.

I chose to analyze both metal and glass artifacts in this study to better understand relationships among materials used as adornments. For example, glass bead recipe subgroups identified through chemical analyses have chronological significance and represent trading routes and relationships that also brought copper-based metal trade objects to sites. In turn, variations in reworking style for copper and brass adornments might reflect the technological practices of particular communities or ethnic groups, whose identities might structure social relationships governing the trading networks delivering glass beads and metal trade items. Metal and glass artifacts are complementary lines of evidence because the materials are technologically independent variables derived from different sources and possibly different trade networks.

4.1 Glass bead attribute analysis methods

I used elemental analyses of blue glass beads to identify variation in the glass recipes of beads that visually appear to be made of the same kinds of glass, similar in color, translucency, and shape. To select visually-similar beads for chemical analyses, I examined beads according to their physical attributes as assigned in the most commonly-used bead typology in North America and Europe, the Kidd and Kidd system (1970) as modified by Karklins (1982; 1983). This system is used to classify most glass beads from historic-era sites that I examined in Wisconsin, Illinois, and Iowa. However, the Stone typology, developed for the Michilimackinac glass bead assemblage (Stone 1974) is more frequently used in Michigan. Both the Kidd and Kidd and the Stone system are based on the physical properties of glass beads that allow archaeologists to group beads into visually similar categories of objects manufactured in the same way. Below, I explain how these glass bead typologies work, and identify how they interface with one another.

4.1.1 Bead typologies

Archaeologists have developed typologies to classify glass beads so that they may be compared with those in other assemblages. The two most commonly used typologies in the Upper Great Lakes region are Kidd and Kidd's system (1970) as modified by Karklins (1982; 1985), and Stone's typology developed for Fort Michilimackinac (1974). It was necessary to work within both of these systems, as well as with less formal bead descriptions (e.g. dark blue seed bead, light blue tubular bead) that some archaeologists have used to categorize glass bead assemblages investigated in this dissertation. Both Kidd and Kidd and Stone's systems sort beads on the basis of size, shape, manufacturing method, transparency (diaphaneity), and color.

In order to understand how these typologies work, it is necessary to briefly review the processes of glass bead production. In European workshops, most glass beads produced for colonial-era trade were made using two basic methods, winding and drawing (see Kidd and Kidd 1970: 47-50; Stone 1974: 88). Wound beads were produced individually by winding or wrapping a solid strip of hot glass around a mandrel, usually resulting in striations in the glass bead that follow the circumference of the bead. Wound beads could then be heated, shaped, and decorated with additional pieces of glass. Drawn beads were produced in batches by introducing an air pocket into a heated lump glass, then stretching or drawing the glass into a long, thin tube. The tube could then be cut into individual beads, with visible striations in the glass parallel to the bead aperture. Drawing could produce both tubular beads and shorter, “donut-shaped” seed beads by reheating and tumbling to smooth the glass. Surface decorations of different colored glass could be added to both wound and drawn beads, and multiple layers of glass could be added using either method to produce multicolored beads. Continuous variation in the sizes, shapes, and decorative patterns of glass beads occurs. Although trade bead assemblages from the sites discussed in Chapter 3 vary widely in the number and type of beads present, I have focused on monochrome (blue), drawn, generally small-size beads in my project (see section 4.1.3).

The size of beads is relevant in both the Kidd and Kidd and Stone typologies, but size is not an actual typological attribute in either system. Rather, before identifying types, Stone first categorized beads by function: necklace beads for stringing, seed beads for sewn beadwork and not stringing, and rosary beads (Stone 1974:88). Rosary beads are made of bone or ivory and they are identified by these material types; however, the distinction between glass necklace and seed beads is based on the relative size of beads. Stone assumed that “necklace” beads were larger relative to the average size of beads of that type in the assemblage, and that seed beads were smaller. For “intermediate beads,” he states: “If an intermediate-sized bead is found to be of the same type as beads which have a small average size, then the particular specimen is classified as a seed bead. If the same bead were found to be representative of a bead type which had a large average size, it would be classified as a necklace bead" (Stone 1974:88). The Kidd and Kidd system also does not classify beads by size, but rather notes the presence of very small (< 2mm), small (2-4 mm), medium (4-6 mm), large (6-10 mm), and very large (over 10 mm) beads within each of the typological categories (1970:66).

The Kidd classification system divides beads into typological categories on the basis of bead production methods. Class is the first category in this trinomial system, and it is based on manufacturing processes, identified by striations resulting from drawing or winding the glass. Drawn beads are classed using Roman numerals I to IV, while all wound beads are marked with a "W." Class I beads are monochrome, drawn tubular beads; Class II beads are monochrome, drawn rounded or donut-shaped beads; Class III refers to layered, multicolored tubular beads similar to Class I, and Class IV beads are layered, multicolored rounded beads similar to Class II. Beads in all classes may be modified by reshaping or adding additional glass stripes or other decorations. The second component of the Kidds' trinomial typology marks such decorations and surface treatment such as faceting or twisting with lowercase letters that follow the Roman numeral or W; "a" always denotes the simplest, undecorated form in each class. For example, a type-IIa bead is a drawn, rounded, monochrome bead with no decoration. Color and shape both are considered in the third element of the Kidd and Kidd system, identified with a number after the first two elements. Beads of the same color, but different shape, are numbered sequentially.

The Stone quadripartite typology divides beads on the basis of manufacturing methods, decorations, shape, and color. Stone used the same classifications within his necklace, seed, and rosary bead functional categories. First, the method of glass bead manufacture is identified on the basis of striations in the glass either parallel to the aperture, indicating Class I, drawn beads, or

Class II, wound beads with striations ringing the circumference of the bead, perpendicular to the aperture. The next aspect of the typology, Series, is marked by a capital letter (A, B, C, or D) that refers to the construction of the bead: Series A, "simple" monochrome construction; Series B, "compound" construction with two or more layers of glass; Series C, "complex" construction with further applied decorations; or Series D, compound-complex or "composite" types. The third component of Stone's system, Type, marked in Arabic numerals, refers to the shape of the bead in longitudinal cross-section, while the fourth component, Variety, refers to both color and translucency of the glass and is marked with a lowercase letter. Type-IA1 refers to a drawn, monochrome, convex-shaped bead in the Stone system, and the bead would be classified as either a seed or a necklace bead based on its size relative to others in the assemblage.

In both the Stone and the Kidd and Kidd typologies, bead color is determined by matching with a reference chart, either a Munsell standardized color nomenclature (for Stone) or a *Descriptive Color Names Dictionary* (for Kidd and Kidd). The availability of these color charts, the variable and sometimes poor lighting of research facilities, and the subjective nature of color identification make sorting by color a problematic element of all bead classification systems. Archaeologists have noted the tendency for inter-observer discrepancies in classifying beads, especially in determining color (Bradley 2012:166; Kenyon and Fitzgerald 1986:16; Shugar and O'Connor 2008:66-67), asking "what color, precisely, is 'dark shadow blue'?" (Mason 1986:187). In some assemblages that I encountered, archaeologists had avoided this problem by grouping beads by more basic color categories, such as blue, black, or white. If color was classified more generally in the Kidd and Kidd trinomial system, the third component could be eliminated, and beads would be classified only by production method and shape, resulting in a descriptor such as "IIa blue." In Stone's system for seed and necklace beads (1974), eliminating particular colors would leave off the fourth element (variety), only classifying by class of manufacturing method, construction (simple or compound) and type (shape). The Kidds and Stone both may have recognized the inherent subjectivity in color identifications and chose to use color as the final and most specific component of their typologies.

When studying individual glass beads, the archaeologist can assign the bead to an existing typological category, or if it cannot be easily classified, then it may be described as a variant of an existing type or a new typological category may be created for it. There is no standardized way to determine “how different” a bead must be before it is given a new type or variety. For example, Mason (1986:187) added an asterisk (*) to types of beads from Rock Island that he considered variants of the Kidd and Kidd system. When continuous variation was present between two types, Mason elected to use a slash (/) to indicate that a bead likely fell into one of the two related shape and color categories. For example, type IIa55/56 refers to drawn, monochrome round (spherical) or circular (donut-shaped) beads identified as “Brite Navy” in color. In more recent work at Michilimackinac, the type-site for the Stone system, Evans did not create new types but rather grouped non-conforming beads within existing Stone varieties of similar colors and manufacturing style, except in one case, where she referred to Kidd and Kidd instead of Stone to identify the closest typological category (2001:26). A third way of dealing with variation is to apply both the Kidd and Kidd and Stone systems, as Malischke (2009) did in her analysis of the Fort St. Joseph assemblage; she employed an asterisk and slash, following Mason, to deal with non-conforming types and also listed ranges of existing types that might fit the bead. Mason also attempted to classify the Rock Island beads using the Stone system as well as the Kidd and Kidd system to ensure comparability between the Rock Island and Michilimackinac assemblages (1986:192; Table 14.7).

4.1.2 Classification and attribute analysis methods employed

The primary Kidd and Kidd types examined in the dissertation data set are simple, drawn blue beads of types Ia19, IIa31, IIa40, IIa46/47 and IIa55/56 (Figure 4.1). These are the most basic types of blue beads in the typology and also some of the most frequently recovered types from seventeenth and eighteenth century archaeological sites in the Upper Great Lakes. Bead shapes include tubular, round, oval, and donut forms and they range in size from small to very large in the Kidd and Kidd system. During the research process, I identified blue beads of these Kidd and Kidd types so that visually similar or identical beads from different archaeological sites in the study sample could be analyzed using LA-ICP-MS. To learn to use the classification systems, I initially worked with the Rock Island collection, which Mason (1986) typed using both Kidd and Kidd and the Stone system. Therefore, my identifications of IIa31 type beads likely are influenced by the particular color and shape that Mason identified as IIa31 at Rock Island, but that another researcher under different conditions might consider more like IIa35.

Figure 4.1: Glass bead types investigated, labeled according to the Kidd and Kidd system

4.1.3 Sample selection process for blue glass beads

Blue beads (as a general category) were selected for this research project for several reasons: 1) in the Upper Great Lakes, beads from the earliest archaeological sites tend to be predominantly blue in color; 2) blue was a significant and meaningful color in Native American ideological systems, making blue beads a desirable trade item (Miller and Hamell 1986); and 3) refired glass pendants, which are of special interest as they represent innovative repurposing of trade items, were generally made from either blue glass or a combination of blue and white glass (Brown 1972; Howard 1972; Ubelaker and Bass 1970; Walder 2013b). To study the production processes of refired pendants and better understand the resource availability of blue beads as the source of "raw material" used to make pendants, I chose to focus only on analyzing blue glass beads, as well as available pendants and production waste from the same sites. Previous chemical analyses of blue beads (e.g., Hancock et al. 1994, 1996, 2000) successfully identified temporal and geographic markers. Glass color is determined by the addition of different ingredients in glass recipes; for example, the element copper usually produces turquoise-blue glass while the element cobalt results in navy or cobalt-colored glass. Therefore, selecting only blue beads narrows the focus of this study and allows researchers to identify of glass recipe patterns within visually similar or identical groups of glass beads. This eliminates the effects of color preference or consumer choice among the users of beads before deposition in the archaeological record.

Beads selected for chemical analysis were those from the most secure archaeological contexts at each site (Appendix B). Whenever possible, beads were selected from undisturbed feature contexts with clear chronological assignments and markers of social context (e.g. ceramic types associated with particular historic groups). Each bead was described according to its closest Kidd and Kidd type, shape, and diaphaneity. In addition, each individual artifact was photographed using a Dino-Lite Pro AM413T digital microscope either prior to or immediately following chemical analysis. Since primary classification of bead types (using either the Kidd and Kidd or Stone system) was already performed for most assemblages in the dissertation data set, I used existing bead classifications whenever possible. If beads from an assemblage were not classified using one of these two typologies, I used my own knowledge of the bead typology systems to identify beads of the types in the Kidd and Kidd system relevant to my research.

4.2 Glass bead chemical analysis methods

In this section, I briefly review the history of glass bead chemical analyses in North America, and I highlight the strengths and weaknesses of techniques employed. One of the earliest published chemical analyses of glass beads recovered in North America asked, "Do these IIa40 [drawn round turquoise-blue] beads in fact represent a homogeneous group or are there subtle differences through time or over space?" (Chafe et al.1986:13). Underlying this research question is the assumption that the ingredients used to produce glass varied among European glasshouses, and that those variations can reflect trade networks and chronological relationships of archaeological contexts. Methods for detecting these "subtle differences" have improved greatly even in the last ten years. Current glass research methods are reviewed in Janssens' *Modern Methods for Analysing Historical and Archaeological Glass* (2013c) and Henderson's *Ancient Glass* (2013). A recent non-technical summary of methods (Bonneau et al. 2014) is also useful for non-specialists interested in understanding the potential and limits of these techniques.

4.2.1 Methods of chemical analyses of glass trade beads in North America

Minimally or non-destructive chemical testing of glass beads' physical properties has been recognized as an important facet of research in this subject since the 1960s but developed significantly through the 1980s (Glascock 2013; Karklins 1983). More recent work, including my own using LA-ICP-MS, builds on findings of earlier studies conducted using Neutron Activation Analysis (NAA). The below sections summarize key glass trade bead research projects conducted using NAA, LA-ICP-MS, and other methods. Strengths and weakness of each approach, such as levels of destructiveness and elements that can be analyzed, are highlighted.

4.2.1.1 Neutron Activation Analysis

NAA was the first widely used method of glass physical analysis applied to glass trade beads from North American archaeological contexts. This method identifies fifteen to twenty elements commonly present in glass, including cobalt (Co), tin (Sn), copper (Cu), sodium (Na), aluminum (Al), manganese (Mn), chlorine (Cl), calcium (Ca), arsenic (As), and potassium (K) (Chafe et al 1986). Iron (Fe) and lead (Pb) were also important ingredients in some glass bead recipes, and values for these elements can be obtained using NAA, but the process of analyzing these heavy elements requires longer periods of irradiation that would often leave the artifacts too radioactive to return to their curators in a timely manner (Chafe et al. 1986:19), and early NAA studies did not generally include them. NAA is completely non-destructive when applied to glass beads following the methods used by Hancock and his colleagues, but inability to detect lead and iron is a weakness of these NAA analysis methods. In addition, NAA studies can be costly, and they also require the specialized equipment of a reactor facility, and these have become less-available in recent years (Glascock 2013: 194). However, the past successes of using NAA to identify glass recipe patterns related to chronology and trading relationships demonstrated that compositional analysis of glass beads is a viable research approach.

Possibly the earliest chemical study of glass beads in North America applied NAA to detect 36 chemical elements in a sample of 50 glass beads analyzed at the Phoenix Memorial Laboratory at the University of Michigan (Lewis 1979; Karklins 1983:124-125). The beads came from 21 different New World archaeological contexts from Nueva Cadiz, Venezuela, to Ontario, and as far west as Wisconsin. The beads represent a wide variety of colors and types (wound and drawn, simple and composite) from the fifteenth to nineteenth centuries. Lewis analyzed 11 beads from the Rock Island site in Wisconsin, along with 2 black seed beads from the Lasanen site (20 MA 21) and 2 white seed beads from the Fletcher site (20 BY 28). Both of these Michigan assemblages have now been repatriated, so these samples remain the only chemical data available for beads from those sites. Lewis's research demonstrated the viability of NAA analyses for glass beads from archaeological contexts, but the wide-ranging and diverse sample with only a few beads of different types from each site did not lead to the identification of particular chronological, spatial, or temporal patterns in glass bead recipes.

During the 1980s and 1990s, NAA of glass beads was undertaken by Ronald Hancock, Ian Kenyon, and various collaborators at the SLOWPOKE reactor facility at the University of Toronto. This research group investigated chemical composition of several thousand glass trade beads of many varieties from archaeological sites in northeastern North America and the eastern Great Lakes region. Their research goals focused specifically on 1) defining compositionally similar glass groups and then 2) identifying elemental variations within those groups to identify chronological patterning and possible trading relationships. Following Hancock's work, weight percent oxide for major elements and parts per million for trace elements have become the standard method of reporting chemical values, though most of the early NAA discussions focus on the major components of glass recipes.

Hancock's research group had several key contributions and impacts on the field of glass studies in North America. Their analyses of blue glass beads identified copper and cobalt as the two main colorants, and the researchers worked to identify patterns or subgroups within blue types (Chafe et al. 1986; Hancock et al. 1994; Hancock et al. 2000; Kenyon et al. 1995; Moreau et al. 1997). Researchers also identified chronological patterns in the base glass for beads of several different colors by identifying temporal differences in sodium (Na) and calcium (Ca) content (Hancock et al. 1994: 261) as well as potassium (K) (Kenyon et al. 1995:333), indicating that glass recipes changed through time. Moreau and co-authors applied this chronology to a previously un-dated archaeological assemblage of blue beads colored with copper and cobalt (1997). Hancock's research group also linked particular blue glass compositions identified in beads from sites in Ontario, Canada and Amsterdam, the Netherlands, hypothesizing a trading relationship between contemporary sites (Hancock et al. 2000). Only limited research has investigated European production of the specific types of glass trade beads that are recovered in North America, so it is not yet possible to connect recipe variations documented in beads from Upper Great Lakes sites to specific European workshops, but see Karklins et al. (2002) and Bradley (2012). Hancock's research team demonstrated conclusively that chronological and spatial patterns in glass trade beads relate to human behaviors, particularly trading relationships and glass recipe shifts.

4.2.1.2 Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry

Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) is a method of elemental analysis that is faster, less expensive, and more widely available than NAA. I employed LA-ICP-MS in my research because it is a reliable, cost-effective, comprehensive, and minimally invasive method of quantifying the chemical elements present in the glass artifacts. Like NAA, LA-ICP-MS is also capable of determining the composition of other materials, including glass, metal, ceramic, and stone objects. Progress in LA-ICP-MS methods for archaeological research began in the 1990s and developed significantly in the 2000s (Gratuze

2013; Speakman et al. 2007; Speakman et al. 2002). Another major advantage of this method is that the attachment of a laser to the mass-spectrometer allows the researcher to cut through any surface contamination or corrosion, while at the same time leaving no trace on the surface of the artifact visible to the naked eye without magnification. Four adjacent points of analysis are used in the standard LA-ICP-MS procedure for glass (Figure 4.2).

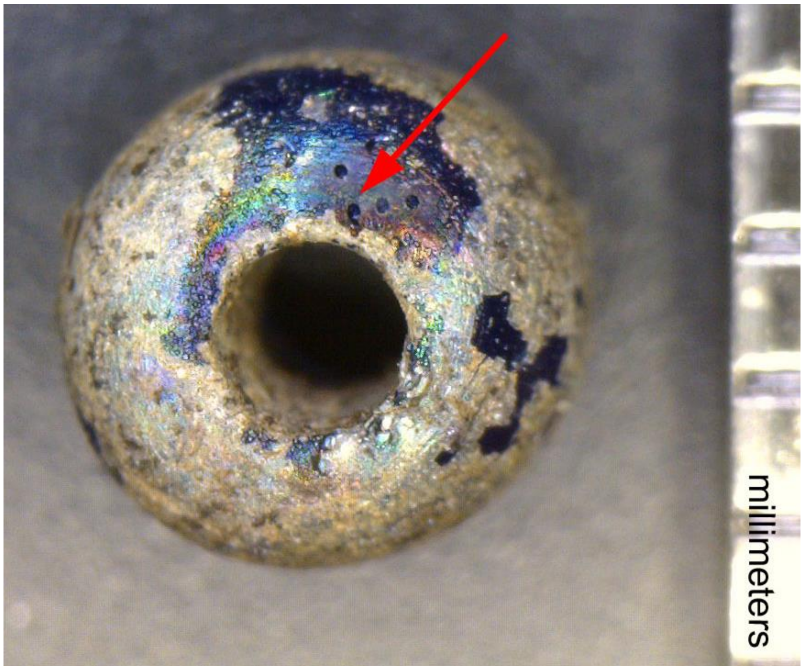


Figure 4.2: A glass bead that has been subjected to LA-ICP-MS. Red arrow indicates four points of analysis. Each point is < 100 micrometers in diameter.

Gratuze (2013) explains that LA-ICP-MS can mitigate surface contamination or corrosion effects because data from the initial ablation or sampling of the surface of the artifact may be discarded, and this is a standard practice in the Elemental Analysis Facility where this study was conducted. The point-based analysis method also makes it possible to sample different layers of glass or different colors in the same artifact, even if the areas sampled are very small and close together, as in a layered, drawn glass bead. LA-ICP-MS has been widely applied to glass beads from archaeological contexts in Asia in order to study trade and provenience of beads (Carter 2013; Lankton and Dussubieux 2006; Lankton and Dussubieux 2013). Those studies demonstrate the usefulness of LA-ICP-MS for gathering data to investigate regional trade network analyses. However, LA-ICP-MS has not been widely used to study the distribution of North American glass trade beads, although Dussubieux used the method to analyze seventeenth-century French objects of personal adornment (Dussubieux 2009), some of which may be similar to objects traded to North America.

4.2.1.3. Other chemical analyses of glass trade beads used in North America

There are many other methods of analyzing glass to determine its chemical composition. These include: X-ray based methods such as X-ray fluorescence (XRF) (Janssens 2013b), scanning electron microscopy with electron-dispersive spectroscopy (SEM-EDS) (Janssens 2013a), ion-beam analysis methods (Šmit 2013), and isotope-ratio studies (Degryse 2013). Some approaches to glass bead chemical analyses attempt to identify a "base" glass recipe that might be have been used in all bead recipes regardless of colorant (e.g., Purowski et al. 2012). In addition, isotopic techniques are now available for tracing the sources of glass ingredients, and this can be accomplished in a minimally destructive manner using laser ablation (see Degryse 2013). None of these has been used in a comprehensive regional study of glass trade beads from North American colonial-era archaeological contexts, but two recent site-specific studies have applied some of these methods to investigate European-made glass beads.

Shugar and O'Connor used portable XRF and SEM-EDS to investigate mid-eighteenth century glass trade beads from Old Fort Niagara at Youngstown, New York. They demonstrated that visual identifications of beads using existing typologies, e.g. Kidd and Kidd, produce discrepancies when compared to chemical analysis results (Shugar and O'Connor 2008). Furthermore, they showed that manufacturing methods for monochrome glass might include layers of glass only identifiable when beads are cut and examined in cross-section, which could be missed using surface-based analytical methods. In his ongoing dissertation research, Blair is employing pXRF to investigate non-diagnostic glass trade beads from Mission Santa Catalina de Guale, a seventeenth-century Spanish mission site located on St. Catherine's Island, Georgia

(Blair et al. 2009). Blair's XRF studies have demonstrated that archaeometric analysis of typologically "non-diagnostic" beads, such as monochrome seed beads, can be used to refine chronologies, clarify intra-site spatial relationships among ethnic groups, and delineate the global trade networks that developed as a result of European colonial endeavors of the seventeenth century (Blair 2013, 2015). Handheld XRF is becoming a more viable method of analyzing glass trade beads, with the advantages of portability and a completely non-destructive approach.

However, there still are several disadvantages to using X-ray based methods. In general, these are surface-based analysis approaches do not account for possible glass corrosion or surface-contamination of artifacts, and they require the material analyzed to be homogeneous (making it impossible to analyze individual sections blue and white striped pendants). Internal standards for portable XRF (pXRF) are not consistent among instruments made by different manufacturers, making it difficult to compare results among researchers. Fewer elements can be analyzed using pXRF than with LA-ICP-MS. Although pXRF is more widely available and generally faster and less expensive than LA-ICP-MS, I elected not to use this method in my glass research because it would not provide as robust a quantitative data-set, and my results might not be comparable with those of future researchers.

For my project, LA-ICP-MS analysis was readily accessible at the Elemental Analysis Facility of the Chicago Field Museum. It is a cost-effective, minimally invasive approach to a large regional analysis of glass beads. Furthermore, since North American archaeologists generally classify glass beads visually, based on style or color, addressing elemental chemical differences in beads of the same types highlights and corrects weaknesses of these typologies.

4.2.2 Compositional Analysis Method Employed

I used LA-ICP-MS to analyze a total of 887 glass samples from a total of 874 artifacts, including 27 glass pendants (some analyzed more than once) and 847 glass beads. The full analysis results are discussed in Chapter 5 and presented in Appendices B and C. The analyses were carried out at under the supervision of Laure Dussubieux, lab manager of the Elemental Analysis Facility (EAF) at the Field Museum of Natural History in Chicago, USA, using a Varian (now Bruker) Inductively Coupled Plasma - Mass Spectrometer (ICP-MS) connected to a New Wave UP213 laser for direct introduction of solid samples. Dussubieux's standardized protocol developed for all glass analyses at the EAF is described here. The parameters of the ICP-MS are optimized to ensure a stable signal with a maximum intensity over the full range of masses of the elements and to minimize oxides and double ionized species formation (XO^+/X^+ and $X^{++}/X^+ < 1$ to 2 %). For that purpose the argon flows, the RF power, the torch position, the lenses, the mirror and the detector voltages are adjusted using an auto-optimization procedure.

For better sensitivity, helium is used as a gas carrier in the laser. In order to determine elements with concentrations in the range of ppm and below while leaving a trace on the surface of the sample invisible to the naked eye, the EAF protocol uses the single point analysis mode with a laser beam diameter of 55 μm, operating at 70 % of the laser energy (0.2 mJ) and at a pulse frequency of 15 Hz. A pre-ablation time of 20 seconds is set in order to eliminate the transient part of the signal and to ensure that any surface contamination or corrosion does not affect the results of the analysis. For each glass sample, the average of four measurements corrected from the blank is considered for the calculation of concentrations.

To improve reproducibility of measurements, the use of an internal standard is required to correct possible instrumental drifts or changes in the ablation efficiency. The element chosen as internal standard has to be present in relatively high concentration so its measurement is as accurate as possible. In order to obtain absolute concentrations for the analyzed elements, the concentration of the internal standard has to be known. The isotope Si29 was used for internal standardization. Concentrations for major elements, including silica, are calculated assuming that the sum of their concentrations in weight percent in glass equals 100 % (Gratuze 1999; 2013).

Fully quantitative analyses are possible by using external standards. To prevent matrix effects, the composition of standards has to be as close as possible to that of the samples. Two different series of standards are used to measure major, minor and trace elements. The first series of external standards are standard reference materials (SRM) manufactured by the National Institute of Science and Technology (NIST): SRM 610 and SRM 612. Both of these standards are soda-lime-silica glass doped with trace elements in the range of 500 ppm (SRM 610) and 50 ppm (SRM 612). Certified values are available for a very limited number of elements, so concentrations from Pearce et al. (1997) are used for the other elements. The second series of standards were manufactured by Corning. Corning Glass B, C (for leaded glasses), and D are glasses that match compositions of ancient glass (Brill, 1999, vol. 2, p. 544). At the EAF, the LA-ICP-MS detection limits range from 10 ppb to 1 ppm for most of the elements. Accuracy ranges from 5 to 10 % depending on the elements and their concentrations. A more detailed account of the performances of this technique can be found in Dussubieux et al. (2009).

4.2.3 Data analysis method employed

LA-ICP-MS chemical analysis provides quantitative data for more than 50 individual elements, and managing the glass analysis dataset required several steps. All chemical analysis results for LA-ICP-MS investigations of glass beads and pendants are stored in an Excel spreadsheet as well as a Filemaker Pro 11 relational database specially designed to link the compositions of glass beads to provenience and curation information, a physical and typological description in the Kidd and Kidd system , and Dinolite images of each artifact (Figure 4.3).

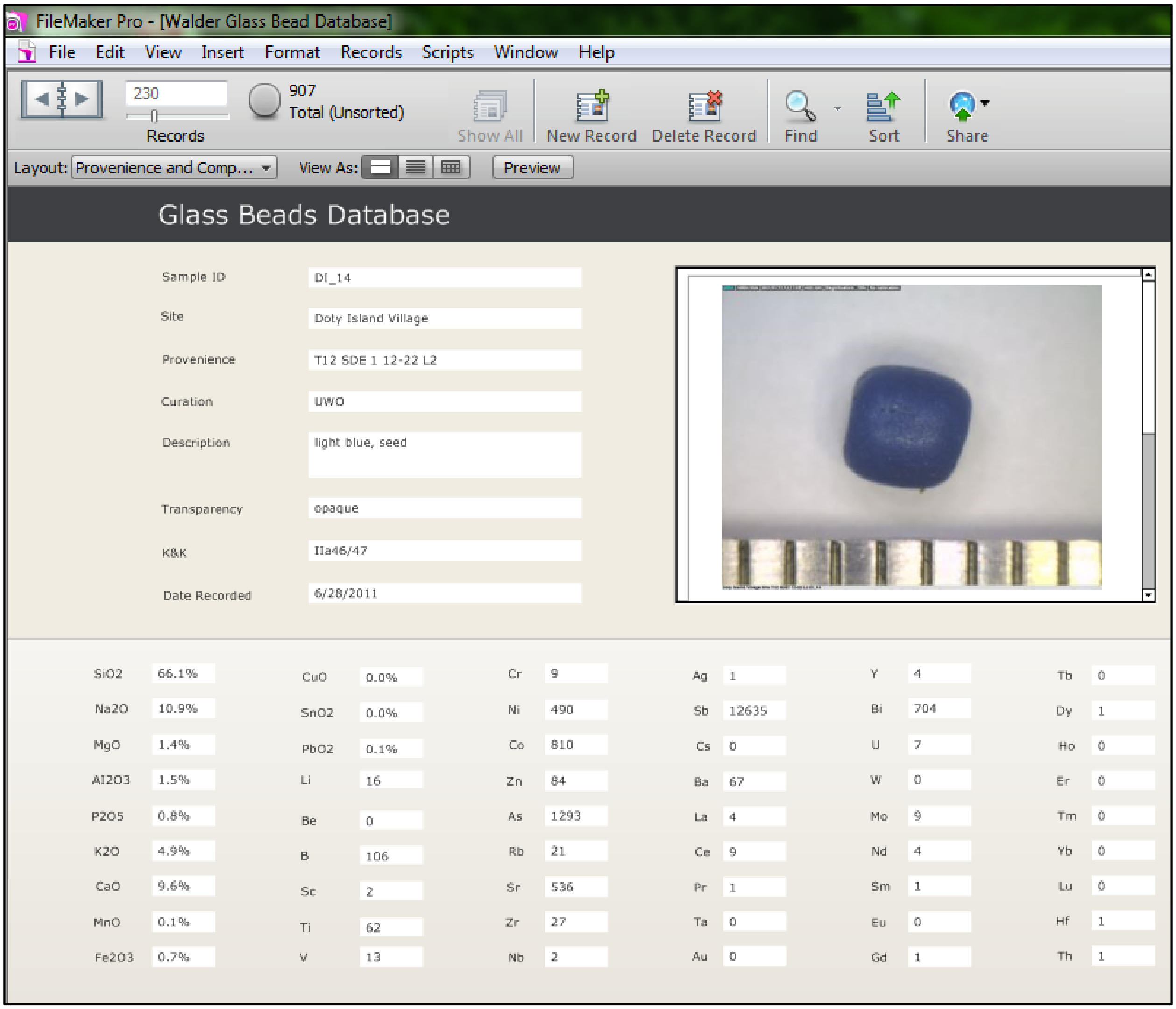


Figure 4.3 Screenshot of main layout of the Filemaker Pro glass bead database, illustrating how provenience information, images, and LA-ICP-MS results for 54 analyzed elements are stored for each artifact on a single database record.

To identify and explore patterns in the LA-ICP-MS elemental data, multivariate statistical sorting techniques such as principal component analysis (PCA) and cluster analysis can be employed (Baxter 2008:975). However, results for these techniques vary based on elements selected to use in analysis, the standardization of data (i.e. square and log all numerical data), and other data adjustments prior to analysis (Baxter et al. 2006). Multivariate approaches are useful for exploration of patterns in datasets but are not well-suited to evaluating the statistical significance of those patterns (Drennan 2009:263). An alternative way to investigate elemental data is the bivariate scatterplot approach, which uses simple x versus y-axis biplots of key elements to illustrate patterns or clusters in the dataset. This approach works well for large datasets of the kind generated from NAA or LA-ICP-MS analyses of archaeological materials like ceramics, stone, and glass. Previous studies have demonstrated that bivariate plot clusters are often more meaningful than those derived from complex statistical methods (Hancock et al. 2008; Michelaki and Hancock 2011). Researchers who conducted NAA studies of glass beads at the SLOWPOKE reactor (summarized in Hancock 2013) sorted their results into compositional subgroups using the bivariate method, and this continues to be a viable method of sorting elemental data for glass beads (e.g. Carter 2013; Dussubieux 2009; Shugar and O'Connor 2008).

I employed the bivariate sorting method as my primary means of identifying patterns in elemental data. First, I sorted the bead data by glass colorant employed (e.g. Cu, Co), since colorants correspond generally to bead types used in classificatory systems such as Kidd and Kidd (1970). For each colorant category, I used Microsoft Excel to create simple biplots of all major elements reported in oxide weights compared first to one another (e.g. compare NaO_2 to MgO, then CaO, etc) and then to trace elements known to be important in glass ingredients (e.g. Sb, Sn, As, Ti, Co). I noted when biplots produced distinct clusters of samples. I used the biplots with the clearest distinctions to delineate glass "subgroups" that shared similar compositions.

When attempting to identify variation within these already compositionally-similar subgroups, multivariate statistical approaches can be used as tools identify which elements will show the clearest separation of subgroups in bivariate plots. In PCA, component loading of variables (in this case elements present in glass) identifies those elements that contribute the most variation for each component of difference in the data set (Drennan 2009: 304). Likewise, cluster analysis will identify variables responsible for the highest orders of clusters (Drennan 2009: 319). Iterative runs of multivariate techniques also can help identify individual, compositionally distinct glass beads acting as outliers within subgroups (Baxter 1999). I used these multivariate methods in my data analysis to identify elements producing meaningful bivariate plots that would further delineate differences within glass subgroups and to detect beads with distinct chemical compositions that made them outliers in the LA-ICP-MS dataset.

4.3 Metal attribute analysis methods

Metal artifacts were also examined in an effort to produce a more unified understanding of how technological style could be used to assess influences of ethnic identity, hybridity, and trade networks on ornament production during the early historic period of the Upper Great Lakes. Out of the 38 sites assemblages I investigated in my glass trade bead analysis, there were 24 sites that yielded copper-abased metal artifacts attributed to c. 1630 – 1730 historic-era components. The results of analysis and interpretation of these artifacts is discussed in Chapter 6.

4.3.1 Methods of attribute analyses of North American historic copper-based metal

Kathleen L. Ehrhardt and Lisa Marie Anselmi have developed the only standardized approaches to the physical analysis of copper-based metals from Native American-affiliated archaeological sites in North America (Ehrhardt 2002; 2005; 2010; 2013; Anselmi 2004; 2008). The goals of their research were similar to my own: to understand relationships between technological style and identity (Ehrhardt 2005:36-37) and to document copper-based metal-working industries and understand differences in working style among diverse ethnic groups

(Anselmi 2004:5; 2008). Both researchers investigated early-historic and proto-historic sites; Ehrhardt worked in the Illinois region while Anselmi's study covered eastern North America.

Their methods of documenting the attributes of copper-based metal objects, including metal working strategies, length and width of artifacts, and metal thickness provides information about the "technological systems" that Native Americans applied to European-made metal trade items. Both Ehrhardt and Anselmi created typologies of metal objects. Ehrhardt's typology of metal items is based on artifact completeness, separating finished artifacts from unfinished pieces that do not have a recognizable function or form; function (tinkling cones, beads, tubing, etc.); and portion recovered, described as intact or fragmentary (2005:43-44). Anselmi classified objects according to a function-neutral typology rather than imposing Ehrhardt's use-based categories such as "ornament" or "production waste." Through statistical correspondence analysis, Anselmi established that that manufacturing methods did indeed vary both through time and among archaeological sites attributed to different social groups (2004).

4.3.2 Attribute Analysis Method Employed

I conducted attribute analysis of metals from 25 historic-era archaeological sites in the Upper Great Lakes, but these sites differ from those contributing glass beads for analysis. While surface-collected glass beads were included in the LA-ICP-MS, since I was analyzing glass composition, uncontrolled surface-collected copper-base metal would not be appropriate for examinations of relative percentages of assemblages because of the possibility of intrusion from later components. Rather, I focused on sites with clear archaeological contexts for metal artifacts in order to have control over time and the assigned cultural affiliation of site occupants. Attribute analysis of copper-based metal artifacts therefore focused on the assemblages that would provide the largest sample sizes for comparison of overall working methods across the region.

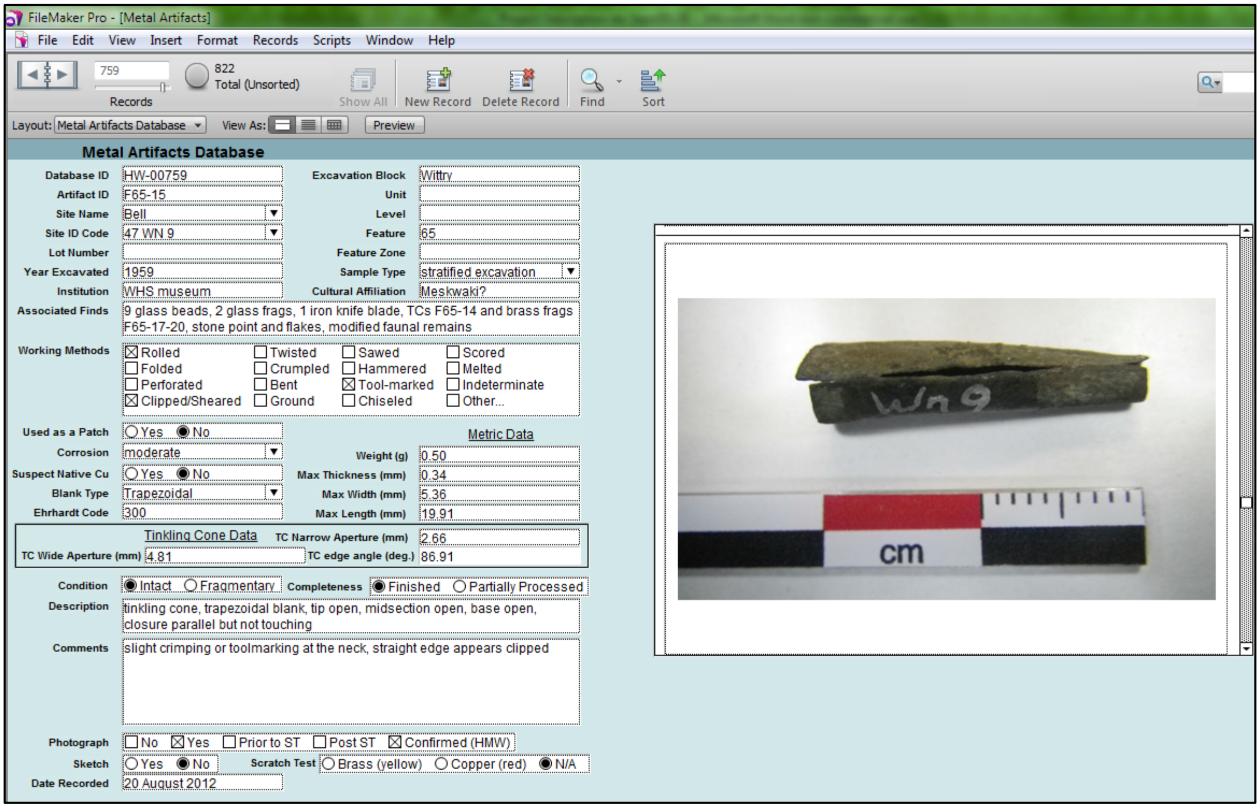


Figure 4.4 Screenshot of the main layout of the Filemaker Pro database for copper-base metal. Bold print in section 4.3.2 refers to database fields.

To conduct the analyses, I recorded the qualitative and quantitative attributes investigated by both Ehrhardt and Anselmi by inputting information directly into a customized Filemaker Pro 11 relational database (Figure 4.4). In discussions of each attribute in this section, bold text represents a database field. During the course of analysis, all copper-based metal artifacts were examined with a low-power hand-lens or loupe. Each artifact was photographed using either a Nikon D5100 DSLR or a Pentax Optio W90 digital camera, and distinctively modified or unique objects also were photographed and documented using the Dino-lite digital microscope. Images were cropped and reduced in size for inclusion in the database. In some cases, the color balance was adjusted in order to better visually represent the particular working methods visible in each image, using Photoshop CS5 and Picasa 3.0 image editing software. Full-size and unmodified images were retained and organized in a digital folder system sorted by archaeological site and the date the photo was taken. Photographs were taken prior to any modification of the artifact, such as scratch-testing or removal of a fragment for chemical analysis.

4.3.2.1 Provenience information recorded

Within the Filemaker database, I assigned each artifact a unique **Database ID** number, beginning with HW-00001. **Artifact ID** refers to any existing catalog number designated by curating institutions. Provenience information recorded included **Site Name** and trinomial Smithsonian **Site ID Code**, **Lot Number, Year Excavated,** curating **Institution, Excavation Block, Unit, Level, Feature,** and **Feature Zone**. Archaeological **Sample Type** categories included stratified excavation, flotation sample, surface collection, or shovel test pit. When readily available, information about any known **Cultural Affiliation** and **Associated Finds** was also recorded.

4.3.2.2 Qualitative Assessments: working methods

Each paragraph below corresponds to one of the **Working Methods** in the Metal Artifacts database. I used a checkbox field to indicate the presence of each of the working methods documented in Ehrhardt's and Anselmi's research. Working methods described in detail in Anselmi's dissertation (2004:150-176) include "1) chiseling, 2) scoring, 3) bending, 4) hammering or flattening 5) grinding, 6) folding, 7) rolling, 8) perforating, 9) cutting using scissors or snips, 10) sawing using a jeweler's saw, 11) melting, and 12) twisting" (Anselmi 2004:78). Anselmi based these categories on earlier observations of an assemblage of protohistoric Huron-affiliated copper-based metal objects (Latta et al. 1998) and the work of other researchers investigating native copper (e.g. Martin 1999). Anselmi also conducted limited experimental archaeological research to demonstrate the physical outcomes of the reworking methods (2008-42-43). Ehrhardt documented similar working methods in her research. The working methods that I describe below were identified following the methods described in Anselmi (2004:150 – 176).

Rolling is a working method that is indicated by curving of the metal, possibly accomplished by wrapping it around a mandrel or stick. Tinkling cones are examples of rolled artifacts that were probably wrapped around a mandrel to achieve a finished form. The edge of an artifact may be partially rolled or upturned in a curve.

A **Folded** artifact is identified when the metal is doubled over flat, creating a double thickness of metal. When an artifact's surface was bent but the two sides did not meet, it was considered **Bent**, not folded (see below). Artifacts may be folded or bent more than once.

A **Perforated** artifact is one with a hole in it. Small holes from corrosion or other damage to artifacts that appeared to be post-depositional in nature, on the basis of corrosion levels, were not considered perforations.

A **Clipped/Sheared** object had evidence of modification with snips or shears. This evidence includes burrs or curls of metal along straight edges, and over-cuts that extend past an edge or corner and on to the body of an artifact.

A **Twisted** piece of metal has more than one face or side of the metal visible from any given angle. There may be many twists on a long, thin strip, or only a single twist.

A **Crumpled** artifact has many small bends and stress-lines visible and appears to be heavily worked. Crumpling leaves creases that look like a sheet of paper wadded into a ball and then partially unrolled.

A **Bent** artifact has a straight edge where an object is folded but not completely flattened with two surfaces of metal touching. Metal may have been repeatedly bent back and forth in attempts to snap into two pieces.

A **Ground** artifact has striations that indicate the surface or edge of the metal was moved across a rough surface. Grinding is irregular in direction.

A **Sawed** artifact would also have striations which might be more regular than a ground artifact. Although sawing was a working method that Anselmi documented in her research, I did not encounter any artifacts that I consider to be sawed; I kept “Sawed” as a possible working method in the database in case artifacts of this type were encountered in the future.

Hammered artifacts have indentations on the surface that appear to come from attempts to flatten the artifact by pounding. Unlike chisel marks, hammering marks are shallow, non-distinct, and extend across a flat surface of the artifact.

I created a category for indeterminate “**Tool-marking**” not be otherwise classifiable as scoring or chiseling. Such tool-marking was a catch-all category for impressions or dents in artifacts that appeared to come from tools other than shears, sharp objects, chisels, or hammers.

Chiseled artifacts have distinctive indentations either impressed into the body or sometimes jagged edges that appear to have been separated from larger pieces by a series of blows from a blunt object functioning as a chisel.

Scored artifacts have lines incised on the surface of the metal, often parallel to the edges of the artifact. Scoring also can appear irregularly across the surface of the object, but in single or multiple lines that are not as irregular or numerous as those seen in grinding.

Melted artifacts have globular forms and appear similar to slag or melting waste. Melting is only hypothesized, not confirmed though any physical analysis.

Indeterminate was selected in the working-methods checkbox if none of the above methods was apparent. I created the **Other** category in the database to identify further methods, but this was not necessary in the course of the research.

Patching was a metal-working method that might have taken place not exclusively as a practice for reworking a kettle or other item into a new form, but rather to extend the use-life of an original object. Patches are not a form that Ehrhardt identified in her work, and they are a problematic form because it can be difficult or impossible to differentiate between material that once was part of a patch and material that was part of a patched kettle body. Furthermore, underwater archaeological exploration uncovered a rare find of sunken, loaded trade canoes in the Boundary Waters area of Northern Minnesota. Some canoes contained kettles still nested to maximize packing space, and some kettles, though not ones found in the nested contexts, had regular, rectangular patches on them (Wheeler 1975). This demonstrates that kettles sometimes arrived in North America already patched, as if European workshops sent "seconds" or perhaps even repaired items for trade. Therefore, I recorded patching as separate checkbox rather than as one of the working methods. "**Used as a patch**" was checked "Yes" when either perforations or rivets were present, unless the perforation was clearly in a location for stringing, as on a pendant. Because some perforated and riveted objects are fragmentary, this designation may record scraps of metal that had patches affixed to them, not just patches.

4.3.2.3 Other Qualitative assessments

Corrosion levels were assessed qualitatively on a scale of minimal, moderate, heavy, severe and included an additional category of "conserved" when electrolysis was used by a curating institution. This assessment provides information that might be useful if additional compositional analyses are undertaken at a future time.

"**Suspect Native Cu**" was marked based on the outward appearance of the object as well as its archaeological context. Since native copper was cold-worked and hammered, edges sometimes have a more scalloped or irregular appearance, rather than a sheet of smelted copper which was more likely to have been clipped or cut with shears from the body of a kettle. A difference in thickness and the corrosion color of an artifact might make it stand out from other copper-based metal artifacts in an assemblage, leading me to suspect native copper. This checkbox was used to identify objects that would be good candidates for further compositional analysis to differentiate between native North American and smelted European copper, but NOT to make further interpretations about the nature or context of the assemblage.

Blank Type identifies the rough shape of the initial piece of metal from which the artifact was made. Tinkling cones often have a trapezoidal blank, while rolled beads or clips begin with a rectangular blank. Blank type also contributes to the attribute code for each artifact.

The **Attribute Code** is a number linked to the **Condition, Completeness, and Description** of the artifact, all of which are based on Ehrhardt's typology. The condition or portion is either "Intact," for forms that are clearly not broken, or "Fragmentary," for artifacts that have clearly been broken either pre or post-deposition. "Completeness" refers to whether an artifact is in a recognizable finished form, or whether the object is only partially processed. Ehrhardt considered all "scrap" to be partially processed. The description of the artifact refers to the functional category and particular attributes of the category, such as the closure style of tinkling cones and beads or the angle of "legs" for clips.

During the course of the project, I expanded and modified Ehrhardt's typology to account for forms and artifacts present in my study that did not match any of her existing forms. This produced a final typology of 241 individual types. In addition to personal adornments and production waste from making them, typological categories tabulate unmodified but detached kettle parts, patches, and scraps of patched kettles, and other miscellaneous or unique copper-base metal objects often curated with “kettle scrap” such as fragments of hawk bells, copper nodules, or in the case of Rock Island, a cut-copper cross-shaped pendant. Categories are based on the following typological codes in the database: Clips: categories 1 – 13; Beads: 49 – 72; Blanks: 100-151; Tubes, Tubing, Objects: 200-228; Tinkling cones: 300-355; Scrap: 400-417; Miscellaneous/Other: 500-533; Patches and Patched pieces: 550-564. The final typology that resulted from the analyses is presented in Appendix E.

The **Comments** field records any additional observations and qualitative assessments of the artifact not recorded in other fields. Comments were optional. If **Photograph** of the artifact was taken, the “Yes” box of that field would be checked. “Prior to ST” and “Post ST” identify whether photographs were taken prior to or following a scratch test. When joined with artifacts in the database and checked, the “Confirmed (HMW)” checkbox was marked. Very few objects were sketched, as photographs were found to be an adequate visual representation of artifacts, but if I did complete a **Sketch** of the artifact, then I would check the “Yes” radio button.

When it was permissible, a **Scratch Test** was performed to determine if the base metal was coppery (reddish) or brassy (yellowish). Scratch testing is a moderately effective way of differentiating between brassy and coppery metals, although the outcome of scratch testing been inconsistent with findings from more reliable archaeometric approaches (see Ehrhardt 2005:46). Despite this noted problem, I carried out scratch testing when permissible, since it would have been impossible within the scope of the study to apply an archaeometric method, even one as inexpensive and widely available as pXRF, at a scale of more than 3,000 artifacts. Scratch testing is an effective and cost-free method of quickly and easily differentiating between basic metal types, performed by scraping off corroded metal with a sharp instrument (Fitzgerald and Ramsden 1988). This procedure is now widely used, but can be hindered by variations in researcher perception and laboratory lighting conditions. Fitzgerald and Ramsden noted that in their sample of sites from northeastern North America, brass as a percentage of the total assemblage increased over time (1988:158-159). In the present study, both the Bell and Rock Island assemblages were fully scratch tested; when it was permissible, other assemblages were also investigated in this way. The goal of such testing is to make a rough determination of how much of the assemblage is copper versus brass, with the intent of understanding possible changes through time in the acquisition of copper-based metals at that site.

4.3.2.4 Quantitative (metric) data

The **Weight** of the object was recorded, recognizing that corrosion, post-depositional breakage, and adhering soil matrix make this a rather arbitrary measurement. The **Maximum Thickness** of the metal was recorded at its maximum point, which was identified by taking several measurements at various edges of each object, taking care to only record the thickness of a single ply of sheet metal in instances where the artifact was folded or multi-layered. The **Maximum Width** and **Maximum Length** measurements of the artifact reflect its maximum dimensions in a 2-D plane, rather than the actual maximum width and length of the artifact blank. Therefore, a maximum width-length ratio records the area in space that the artifact takes up, rather than how much metal would be used in the object. Ehrhardt recorded the lengths and widths of the actual blanks. Both methods provide different information – as recorded, the method used in this dissertation allows the general categorization of the metal objects among sites. It also is possible to extrapolate the actual length or width of a blank by calculating distances on photographs taken with a scale from directly above the artifact. For tinkling cones, the maximum width generally reflects the external width of the aperture at the base of the cone. Flattened cones were measured using the same attributes, but flattening was noted. The external width of the cone at the tip was not recorded but could be calculated from other measurements.

For tinkling cones, two additional data points were measured on the interior of each end of the cone: the **Narrow Aperture** and **Wide Aperture** diameters. These measurements allow the calculation of an artificial edge angle, using the following formula:

=Degrees (Acos [([(TC Wide Aperture-TC Narrow Aperture) / 2]) / (Sqrt ([([TC Wide Aperture-TC Narrow Aperture] / 2) ^ 2] + (Max Length ^ 2)])])

This formula calculates the edge angle of a tinkling cone using trigonometric principles. A triangle with two known side lengths and a right angle is created by subtracting the narrow aperture of the cone from the wide aperture and dividing that value by two. That value and the maximum length of the tinkler form the two sides of this artificial triangle (Figure 4.5).

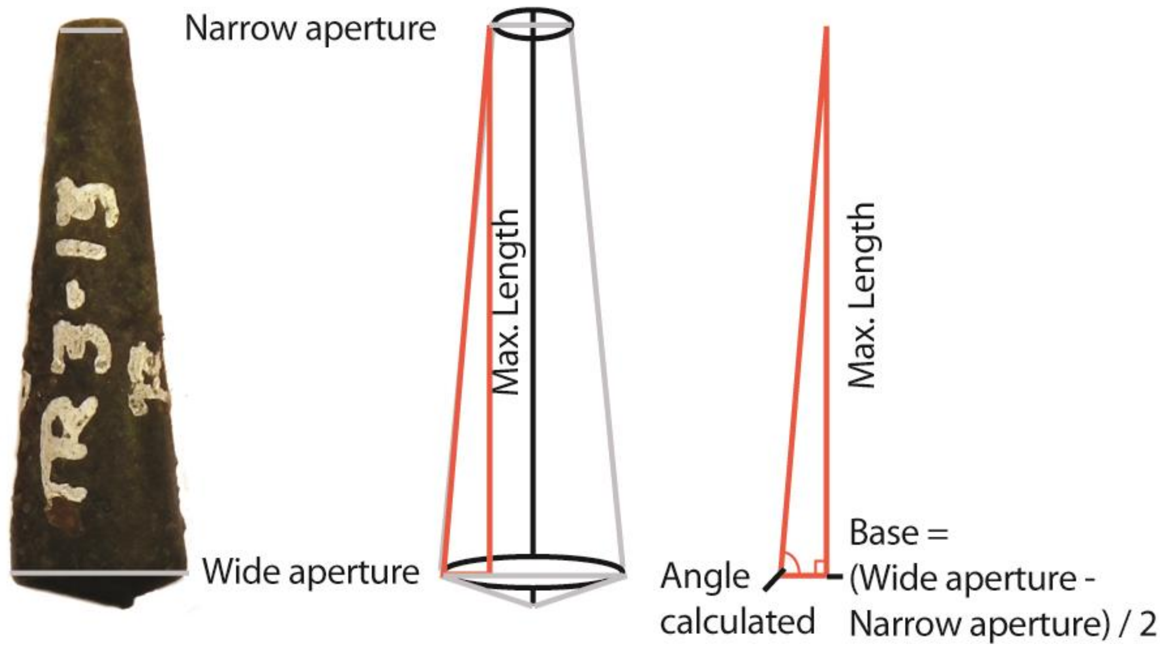


Figure 4.5 Schematic view of tinkling cone and artificial right triangle created from measurements of aperture widths and maximum length of the tinkling cone, illustrating how artificial edge angle measurements were calculated.

The acute interior angles of this triangle were calculated using the Pythagorean theorem, and the angle nearest to the base is the angle calculated by the above formula. The edge angle calculation does not represent an actual edge angle on the cone, which can be difficult to measure and varies depending on the location that the measurement is taken on the artifact. Rather, this calculation provides a median descriptor of the edge angle for the entire object.

Once attribute analysis was complete for all artifacts, data were cross-checked by comparing earlier database entries to later ones, ensuring that attributes were measured consistently and that assignments of typological categories were consistent throughout the study.

4.4 Metal chemical analysis methods

Previous archaeometric analyses of copper-based metal have described compositional types and subgroups without connecting them to specific chronological or geographic trends in European production or manufacturing techniques. In this section, I review relevant compositional analyses of copper-based metals from protohistoric-era archaeological assemblages, discuss strengths and weaknesses of techniques employed, and summarize the archaeometric methods that I used in my two pilot studies.

4.4.1 Methods of metals compositional analysis used in North America

Archaeologists have used chemical analysis to identify subgroups of metal compositions, hypothesized to reflect minimum numbers of vessels contributing to scrap assemblages in an effort to better understand the frequency of trade activities or interactions (Hancock et al. 1995a; Hancock et al. 1995b; Hancock et al. 1995c). NAA has been the most widely used archaeometric method for examining copper-based metal assemblages from historic-era archaeological sites in North America (Fitzgerald and Ramsden 1988; Fitzgerald et al. 1993; Fox et al. 1995; Hancock et al. 1995b; Hancock et al. 1991; Hancock et al. 1995c; Hudgins 2004, 2005; Latta et al. 1998;

Moreau and Hancock 1999, 2011; Mulholland and Pulford 2007; Pavlish et al. 2004). The procedure that Hancock's research group applied, along with a comparison of other methods, is recorded in Hancock et al. (1991). For identifying elements that distinguish cold-worked native or naturally occurring copper in North America and smelted copper obtained via trade with Europeans, NAA has been particularly useful (Fox et al. 1995; Hancock et al. 1991). Because of the prevalence of in-workshop recycling in Europe, documented to have occurred since at least the Early Bronze Age (Bray et al. 2012), it is not possible to link particular chemical subgroups in kettle scrap to different geologic sources or locales of original manufacture.

Today, NAA is no longer widely available at as many research institutions; it is an expensive and destructive method of analysis, and it requires extensive sample preparation. Notably, NAA requires the removal of a small portion of artifacts for analysis; depending on the elements sampled, the irradiated piece may not be returned to curators (Ehrhardt 2005:52). The many weaknesses of this method, as compared to more readily available and cheaper techniques such as LA-ICP-MS and pXRF, made it impractical to use NAA in my study.

The LA-ICP-MS method has also proven useful in determining the chemical composition of metal artifacts, such as native copper (Lattanzi 2007), and European copper and brass (Giumlia-Mair 2005) , though corrosion of artifacts is a significant limiting factor in trace element analysis (Chiavari et al. 2011; Deraisme et al. 2008; Dussubieux et al. 2008; Resano et al. 2010). As with the LA-ICP-MS studies of glass, the main goal of LA-ICP-MS research on copper-based metals from archaeological contexts has been defining chemical groups related to patterns of human activity, especially ore sourcing metals patterns and separating native from smelted coppers. While LA-ICP-MS has been used in a wide variety of archaeometric studies in recent years (see Resano et al. 2010), it functions best when samples have a high degree of internal homogeneity. Unfortunately, archaeological metals are generally less homogeneous than is ideal for using LA-ICP-MS (Dussubieux et al. 2008). The strengths of this method are also similar to those of using this method on glass: surface corrosion can be removed in a minimally-destructive manner; the method is affordable and readily available; and results are comparable to other elemental analysis methods. However, there was no previous research with LA-ICP-MS comparable to the NAA studies differentiating between chemical subgroups in metal artifacts that linked groups to particular kettles (Michelaki et al. 2013).

4.4.2 Compositional Analysis Methods employed

Since NAA was unsuitable for my research project, and the effectiveness of using LA-ICP-MS to delineate chemical subgroups in metal artifacts had not been determined, I conducted two pilot studies that examined the feasibility and usefulness of several different chemical analysis methods compared with LA-ICP-MS for investigating metal objects. Research questions varied based on the capabilities of the instruments being tested.

4.4.2.1 Pilot study: comparison of ICP-OES and LA-ICP-MS

I first investigated the feasibility of using LA-ICP-MS as a way to identify chemical groups in copper-based metal by comparing this method to the more destructive but more homogenizing technique of Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES). To make up for heterogeneity of metals, ICP-OES requires dissolving samples in acid before analysis; this homogenizes the composition of the sample being examined. My small pilot study analyzed fourteen metal fragments recovered from the Bell site to determine if it is possible to mitigate for the effects of the heterogeneity of archaeological metal objects and the unintentional sampling of corrosion products during compositional analysis with LA-ICP-MS. Because of its highly destructive nature, ICP-OES served only as a control analysis method and was not considered feasible for a larger-scale study. Because the artifacts sampled were recovered during early metal-detecting surveys in the 1970s, the provenience information associated with them is limited, and destructive analysis of samples was acceptable.

Some artifacts used in this pilot had been examined in a preliminary study of scrap metal fragments using Scanning Electron Microscopy – Energy Dispersive Spectroscopy (SEM-EDS) as well as atomic absorption spectroscopy (AAS) to characterize the compositions of twelve samples of highly corroded surface finds (Freeman and Behm 1998). They noted that the commonly applied nomenclature of "kettle brass" was perhaps incorrect, as their compositional study revealed only copper objects. In that study, levels of zinc were so low that Freeman and Behm concluded that all of the trade metal analyzed was unalloyed European copper, not brass, though they only sampled 12 metal fragments of the much larger collection. They also found that there were significant differences in the percent of copper detected using the two different analysis techniques. This study demonstrated that neither AAS nor SEM-EDS were reliable by themselves for delineating subgroups connected to the composition of particular kettles.

Five kettle metal artifacts from the original Freeman and Behm (1998) study were available for my LA-ICP-MS and ICP-OES comparison, along with ten additional samples from the same surface-collected assemblage. Artifacts were selected based on their unmodified appearance; other than having been cut from an original kettle or sheet of metal, none appeared worked into ornamental or other forms (Table 4.1).

Table 4.1: Sample numbers, weights of removed portions of the artifacts, visual description, location of LA-ICP-MS ablation, and weights of final samples used for ICP-OES analysis.

Samp #	Total Wt (g)	Cut (g)	Desc.	Photo before / after	LA-ICP-MS	ICP-OES weight (g)	(mg)	Sample #
612	11.1567	0.2202	Coppery	y	cut	0.0206	20.6	1
636	4.717	0.1973	Coppery	y	cut	0.0197	19.7	2
711	3.3526	0.1924	Coppery	Y	cut	0.0197	19.7	3
825	0.3535	0.0565	Coppery	Y	cut	0.0209	20.9	4
833	0.2258	None	Coppery	Y	edge	N/A	N/A	N/A
Additional artifacts not analyzed by Freeman and Behm								
634	2.3298	0.2708	Coppery	Y	cut	0.0204	20.4	5
693	3.1378	0.2176	Coppery	Y	cut, corr.	0.0209	20.9	6
701	1.8529	0.1295	Brassy	Y	cut, corr.	0.0201	20.1	7
704	1.2522	0.0793	Coppery	Y	cut	0.0203	20.3	8
706	2.0679	0.2095	Coppery	Y	cut	0.0203	20.3	9
707	3.6635	0.1684	Coppery	Y	cut	0.0197	19.7	10
726	1.1847	0.0717	Brassy	Y	cut	0.0205	20.5	11
751	1.7835	0.0737	Brassy	Y	cut	0.0196	19.6	12
757	6.2152	0.3372	brassy	Y	cut	0.02	20.0	13
775	1.7397	0.1402	coppery	Y	cut	0.0204	20.4	14

For all artifacts except for Sample #833, a small fragment was cut from the artifact using a metallography saw, which revealed a clean and uncorroded edge of the sample for LA-ICP-MS analysis and provided the necessary material for ICP-OES. Photographs of each artifact were taken before and after the destructive sampling (Figure 4.6). Artifact 833, used in the original Freeman and Behm study, was too small to permit additional sampling for ICP-OES, but it was subjected to LA-ICP-MS on the still-fresh cut edge where material had been removed by previous investigators.

Figure 4.6 Illustration of artifact # 825 before (left) and after (right) removal of sample material.

The LA-ICP-MS analyses of metal artifacts wereconducted at the Chicago Field Museum’s Elemental Analysis Facility. The procedure is the same as described for glass artifacts in section 4.2.2, except not four but five points of ablation were used (Figure 4.7), which is the standard protocol for metal artifacts at the EAF.

Each of the 15 samples was ablated on the edge so that the artifact would not be perforated in the ablation procedure. The laser was set at 100 micrometer ablations, and five ablations were conducted on each artifact. For sample 693, which appeared coppery upon visual analysis, and sample 701, which appeared brassy, ablations were conducted both on the cut surface of each artifact sample and through the corrosion on one of the uncut edges, in order to determine if surface corrosion would have a greater impact of the results of each method of laser ablation. This would in turn determine if LA-ICP-MS was a viable method for my dissertation research, since cut edges would be unacceptable to many curating institutions. During the analysis process, elements were not measured using the mass spectrometer until it was determined that the laser had cut through the corroded layer and had reached the unaltered metal beneath it. As in the glass analysis protocol, copper standards with known concentrations of trace elements were repeatedly sampled during the analysis process in order to build the calibration curve for the study.

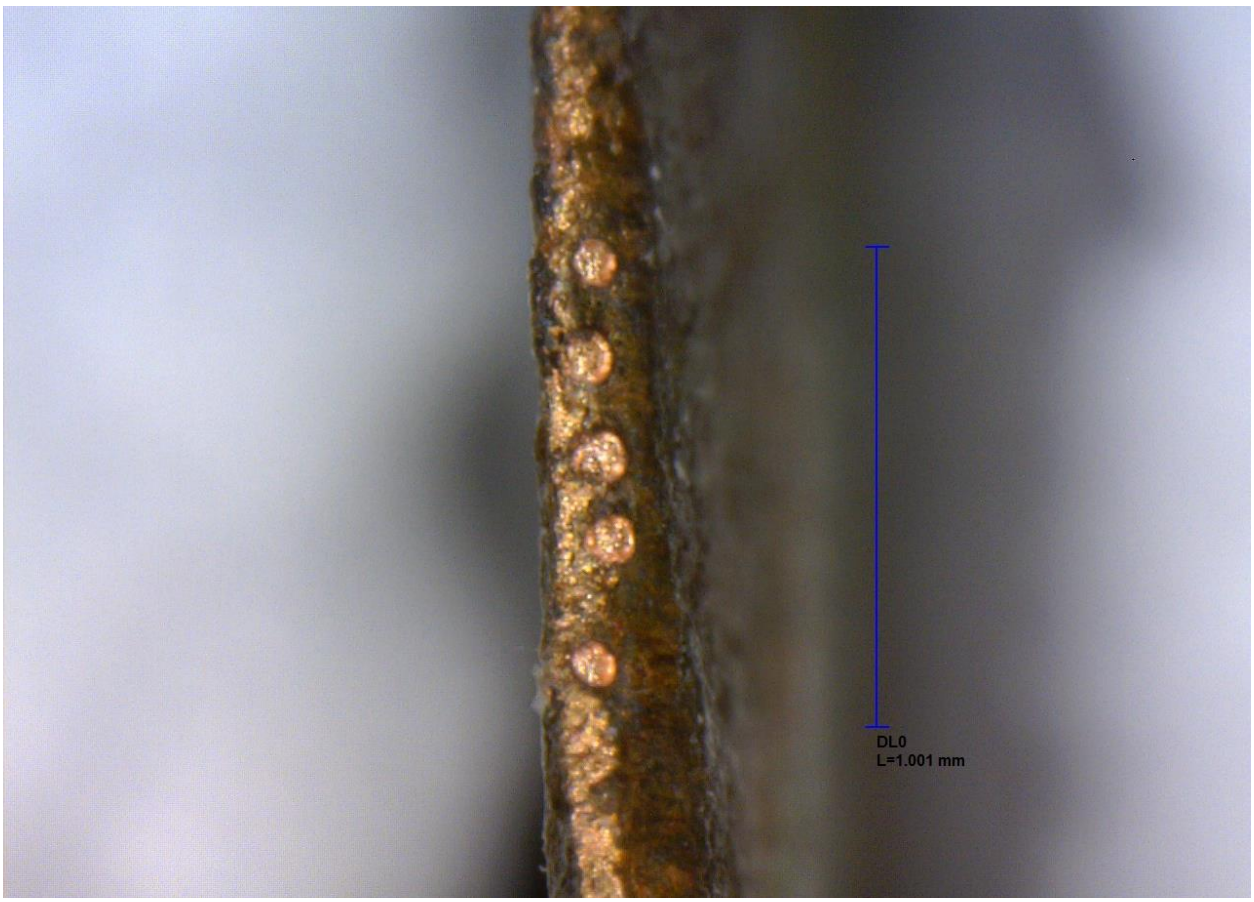


Figure 4.7 The cut edge of a copper object, showing five laser-ablation removal areas

After completion of the LA-ICP-MS analysis, the cut fragments were returned to the UW-Madison Laboratory for Archaeological Chemistry, where the ICP-OES sample preparation and analysis was conducted with the aid of Dr. James H. Burton. The visually recognizable corrosion on each of the cut metal pieces was removed using a Dremel mechanical abrader. With the corrosion removed, a sample of clean metal weighing between 19.7 and 20.9 mg was cut from the larger fragment and placed in a test tube for dissolution. The metal pieces were dissolved in .5 mL of concentrated nitric acid. After adding the clear acid, all of the samples turned a greenish color due to the formation of copper nitrate. The samples were heated to 130 degrees C. for 15 minutes. 19.5 ml of ultrapure water was added to each test tube. After mixing, the samples were fully prepared for ICP-OES analysis. Each sample was atomized using heated argon gas until it fluoresced and an image could be taken. In the same way as standards are used in LA-ICP-MS to build a calibration curve, standards with known compositional values are also run during ICP-OES. The spectroscopic images from samples being analyzed are compared with standards previously run in order to generate the compositional analysis data. Results were multiplied by weight and divided by the dilution volume, then divided by 10,000 to obtain the percent of composition for relevant elements. Results are presented in Chapter 6.

The comparison of ICP-OES and LA-ICP-MS method did allow for the delineation of some high and low trace element chemical groups of interest for interpreting the Bell Site, as discussed in Chapter 6, but neither approach was deemed a feasible direction for a large scale dissertation project. Levels of corrosion products present in LA-ICP-MS results, even when applied to cut edges, were greater than those documented with the more destructive ICP-OES method. Therefore, as a result of this pilot study, I determined that it would not be possible to conduct a large-scale LA-ICP-MS study of metal artifacts to investigate chemical subgroups of the metal, unless curators allowed physical modification of artifacts. Complete discussion of the results of these analyses are presented in Chapter 6.

4.4.2.2 Comparison of LA-ICP-MS and pXRF to differentiate native from smelted coppers by testing unprepared metal surfaces

After the first pilot study, I did not pursue further archaeometric research intended to determine if copper-based metal scraps came from the European-made object. Rather, I addressed a simpler question, differentiating between native American copper and smelted European copper artifacts. Ehrhardt recently applied portable XRF to materials from the New Lenox, Illinois site in order to assess the impact of corrosion on portable analysis instruments (Ehrhardt and Kaiser 2011). She found that surface corrosion does affect the results of pXRF and in that study, cleaning of surface corrosion was necessary to obtain results that could clearly differentiate between native and smelted copper. However, since surface treatment is not always acceptable to curating institutions, I worked with Laure Dussubieux of the Chicago Field Museum, to further assessed the reliability of portable x-ray fluorescence (pXRF) as a fast and effective method of identifying cold-worked native versus European smelted coppers without any sample preparation (Dussubieux and Walder 2015).

In this pilot study we applied pXRF to 43 copper artifacts from two archaeological sites in the Upper Great Lakes region and reanalyze 18 of them with LA-ICP-MS. Portable XRF and LA-ICP-MS results concurred well. This study shows that for differentiation between native North American and European smelted copper types, pXRF can be used reliably, without modifying artifacts and despite surface corrosion. Archaeometric techniques are more reliable than visual differentiation of copper types, providing archaeologists with an accurate and non-destructive way to identify "protohistoric" European-trade items in early contexts and to assess the continuity of native copper object use on historic-era archaeological sites.

In North America prior to European contact, Native peoples did not smelt copper ore, but practiced cold-working, annealing, and other forms of non-pyrotechnic metallurgy. However, smelted European-made copper objects later became available to Native Americans through trade. Differentiating these two different copper technologies is useful to archaeologists in two situations: 1) Recognition of possible "protohistoric" sites, where smelted European copper might be the only trade item present in the assemblage, likely obtained through down-the-line trade, and 2) Demonstrating persistence of traditional copper-working technology in later historic periods among Native American peoples also obtaining items originally manufactured in Europe.

In this archaeometric study, two sites contributed both cold worked native copper and European smelted copper artifacts, Rock Island and the Clunie site. For this small-scale pilot study and methodological investigation, the research questions were:

1) Does pXRF differentiate native from smelted coppers as effectively as LA-ICP-MS?

2) Were smelted copper objects obtained in the proto-historic period at Rock Island?

Since a few other European-made trade goods were present in association with Lake Winnebago Trailed Oneota ceramics, smelted copper could have been present as well.

3) Are smelted copper objects present in a seemingly native copper assemblage at the Clunie site? All artifacts expected to be native copper based on predominantly prehistoric dates for the ceramic materials, but European material could be present in small quantities.

4) Does the use of native copper persist in late seventeenth and eighteenth century occupations of Rock Island? European-made trade items, including cut copper and brass scrap are abundant in this period, but native copper objects also might be present in the assemblage.

The popularity of portable XRF has been growing tremendously over the past decade among archaeologists. In general, XRF is an analytical technique that measures the surface composition of an artifact, only penetrating a few microns into the sample, depending on settings used. The use of pXRF could be problematic in the case of copper or copper-based artifacts, which can be heavily corroded with a layer of oxidized material that can be 30 microns thick or more (Dussubieux et al. 2008). The composition of the corrosion layer is usually depleted in copper and can be enriched in a variety of trace elements (Moreau and Hancock 1999). In addition, pXRF has relatively high limits of detection compared to other standard methods applied to North American copper, such as INAA (e.g. Michelaki et al. 2013). Previous research established that it was possible to discriminate American Native copper from European smelted copper using LA-ICP-MS even on a very corroded surface based on the concentrations of As, Ni, Ag and Sb (Dussubieux et al 2008). A previous study showed it was possible to differentiate European smelted copper and North American Native copper using pXRF on artifact surfaces after removal of corrosion material (Ehrhardt and Kaiser 2011). However, such cleaning is unacceptable in some cases. The present work demonstrates cleaning is not necessary to simply differentiate between native and smelted copper artifacts using pXRF.

Samples were selected to test the archaeological research questions and compare reliability of pXRF and LA-ICP-MS. Selections are NOT representative of total metal assemblages of each context. Each artifact was assigned to one of four categories that describe the artifact's archaeological contexts, associated artifacts, technological working methods, and visual appearance (Table 4.2 and Figure 4.8).

Table 4.2: Categories of metal samples

A: Native Copper, Proto-historic:	Native-made ceramics or other materials; working methods hammering or indeterminate
B: Smelted Copper, Proto-historic:	Native-made ceramics or other materials; working methods include scoring, clipping, or other possible use of European-made tools
C: Native Copper, Later-historic:	European-made trade items present; working methods may be hammering or indeterminate
D: Smelted Copper, Later-historic:	European-made trade items present; working methods include scoring, clipping, or possible use of European-made tools

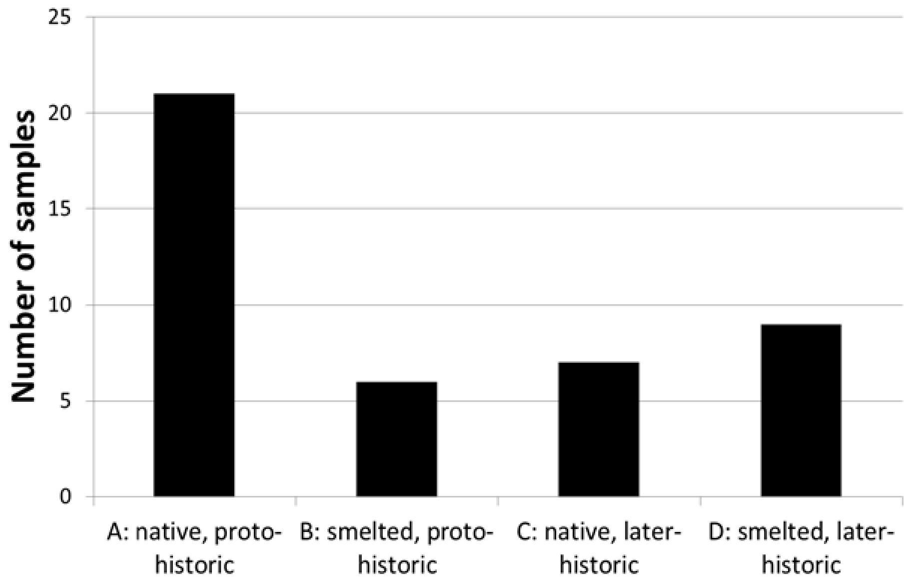


Figure 4.8 Overview of metal samples by archaeological category

Portable XRF analyses were conducted using an Innov-X Alpha Series instrument at the EAF. This excitation source of this instrument is an X-ray tube with a tungsten anode. The Si PiN diode detector has an energy resolution of less than 230 eV FWHM at 5.95 keV Mn Kα line. The artifact samples were analyzed without any kind of sample preparation. In accordance with Dussubieux's lab protocol for pXRF employed at the EAF, the voltage was 35 kV and the current 20 mA. Total acquisition time was 60 seconds in total. Quantitative results are calculated using fundamental parameters, by the software provided with the instrument. More than twenty elements are analyzed using pXRF (Figure 4.9).

The LA-ICP-MS analyses were carried out at the Field Museum with a Varian (now Bruker) Inductively Coupled Plasma-Mass Spectrometer (ICP-MS). A New Wave UP213 laser is connected to the ICP-MS for direct introduction of solid samples. The analytical protocol used for this study is derived from the one described in Dussubieux et al. (2008). As the surface of the artifacts was corroded, two ablations were performed at the same location. The laser beam is focused at the bottom of the first crater before starting the second ablation. Only the signal acquired during the second ablation is recorded.

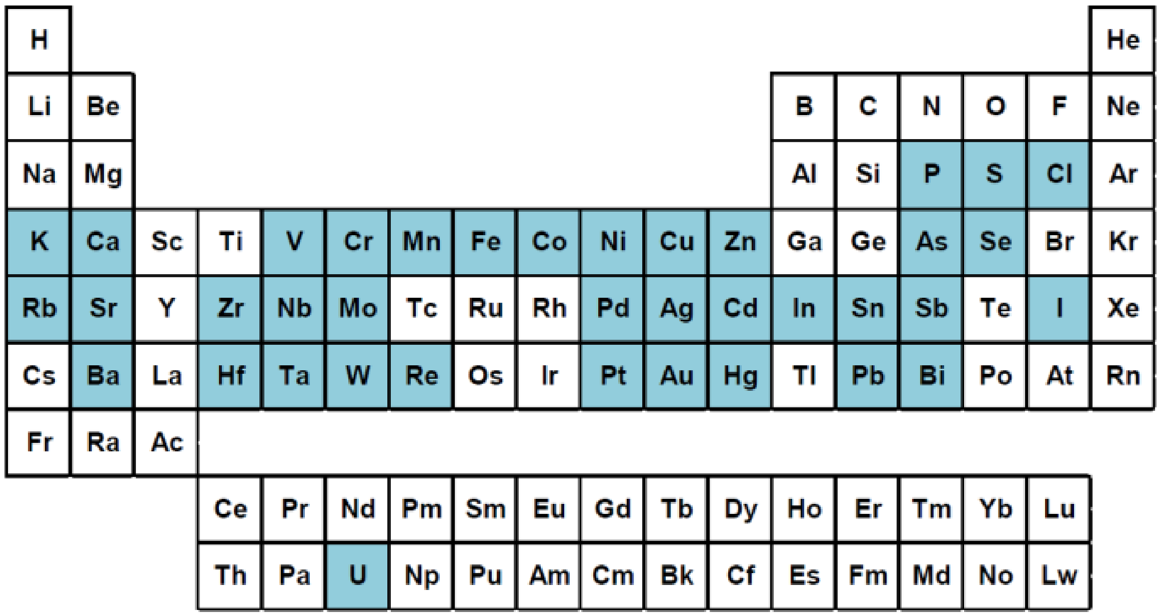


Figure 4.9 Elements sampled using pXRF (image courtesy Laure Dussubieux)

A close examination of the results obtained using pXRF shows that all European smelted copper artifacts (as identified by LA-ICP-MS) exhibit significantly higher concentrations of 2 or more of the following elements: Ni, As, Sn and Pb with one exception (see HW-01754). Native copper has concentrations systematically below detection limits for Ni, Sn and Pb. Arsenic is fairly high in some of the native copper samples. According to Rapp et al. (2000:55), the average As concentration in Lake Superior native copper sources is 430 ppm. Therefore, high As alone does not indicate that an object is made of smelted copper. Using these observations, group attribution was done on the remaining artifacts not analyzed using LA-ICP-MS. We determined that it was possible to use trace elements to differentiate reliably between native and smelted copper using these methods, and results of this pilot study are presented in Chapter 6.

4.5 Summary

In this chapter I have presented the attribute analysis process and chemical analysis methods employed to examine patterns of compositional difference in glass trade beads and refired glass pendants and the technological style differences among reworked metal artifacts. The methods used to conduct two pilot studies of compositional characterization for copper-base metals, including ICP-OES, pXRF and LA-ICP-MS, were also outlined, and the methodological value of using pXRF to differentiate between smelted and native copper is emphasized. The chapter also describes how *chaine opératoire* for reworked copper-based metal objects in the study sample was documented using the attribute analysis methods developed by Ehrhardt (2005) and Anselmi (2008). Blue glass beads were selected as a complementary research category because of their ubiquity on seventeenth century sites, their reworking into blue glass pendants, and because of the social significance of the color blue in Indigenous ideological systems in North America. Glass trade beads were selected for archaeometric analyses according to their physical attributes including manufacturing method, shape, and color using existing technological typologies, emphasizing Kidd and Kidd (1970). LA-ICP-MS was the primary means of compositional analysis for glass trade beads and pendants. Results of the glass analyses are presented in Chapter 5, and results of metal analyses are presented in Chapter 6.

Chapter 5. Glass analysis results: implications for chronology, trade, population movement, and cultural affiliation

In this chapter I present the results of LA-ICP-MS analyses of glass beads and refired glass pendants and my interpretations of identified patterns in the glass recipes as they relate to the timing of site occupations, geographic locations of sites, and socially-structured trading relationships. A total of 874 artifacts, mainly drawn blue glass beads, were analyzed from a total of 30 archaeological assemblages in the Upper Great Lakes dated to c. AD 1630 to 1730. I sampled all types of drawn blue beads present in each site's assemblage, preferably from closely controlled archaeological contexts such as well-dated features, but including surface-collected artifacts when they were the only available beads representing a site. Because of my regional scale of investigation, in this chapter, data are considered at the site-level of provenience and are not used to conduct within-site spatial comparisons of glass recipe patterning.

This chapter is organized into three interrelated sections, beginning with a brief discussion of how glass beads may have moved through trade networks into the Upper Great Lakes region and a summary of the archaeological contexts of beads selected for analyses. The second section describes the glass bead recipe groups and subgroups recognized in the LA-ICP-MS dataset using bivariate scatterplots of major, minor, and trace elements (Hancock et al. 2008) and iterative runs of principal component analysis (PCA) (after Michelaki and Hancock 2011) to search for patterns in the compositions and identify elements responsible for chemical variations. I compared all major elements to all minor and trace elements, and also relied to published work (e.g. Hancock 2013) to determine which elements to use to delineate glass subgroups. Results indicated that bead typologies based on the classification of perceived visual differences, such as the Kidd and Kidd (1970) system do not always correspond to glass recipe subgroups present in the chemical data set. The third major section of this chapter addresses glass recipe similarities between bead subgroups and the reworked glass pendants to assess the possibility of on-site pendant production in the Upper Great Lakes. I conclude with my interpretations of my results as they relate to the research questions of this project, especially those questions that concern clarifying the chronology and distribution of trade-item introduction. For all glass artifacts analyzed, Appendix B provides site-specific provenience information, a physical description of each bead sampled, Kidd and Kidd type assigned, and curation-related data for each artifact. Appendix C presents the full LA-ICP-MS chemical analysis results for each glass sample.

5.1 The glass bead trade in the Upper Great Lakes

This section briefly summarizes historical records trade of glass beads in the Upper Great Lakes region, discusses the arrival and exchange of beads and trade items in ships stocked for the trade in Europe, and identifies the glass beads and refired pendants or fragments from each archaeological site in the region that I selected for LA-ICP-MS analysis.

5.1.1 Historically and archaeologically documented movement of trade beads

Glass trade beads produced in Old World workshops arrived in the Upper Great Lakes through both documented and undocumented trade networks. Documentary evidence such as inventories, cargo catalogues, shipping records, and other texts has shown that beads were an important category of goods shipped to this region to exchange for furs in the eighteenth century (Anderson 1994; Kent 2001, 2004). Trade records are available for key hubs in the French colonial exchange networks, such as Montreal, Detroit, and Fort Michilimackinac, but since illicit *coureurs de bois* worked further inland in the *pays d'en haut,* outside the influence of government record keepers, documentary evidence does not fully trace the routes of trade (White 1991:28; 68-69). Down-the-line trade in glass beads and other items also moved along existing Native networks without documentation (Shackelford 2007; Sleeper-Smith 2009), making it more difficult to reconstruct trading relationships using historic records alone.

French explorers, traders, and missionaries were some of the first Europeans to visit the interior of the Upper Great Lakes region in the seventeenth century, bringing with them glass beads and other gifts to foster new relationships with peoples that they encountered. In 1679, one explorer, Rene Robert Cavelier, Sieur de La Salle, visited the islands of the Door Peninsula, including Rock Island, to rendezvous and trade glass beads and other items for furs harvested by local groups, most likely the Potawatomi (Mason 1986: 17). La Salle and other early explorers relied heavily on their Native guides and contacts to develop alliances and trading relationships and help them navigate the unfamiliar territory (White 1991:28; 35). La Salle's missions were not always successful, and archaeologists and explorers (e.g. Gross and Jackson 2014; Liebert and LLC 2015) continue to search for his ill-fated trade ship *Le Griffon*, which sank somewhere in Lake Michigan between Green Bay and Michilimackinac on September 18th, 1679 (Quimby 1966:45-62). La Salle was not aboard, and he continued to explore the interior of New France.

In 1684, La Salle set off from France commanding four ships, including a *barque* christened *La Belle* (Bruseth and Turner 2005). *La Belle* sailed fully-stocked with trade items necessary for establishing a strategic French colony near the mouth of the Mississippi River to control interior North American trade routes (Bruseth and Turner 2005:20). In 1686, *La Belle* ran aground and eventually sank in Matagorda Bay off the southern coast of Texas, and in 1996 and 1997 a massive, publicly-funded archaeology project run by Texas A&M University constructed a dry cofferdam around the site and excavated the entire wreck, which was formally designated as the La Salle Shipwreck Site (41MG 86). The meticulous excavation of the well-preserved *La Belle* provided a unique opportunity to study a French colonial-era ship stocked for the New World; the excavation revealed a ship that had all of the necessities for starting a new colony, including cannons, woodworking tools, ceramic jars, axes, iconographic rings, pins, needles, and an entire box of glass trade beads strung to be easily divided and exchanged. There also may have been another barrel containing beads that was accidentally blown open during the preliminary excavation of the ship (Bruseth and Turner 2005:87). The beads La Salle brought with him to set up his new colony in the Gulf of Mexico might even have come from the same European glass workshops that provided beads for his earlier expeditions in the Upper Great Lakes. By analyzing glass beads from *La Belle* as a comparative assemblage, I specifically connect my work with Upper Great Lakes glass trade beads to the study of French colonial trade networks delivering glass beads to North America, and integrate my project in broader contexts of exchange and global trade networks of seventeenth century colonial enterprises.

5.1.2 Summary of provenience information for glass beads selected from archaeological contexts in the Upper Great Lakes

To better delineate particular trading relationships among sites that are unrepresented in the documentary record, I selected glass trade beads from a total of 30 archaeological sites in the Upper Great Lakes, plus *La Belle*, to cover as many locations as possible and trace the movement of the artifacts (Table 4.1). Details of the artifact selection process were presented in Chapter 4, section 4.1.3. The number of individual beads selected for analysis from each site is not a statistically representative sample of each assemblage; some small bead assemblages were sampled at 100%, while large collections with tens of thousands of glass beads necessitated selection of beads from the most temporally-secure feature contexts. This broad program of sampling beads from archaeological sites across the Upper Great Lakes makes my project the first comprehensive regional study of glass trade bead composition in the Midwest, and only the second such study in North America, after the work of Hancock and his colleagues in Ontario (summarized in Hancock 2013).

Although the wreck of La Salle's trade ship *La Belle* took place in the Gulf of Mexico, far outside the geographic boundaries of my project, I included glass beads from *La Belle* in my LA-ICP-MS study as a way to link sites in the Upper Great Lakes with beads known to have been produced in Europe and obtained by French traders at a particular point in time, prior to 1684. Because the beads bought to outfit *La Belle* were most likely made in 1683 or 1684, chemical analysis of all of the major glass bead types in this collection provides well-dated glass recipe information to researchers working with beads other than the drawn blue types in my study. This should help other researchers in Europe and North America identify the origins of European-made beads recovered on archaeological sites, narrows the chronology of sites yielding similar bead types, and provides comparative results with other research conducted on seventeenth century glass adornments (e.g. Dussubieux 2009). I analyzed 67 beads from *La Belle* and another 16 beads from an associated on-shore settlement, the Fort St. Louis site (41 VT 4). These 83 total artifacts are a tiny fraction of the roughly half a million beads recovered in the excavations; however, they represent the major bead styles and archaeological contexts from the ship and the Fort St. Louis site. Because I applied a different artifact selection strategy to the *La Belle* and Fort St. Louis bead assemblage, and since this area is far outside the geographic bounds for this dissertation, I discuss the interpretations of my analyses of these beads separately, in Appendix D.

Table 5.1: Archaeological contexts of glass artifacts sampled with LA-ICP-MS. Provenience provides counts of artifacts from feature, unit, and surface contexts for each site.

Site	**Area**[1]	**N**	**Provenience by type of archeological contexts**		
			Feature (pit, wall, trench, burial etc.)	**Unit** (square, non-feature context)	**Surface** (uncontrolled)
Arrowsmith	LW	3	1	2	0
Bell	LW	36	17	13	6
Cadotte	LS	10	0	10	0
Carcajou Point	FLK	1	0	0	1
Chautauqua Grounds	GBDP	4	0	0	4
Chickadee	LW	9	9	0	0
Cloudman	MI	16	0	16	0
Clunie	MI	1	1	0	0
Doty Island	LW	79	3	76	0
Farley Village	W	3	3	0	0
Fort Michilimackinac	MI	74	63	11	0
Fort St. Joseph	MI	45	36	9	0
Gillett Grove	W	16	4	12	0
Goose Lake Outlet #3	LS	13	0	13	0
Gros Cap	MI	7	0	7	0
Hanson	GBDP	23	6	23	17
Iliniwek Village	S	70	70	0	0
La Belle Shipwreck[2]	TX	81	68	13	0
Marina	LS	17	8	4	5
Markman	LW	1	0	1	0
Marquette Mission	MI	120	119	1	0
Milford	W	5	5	0	0
Mormon Print Shop	MI	4	2	2	0
New Lenox	S	12	12	0	0
Norge Village	MI	1	0	1	0
Peshtigo Point	GBDP	11	0	0	11
Point Sauble	GBDP	5	0	0	5
Red Banks	GBDP	20	0	0	20
Rock Island	GBDP	122	74	48	0
Wanampito	W	1	0	0	1
Zimmerman	S	64	64	0	0
TOTALS	**--**	**874**	**565**	**262**	**70**

[1] Areas correspond to those described in Chapter 3: MI = Michigan's Lower Peninsula and Straits of Mackinac; GBDP = Green Bay and Door Peninsula of Wisconsin; LS = Lake Superior area; LW= Lake Winnebago area and Arrowsmith; FLK = Fox Lake and Koshkonong area; W= Western neighbors; S = Southern neighbors; TX = Texas

[2] Includes beads from La Belle and associated on-shore Fort St. Louis site; see Appendix D for further discussion of these samples

5.2 Glass Recipe Compositional Groups

Glass trade bead compositions can be sorted into groups and subgroups on the basis of identified amounts of the chemical elements detected in an elemental analysis; this is the method that previous researchers have applied in North America (e.g. Hancock 2013; Sempowski et al 2000; Shugar and O'Connor 2008), and it is the one that I employed in this project. I first sorted glass beads by colorant categories and then identified chemical subgroups within categories on the basis of proportions of diagnostic elements present. The glass used in the production of trade beads is a silica-based substance with a high degree of internal homogeneity, and variations in certain chemical elements are related to ingredients used in production of glasses, including fluxes, stabilizers, and colorants (Fernández–Navarro and Villegas 2013). Silica, from crushed quartz or sand sources, is the base ingredient in most glasses, including the soda-lime glass used in most trade beads (Henderson 2013). Fluxes are used to lower the melting point of the glass, and these include different types of soda or sodium carbonate derived from burning various kinds of plant matter, or minerals such as feldspar, producing soda-lime or potash (Henderson 2013: 22-55; Moretti and Hreglich 2013: 29). In LA-ICP-MS elemental analyses, fluxes are usually represented by concentrations of sodium oxide or soda (Na_2O) and potassium oxide or potash (K_2O). Magnesium (MgO) and phosphorus pentoxide (P_2O_5) levels are related to the particular kind of plants or soda sources used to create the flux (Henderson 2013:95; Wedepohl et al. 2011:82). Stabilizers, which elemental analysis detects in the forms of aluminum oxide (Al_2O_3) and calcium oxide (CaO), make glass less likely to degrade while in use by increasing water resistance (Moretti and Hreglich 2013: 30). In blue glass beads, colorants include copper (Cu) and cobalt (Co), and beads may be opacified using tin (Sn), antimony (Sb), or lead (Pb) (Hancock et al. 1994), all of which can be detected using LA-ICP-MS. All of these ingredients and chemical elements are used to delineate glass recipes and subgroups within colorant categories for each of the bead types.

I sort my glass samples first by bead colors and visual types that roughly follow the Kidd and Kidd typology (Figure 5.1), and then by identifying subgroups based on chemical differences within each of the categories. See Chapter 4, Section 4.2.3 for further discussion of my data analysis methods. Visual color differences correspond to chemical colorants. For example, white seed beads lack the copper and cobalt colorants present in blue beads and contain some different opacifiers, requiring them to be addressed separately. This method of first examining beads sorted by colorant, then identifying subgroups within colors, was pioneered by Ronald G.V. Hancock, Jean-Francois Moreau, and their collaborators at the now-defunct SLOWPOKE reactor in Toronto, Canada, during the 1980s through early 2000s (summarized in Hancock 2013). They oriented their chemical analyses around glass bead types (e.g. Kidd and Kidd 1970) and general glass bead colors such as red (Sempowski et al. 2001), white (Hancock et al. 1997; Moreau et al. 2004; Sempowski et al. 2000), turquoise or "copper-colored" (Kenyon et al. 1995; Moreau et al. 1997), and dark blue or "cobalt colored" (Hancock et al. 1994; Hancock et al. 2000). Once color categories are separated, then chemical subgroups within each category are identified.

Chemical subgroups are more useful than the Kidd and Kidd types or general color categories for addressing the research questions of my project for several reasons: 1) chemical subgroups reflect change in glass bead recipes over time or differences among European glass workshops, not choices of bead suppliers, 2) archaeologists classify types subjectively based on color, shape, and other visual differences, while subgroups are objectively classified chemical groups, and 3) subgroups within visually identical bead types are only identifiable through chemical analysis, so their variation on archaeological sites cannot be a product of consumer choice, and instead reflects resource availability and access to trade partners.

Figure 5.1: Representative illustrations of the Kidd and Kidd bead types examined in this project

In my research, I conducted a total of 887 LA-ICP-MS analyses of 874 glass beads, pendants, and refired glass fragments. Some objects were sampled with LA-ICP-MS in more than one location to assess different glass colors and pendant heterogeneity. LA-ICP-MS samples from each archaeological site in each category are grouped according to the colorants that distinguish this group from the others, as well as the main Kidd and Kidd types comprising each category, glass opacity, and general color (Table 5.2). These descriptors apply to most beads in the category, though individual artifact variations are present, especially in the largest categories. This table quantifies the LA-ICP-MS samples, not beads, since some artifacts such as doubled beads, multi-colored pendants, and other miscellaneous artifacts have been analyzed in several points on the same object.

Table 5.2: LA-ICP-MS samples from each site, sorted by major glass group.

	General Descriptions and Glass Bead Types of LA-ICP-MS samples (artifact counts in parentheses[1])						
Sites (alphabetical)	**Co-colored, Dk Blue, transl. IIa55/56 & Ia19**	**Co + Sb, Blue, opaque IIa46/47**	**Cu-colored, Turq., opaque IIa31 & IIa40/41**	**Mn-colored, Black, opaque IIa7/8**	**White Sb-opaque IIa13/14**	**Misc. types**	**Re-fired glass pendant & frags.**
Arrowsmith	1	0	1	0	0	1	0
Bell	26	0	8	0	0	2	0
Cadotte	1	0	7	0	0	2	0
Carcajou Point	1	0	0	0	0	0	0
Chautauqua Grounds	0	0	4	0	0	0	0
Chickadee	1	2	6	0	0	0	0
Cloudman	16	0	0	0	0	0	0
Clunie	0	0	1	0	0	0	0
Doty Island	50	11	13	2	0	2	1
Farley Village	3	0	0	0	0	0	0
Fort Michilimackinac	26	7	25	1	11	0	7 (4)
Fort St. Joseph	21	5	19	0	0	0	5 (4)
Gillett Grove	2	1	8	0	1	0	2
Goose Lake Outlet #3	3	0	10	0	0	0	0
Gros Cap	2	0	1	0	0	2	2
Hanson	9	0	8	0	0	6	0
Iliniwek Village	21	15	34	0	0	0	0
La Belle Shipwreck[2]	54	9	2	7	6	5 (3)	0
Marina	4	0	11	0	0	0	2
Markman	0	0	1	0	0	0	0
Marquette Mission	46	15	54	1	0	0	4
Milford	5	0	0	0	0	0	0
Mormon Print Shop	1	0	2	0	1	0	0
New Lenox	5	0	7	0	0	0	0
Norge Village	0	0	1	0	0	0	0
Peshtigo Point	0	0	11	0	0	0	0
Point Sauble	0	0	3	0	0	2	0
Red Banks	9	0	9	0	0	3 (2)	0
Rock Island	53	10	51	0	0	7 (5)	6 (3)
Wanampito	0	0	1	0	0	0	0
Zimmerman	12	18	27	0	0	0	8 (7)
TOTALS	372	93	325	11	19	32 (27)	35 (27)

1 Values in parentheses indicate the actual number of artifacts sampled from each site, since some artifacts were sampled more than once.
2 Includes beads from La Belle (Texas) and the associated on-shore Fort St. Louis site; see Appendix D for further discussion of these samples

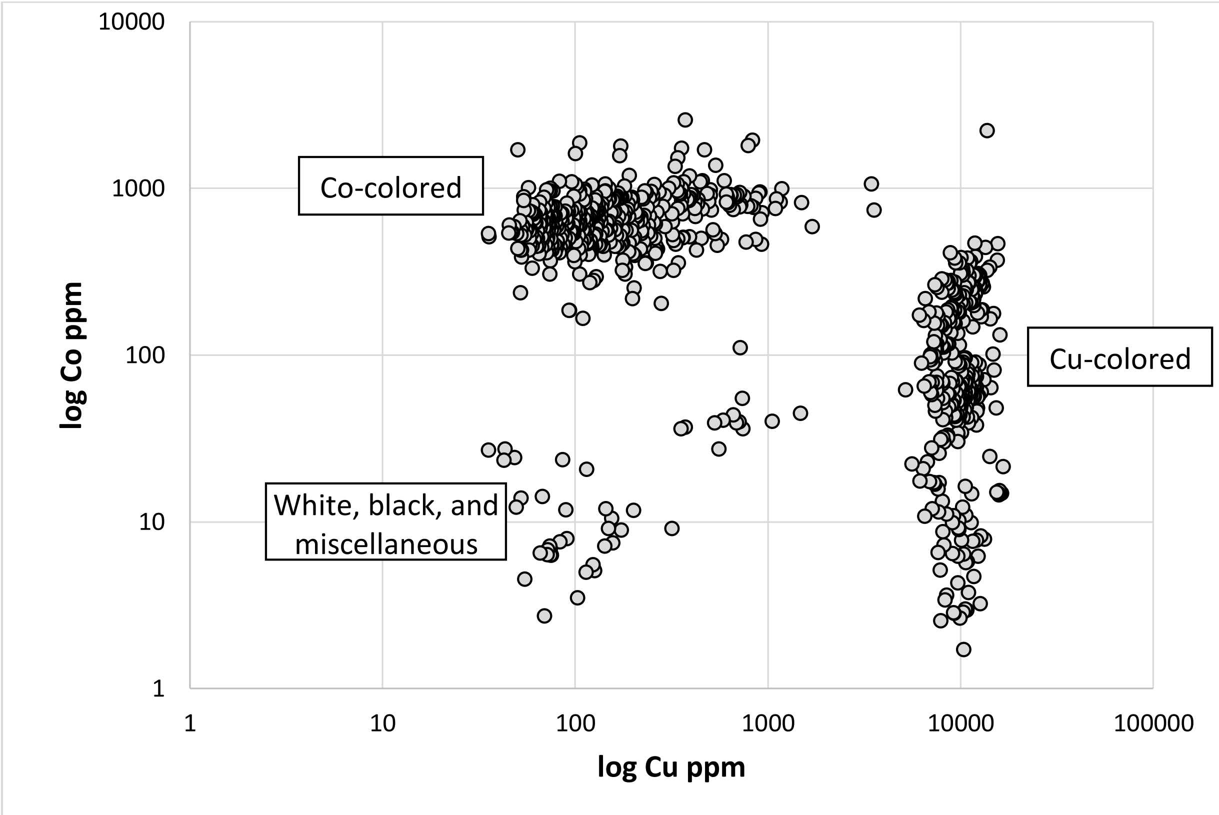


Figure 5.2: All glass samples sorted by two main colorants, Cu and Co, before proceeding with subgroup identifications. Data are logged to show better separation among groups. Each point represents one LA-ICP-MS sample.

I followed Hancock's model of identifying general groups and subgroups within my blue bead data set, beginning by separating beads according to their chemical colorants (Figure 5.2). Elements that function as colorants are not the only way to separate these visually distinct bead types into compositional groups. A biplot of calcium oxide weight percent against the sodium oxide weight percent demonstrates that differences between bead colorant groups extend to the base glass recipes used for most, but not all of the beads in each colorant group (Figure 5.3). However, I chose to sort beads first by colorant, rather than by stabilizer, flux, or other base ingredients, because this produces very clear chemical groups, and those groups generally correspond to categories within the Kidd and Kidd or other typologies.

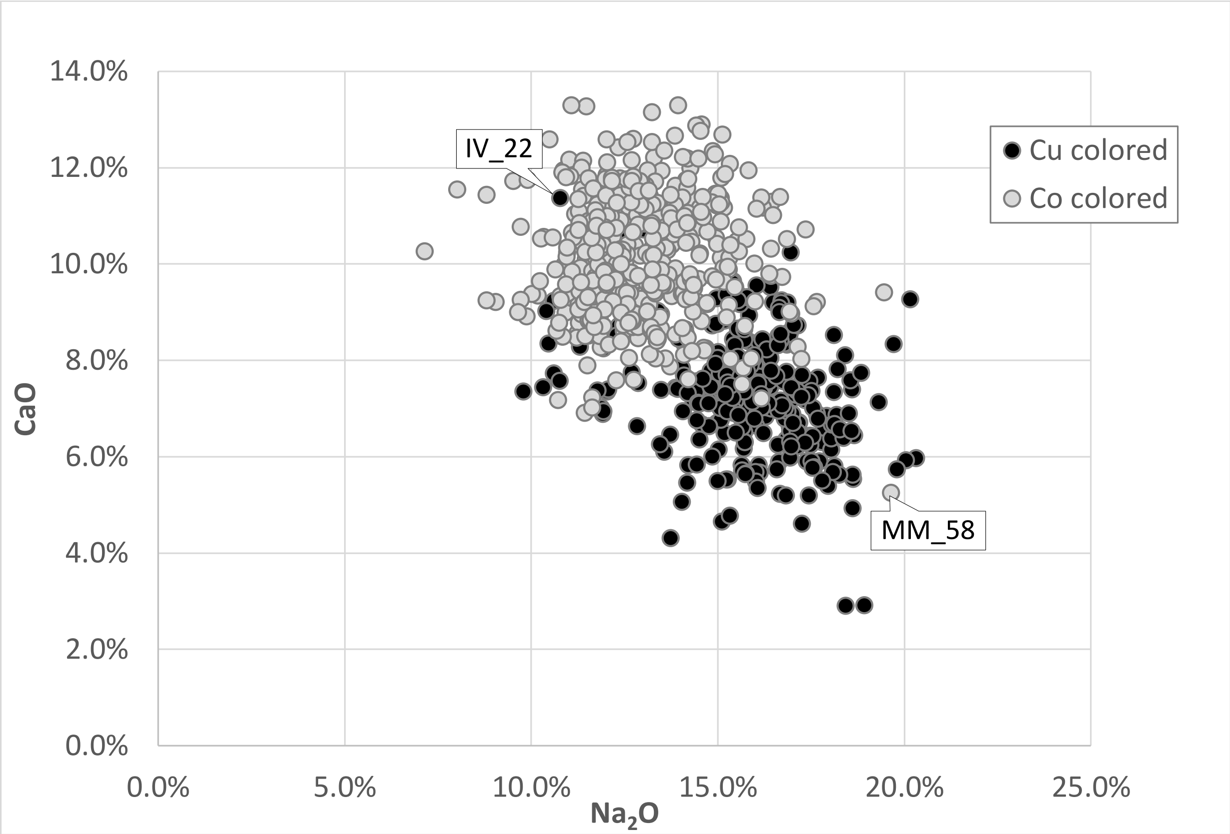


Figure 5.3: Oxides of sodium and calcium in blue glass artifacts (black, white, and miscellaneous samples removed) plotted against one another, illustrating similarities and differences in base glass among beads colored with copper or cobalt. Two outliers are labeled by bead ID.

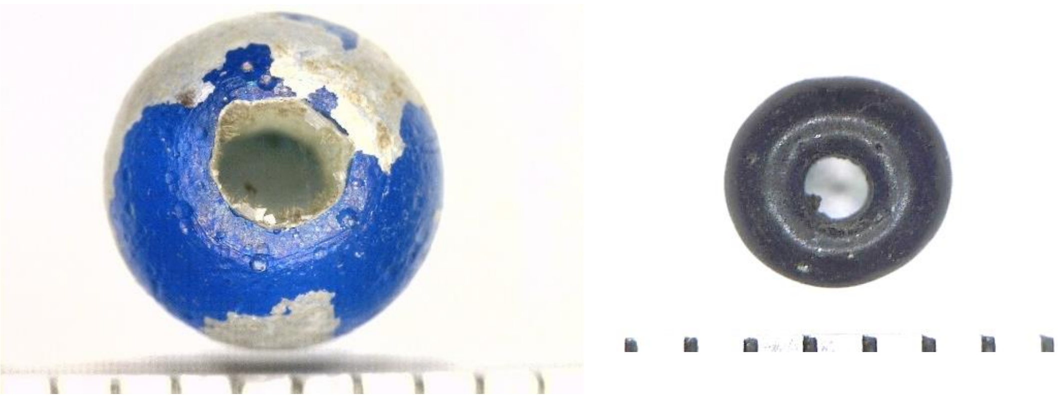


Figure 5.4: Cu-colored bead IV_22 (left) and Co-colored bead MM_058 (right) are beads that do not follow the general glass recipe pattern for Na_2O and CaO found in other beads colored with Cu or Co (Figure 5.3). However, these beads are visually very similar to other beads of the same Kidd and Kidd types examined in this dissertation (Figure 5.1). Scales in mm.

I sorted beads first by colorant because colorant groups generally parallel Kidd and Kidd or other typological categories better than other glass ingredients. Consider this example: previous NAA research has established that soda-lime glass beads colored blue with cobalt (Co) generally have higher calcium (Ca, a glass stabilizer) and lower sodium (Na, a flux), than beads colored blue with copper (Cu) (Hancock, Chafe et al. 1994), and when Ca is plotted against Na (Figure 5.3), most beads in the present study follow this pattern. However, there are exceptions, like beads IV_22 and MM_058 (Figure 5.4). Therefore, sorting by flux or stabilizer is not as reliable a way to delineate major glass groups as by colorant, but it highlights individual beads that may not "fit" with other beads colored the same way that fall into the same typological category. For example, bead IV_22 is colored with Cu, and it is opaque like most type IIa31 beads. While it is larger and a slightly different shade of blue than most beads of that Kidd and Kidd type examined in this project, it was not different enough for me to assign to another typological category. However, because of the chemical differences identified with LA-ICP-MS, I considered IV_22 separately from other beads of its type. MM_058 is Co-colored and visually indistinguishable from others of the type IIa55/56, but like IV_22, it does not match the Ca and Na values of most other beads in its colorant group. Variation in key ingredients such as Na and Ca in beads with different colorants indicates diverse "base" glasses may have been used for each glass color, but the presence of outliers like IV_22 and MM_58 demonstrates that colorants correspond to typological categories (i.e. Kidd and Kidd 1970) more reliably than base glasses.

Within glass bead colorant categories, previous researchers have identified temporal distinctions in chemical subgroups and patterns in elemental analysis data obtained from beads recovered in North America. Fluxes, such as Na, stabilizing ingredients, such as Ca, and opacifiers, such as Sn and Sb, have all been identified as elements signify shifts in ingredient amounts or proportions over time in glass bead recipes (Table 5.3). In my discussions of chemical subgroups identified in Upper Great Lakes glass beads, I link my findings to existing understandings of glass recipe subgroup chronologies identified elsewhere in North America.

Table 5.3: Relevant previous research delineating temporal periods in subgroups within glass beads of a particular colorant group, using diagnostic chemical elements

Est. temporal range (AD)	**Colorant group**	**Diagnostic element(s)**	**Citations**
1580 – 1600	Cu (blue - turquoise)	Ca < 1.8% +/- 0.7; Na < 10.4 % +/- 1.0; if opacified: Sn > 55000 ppm	(Hancock et al. 1994)
1580 - 1650	Co (blue-cobalt)	Sn > 55000 ppm	(Hancock et al. 1994)
1620 – 1650	Cu (blue - turquoise)	Ca > 3.4% +/- 1.0; Na = 11.4% +/- 0.7; if opacified: Sn > 55000 ppm	(Hancock et al. 1994)
1660 – 1760	Cu (blue - turquoise)	Ca > 4.6 % +/- 1.0	(Kenyon et al. 1995)
1640 – 1675	Sn (white)	Sn > 31000 ppm	(Sempowski et al. 2000)
1675 – 1710	Sb (white)	Sb > 39000 ppm	(Sempowski et al. 2000)

For each section below, headings (e.g. 5.2.1) I refer first to the colorant or opacifier (e.g. Cu, Sb, etc.) used in each glass bead recipe group, followed by general color descriptors such as dark blue, turquoise, white, and black to account for the range of color diversity in each category. The most common Kidd and Kidd (1970) types that fall into each colorant group are presented in the parentheses in the headings, but not all beads in each category are perfect typological matches for these types. However, including these types provides readers familiar with Kidd and Kidd (1970) a general point of reference.

In each section, I present the subgroups and outliers identified by comparison of bivariate scatterplots for major elements and using PCA and cluster analyses as exploratory tools to identify elements were responsible for variation in the data set. I also compare key elements in my data set using bivariate scatterplots of particular major, minor, and trace elements that previous researchers have identified as variable in other North American glass trade beads. In general, the chemical patterns and subgroups identified within colorant categories correspond to the timing of archaeological site occupation and trade item distribution. The most common subgroups identified are related to the associated elements magnesium (Mg) and phosphorus (P), which seems to correspond with timing of site occupation. For all major elements, compositional results are presented in oxide weights, while minor and trace elements are presented in parts per million. After presenting the data for each glass type, **I interpret possible meanings and archaeological significance of the results in relation to the research questions in section 5.4.**

5.2.1 Cobalt-colored translucent dark blue beads (IIa55/56 & Ia19/20)

Translucent cobalt beads are the most common general glass type in the study, including a total of 372 beads each analyzed once with LA-ICP-MS. Glassmakers used Co-colored translucent glass to produce small-sized round or donut-shaped "seed" beads, small ovular beads, and both large and small tubular beads. I included both tubular (Kidd and Kidd type Ia19) and round-to-donut-to-oval shaped "seed beads" (types IIa55/56/57) in my investigation to account for the possibility that similar or different glass recipes were used for each bead shape. LA-ICP-MS revealed that some Co-colored beads are opacified with antimony (Sb), and these could constitute a sub-set of Co-colored beads. However, their milky, opaque appearance usually means that Sb-opacified beads are placed in different typological categories in the Kidd and Kidd system, so I consider them separately in the next section (5.2.2). Within the translucent Co-colored glass category, I identified several outliers and subgroups, as well as patterns in the data set related to ingredients used in the base glass production process (Table 5.4).

.

Table 5.4: Summary of Chemical Compositional Data for Co-Colored Bead Subgroups. Major elements in weight percent of oxides, trace elements in ppm. Unique beads (subgroups where n=1) identified by sample ID here; see Appendix C for other bead sample IDs.

Subgroup ID	**Na_2O**	**MgO**	**Al_2O_3**	**P_2O_5**	**K_2O**	**CaO**	**Sn**	**Pb**	**Ti**	**Co**	**Zn**	**As**	**Sb**
High Na (n=1, MM_058)	19.64%	2.12%	3.53%	0.17%	0.95%	5.25%	646	886	817	1347	100	766	208
High Pb (n=1, DI_22)	15.73%	3.07%	1.48%	0.46%	1.18%	8.71%	162	35570	69	652	55	568	883
Sn + Pb (n=1, GL_03)	10.18%	2.78%	2.07%	0.07%	4.89%	9.34%	7150	31081	417	1738	183	7307	26
Na + Pb (n=1, DI_32)	11.83%	1.53%	1.45%	1.34%	5.33%	8.67%	61	19510	78	559	99	789	369
K + Pb (n=1, GC_01)	8.02%	3.21%	1.93%	1.03%	8.14%	11.55%	41	15468	870	475	468	749	479
Sn > 350 ppm (n=13)													
Average	13.50%	2.62%	1.46%	0.24%	5.11%	8.39%	1616	2669	395	1089	166	2552	6
(+/-)[1]	1.25%	0.26%	0.23%	0.02%	1.99%	0.63%	1814	2620	157	387	48	492	2
Med Pb +Sb (n+5)													
Average	16.26%	3.01%	1.59%	0.20%	1.07%	8.73%	220	18707	225	641	37	656	1327
(+/-)	0.74%	0.23%	0.06%	0.02%	0.14%	0.94%	18	2614	95	152	2	167	178
Med P (n=27)													
Average	11.71%	1.69%	1.37%	1.68%	5.32%	9.37%	7	1153	79	617	80	724	377
(+/-)	0.60%	0.25%	0.25%	0.25%	0.53%	0.77%	7	1166	20	118	39	179	522
Mg-low-P (n=219)													
Average	13.21%	3.39%	1.63%	0.32%	2.71%	10.56%	25	585	352	708	57	1502	171
(+/-)	1.59%	0.44%	0.41%	0.10%	0.98%	1.16%	58	785	258	287	49	867	213
P-low-Mg (n=101)													
Average	11.88%	1.73%	1.45%	0.73%	5.28%	9.54%	15	1676	216	608	98	797	541
(+/-)	1.14%	0.29%	0.29%	0.14%	1.03%	1.11%	20	1681	138	138	104	220	542

[1]In all tables (+/-) refers to one standard deviation

The clearest division in the cobalt-colored translucent glass category is between two main subgroups: magnesium-low-phosphorus (Mg-low-P: MgO = 3.4% +/- .4; P_2O_5 = 0.3% +/- .1) and phosphorus-low-magnesium (P-low-Mg: MgO = 1.7% +/- .3; P_2O_5 =0.7% +/- .1) (Figure 5.5). To make final distinctions between Mg-low-P and P-low-Mg subgroups for beads falling between clusters in the bivariate plots, I evaluated ratios of Mg to P along with measured values for these elements. The Mg-low-P subgroup contains an average of 11:1 Mg to P, ranging from ratios of 4:1 to 19:1. The P-low-Mg subgroup contains an average of 2:1 Mg to P, with ratios ranging from 2:1 to 6:1. These two main subgroups correspond to known site occupation dates; Mg-low-P appears mainly on pre-AD 1700 sites, while P-low-Mg is occurs more frequently at sites dated post AD-1700 (Walder 2014). Beads from Rock Island Period 3a (c. 1670 – 1700), and other pre-1700 sites, fit the Mg-low-P subgroup, while beads from Rock Island Period 3b (c. 1700 to 1730) and later sites fit the P-low-Mg subgroup, so I set the transition date c. AD 1700. Beads from the Bell site, which has an occupation period that spans the turn of the eighteenth century, c. AD 1680 to c. 1730, were often compositionally "borderline" between the two subgroups.

In both of the main subgroups, as P (P_2O_5) increases, so does K (K_2O) (Figure 5.6). Therefore, the two main subgroups that I identified in the Co-colored beads could be further described as K+P-low Mg and Mg-low-P-low-K groups, but in the summary data table (Table 5.4) and in discussions of other glass colorant categories where similar subgroups appear, I simplified these to Mg-low-P and P-low-Mg (Figure 5.5). I use this terminology whenever the distinction occurs, keeping in mind that P and K are related elements. Hancock and his colleagues found similar sub-divisions of high and low K, and they noted that high K beads their study were oval shaped while low K beads were mainly circular (Hancock et al. 2000). A similar high versus low K distinction is also visible in the current study sample (Figure 5.6); however no relationship between K and bead shape was present. Hancock and colleagues did not measure Mg and P with NAA and so they were unable to identify the relationship among Mg, P, and K.

Bead shape differences are present in another Co-colored chemical subgroup, Med-P (n=27), which is exclusive to the Doty Island Village site component (Figure 5.5 and Figure 5.6). The Med-P subgroup, with P_2O_5 > 1.1% and MgO < 2.0%, contains both tubular (Ia19) and rounded bead types (IIa55/56). Within the Med-P subgroup, with the exception of one bead (DI_29), the tubular types (Ia19) are the highest in P_2O_5 (1.81 to 2.02%), while donut shaped beads (type IIa55/56) are slightly lower (1.37 to 1.77%). Higher than average P levels in beads from Doty Island persist throughout the glass bead data set and are generally limited to the "Village" portion of the site, which is identified as the c. 1720 – 1780 Winnebago (Ho-Chunk) occupation. The Mahler portion of the site is associated with a c. 1680 – 1710 Fox (Meskwaki) component. This temporal and ethnic distinction was made on the basis of historical texts that located distinct ethnic groups (Meskwaki and Ho-chunk) at Doty Island at different points in time, and the recovery of diagnostic ceramic types associated with those groups in the Mahler and Village portions of the site (Mason and Mason 1993; 1997). Glass beads from Doty Island Village (but not Mahler) have consistently formed unique subgroups within colorant categories, and they may in fact be the latest beads in the study set, extending later than the temporal range of sites that were the primary focus of my study. Therefore, the temporal difference between the two excavation units at the Doty Island site is clearer as a result of the glass bead research.

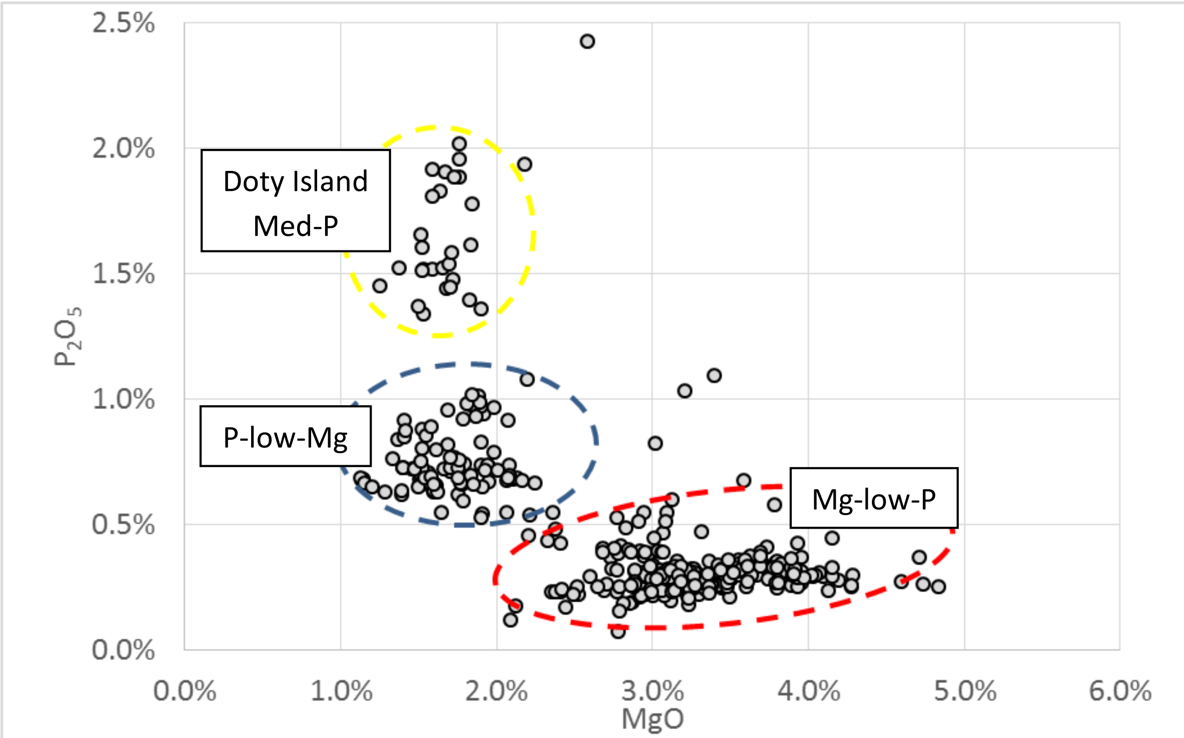


Figure 5.5: Magnesium versus phosphorus, illustrating main subgroups in Co-colored glass. Dashed circles represent general clusters, not statistical relationships.

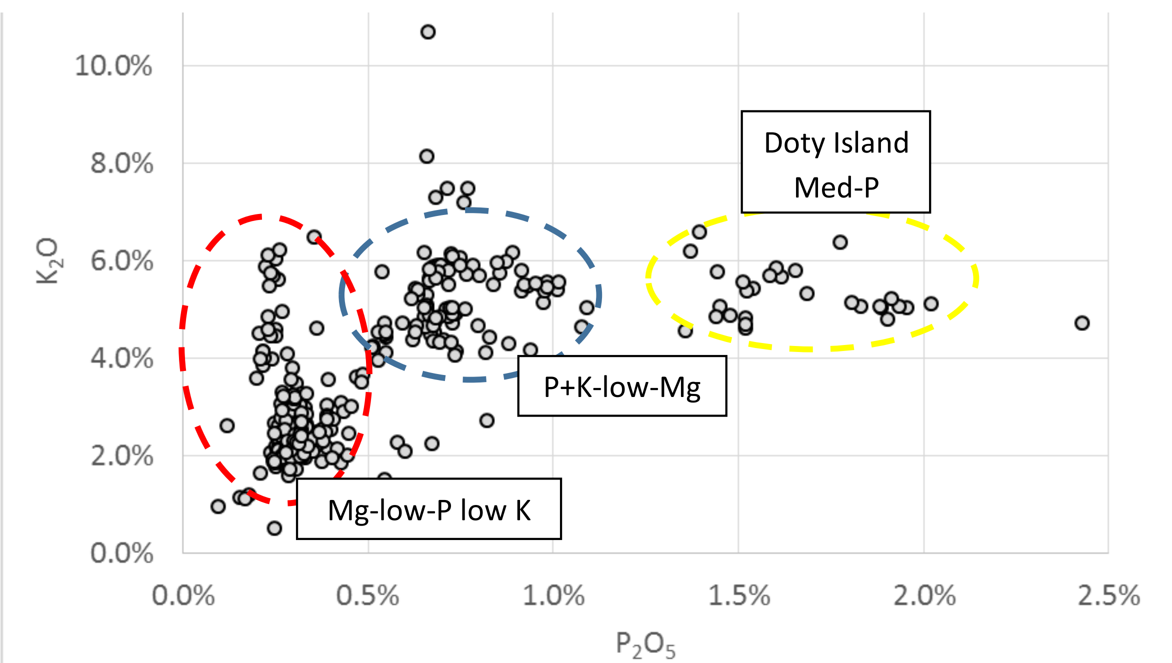


Figure 5.6: Relationship between potassium and phosphorus, illustrating two main subgroups and the Medium P subgroup. Dashed circles represent general clusters, not statistical relationships.

There are also several outliers and two additional small subgroups in the Co-colored glass data set (Table 5.4). Subgroup Sn > 350 ppm (n=13) is a group of beads that include moderate levels of tin (Sn) (515 to 7070 ppm). This is not enough tin to opacify the beads; all are translucent round or oval-shaped beads of types IIa55/56/57. Beads in this group come from Goose Lake Outlet #3 (n=1), Red Banks (n=3), Farley Village (n=1), and Hanson (n=8), all of which likely date to the mid-seventeenth century and are some of the earliest sites in my study. Tin-opacified Co-colored beads were not present in the study sample, but blue beads opacified with very high levels of Sn (>22000 ppm) were identified at two early seventeenth century Huron sites in southern Ontario, Grimsby and Ossossane (Hancock et al. 2000). The small amounts of Sn present in the Co-colored beads from the earliest documented Upper Great Lakes sites may reflect a transition from the use of Sn to less-expensive antimony (Sb) c. 1650-1675, a recipe shift that has been documented in white and Cu-colored (turquoise blue) beads (Kenyon et al. 1995; Sempowski et al. 2000). Conversely, a time-lag in the arrival of glass beads in the Upper Great Lakes might result from down-the line trade, which could have brought beads dated to the early seventeenth century in Ontario into the Upper Great Lakes at later points in time.

The other small subgroup in the Co-colored translucent glass category is a moderate-Pb plus Sb (Med-Pb+Sb) group consisting of 5 beads of type IIa55/56; Sb levels of 1200 to 1600 ppm are not enough to opacify these beads. Two beads are from Iliniwek Village, two from the Milford site, and one comes from Marquette Mission, and the c. 1670s dates for these sites could possibly reflect the beginning of the transition to Sb as a more common glass ingredient, which was taking place at this time (Sempowski et al. 2000). Finally, five individual beads do not fit into any of the subgroups (see Table 5.4). The interpretation of possible archaeological explanations for such outliers is discussed generally for all colorant categories in section 5.4.

When looking for other meaningful relationships among elements, I consulted published literature on Co-colored beads. In an earlier study of cobalt-blue glass, Ronald Hancock and his co-authors reported that the amount of Co present in beads varied significantly, producing a range of hues from a bright navy blue to purple. They also noted that arsenic (As) and Co were positively correlated with one another, possibly from the use of the mineral smaltite as a colorant (Hancock et al. 2000:571). However, in beads from the Eastern Great Lakes, the relationship between Co and As was "not particularly consistent" (Hancock et al. 1994:260). I identified a similar, moderately consistent pattern in my data set, with an R-squared value of 53%, which means that roughly half the variation around the mean fits the regression line (Figure 5.7). This similar level of variability in the relationship between Co and As in the Upper and Eastern Great Lakes samples may reflect similar ingredient choices among European glass workshops.

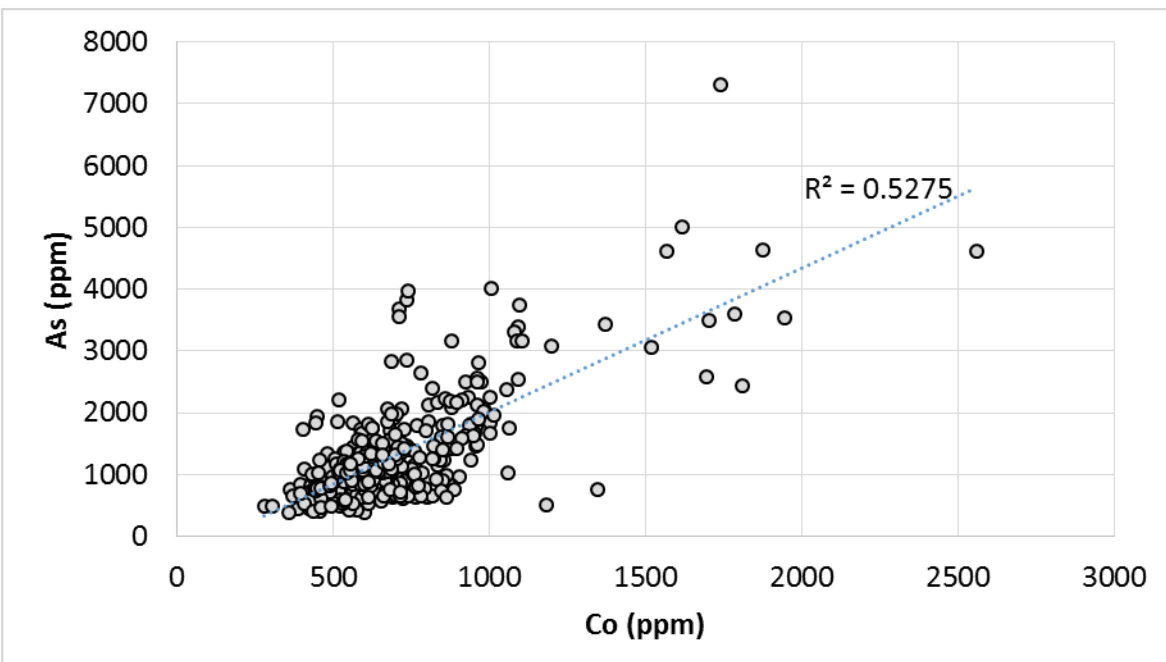


Figure 5.7: Moderately consistent cobalt and arsenic relationship in Co-colored beads

5.2.2 Cobalt-colored, antimony opacified blue small beads (IIa46/47)

Another category of 93 Co-colored beads are opacified with antimony (Sb) of at least 6000 ppm. Co-colored, Sb-opacified beads do not fit well in a single Kidd and Kidd category because this typology relies heavily on color differences to separate types, and Co+Sb colors range from shades close to Cu-colored (turquoise) beads of type IIa31 to a blue deep enough to result in a classification of IIa55/56. For the Co+Sb beads in my study, type IIa46/47, an opaque light blue type, is the most common visual classification. All beads in the Co+Sb category in the present study contain Cu < 1500 ppm and Co > 160 ppm, and color variances come from differences in the levels of Sb, Co, Cu, and manganese (Mn).

Within the Co+Sb category, the Mg vs P subgroupings are present (Figure 5.8), and there are two smaller subgroups and four individually distinct glass recipes (Table 5.5). In the Co+Sb category, the P-low-Mg subgroup (MgO = 1.9% +/- .3; P_2O_5 = 0.7% +/- .1) continues to correspond to archaeological sites dated to post-AD 1700, while the Mg-low-P subgroup (MgO = 3.5% +/- .3; P_2O_5 = 0.3% +/- .03) predates 1700. Two artifacts with intermediate levels of MgO between 2.5 and 2.6% come from the Texas comparative samples from *La Belle* Shipwreck Site (sample BL_027) and the associated on-shore Fort St. Louis settlement (sample SL_12) (Figure 5.8). Their ratios of Mg:P place both beads closer to the Mg-low-P subgroup, which is consistent with the 1686 date of deposition (see Appendix D for further discussion). No Sb-opacified beads were identified from the sites in the study sample dated to the early to mid-part of the seventeenth century, including the lowest levels of Rock Island and many of the sites in the Door Peninsula region. Like the transition to Sb-opacification of white beads (Sempowski et al 2000), European glass workshops may have begun using Co+Sb blue glass recipes by the

1660s. Sb-opacified blue beads are present on the Iliniwek and Zimmerman sites, both of which were occupied at least by the 1670s, if not earlier (Ehrhardt 2005; Rohrbaugh et al.1999).

Aside from the Mg-low-P and P-low-Mg subgroups, some beads in the Co+Sb category have varying levels of the opacifiers Sn and Pb. There are four individual glass recipe outliers, including a single Sn+Pb+Sb bead from Zimmerman (ZM_54) that may reflect a glassmaker's experimentation with different opacifiers during the transition from Sn to Sb c. AD 1650 – 1675 (Sempowski et al 2000). A Med-Sn + Pb subgroup includes beads from the Zimmerman (n=2) and Marquette Mission (n=1) sites (Table 5.5). Notably, no post-1700 beads contain significant quantities of Sn, demonstrating the completeness of the transition to Sb as a glass opacifier by the turn of the eighteenth century. As in the translucent Co-colored category, a small group of beads (n=4) from Doty Island Village forms a Med-P subgroup identifiable by higher levels of P_2O_5 than the rest of the beads in the Co+Sb category. The Doty Island Med-P subgroup is visible in the Mg vs P scatterplot illustrating the two main subgroups of the Co+Sb category (Figure 5.8).

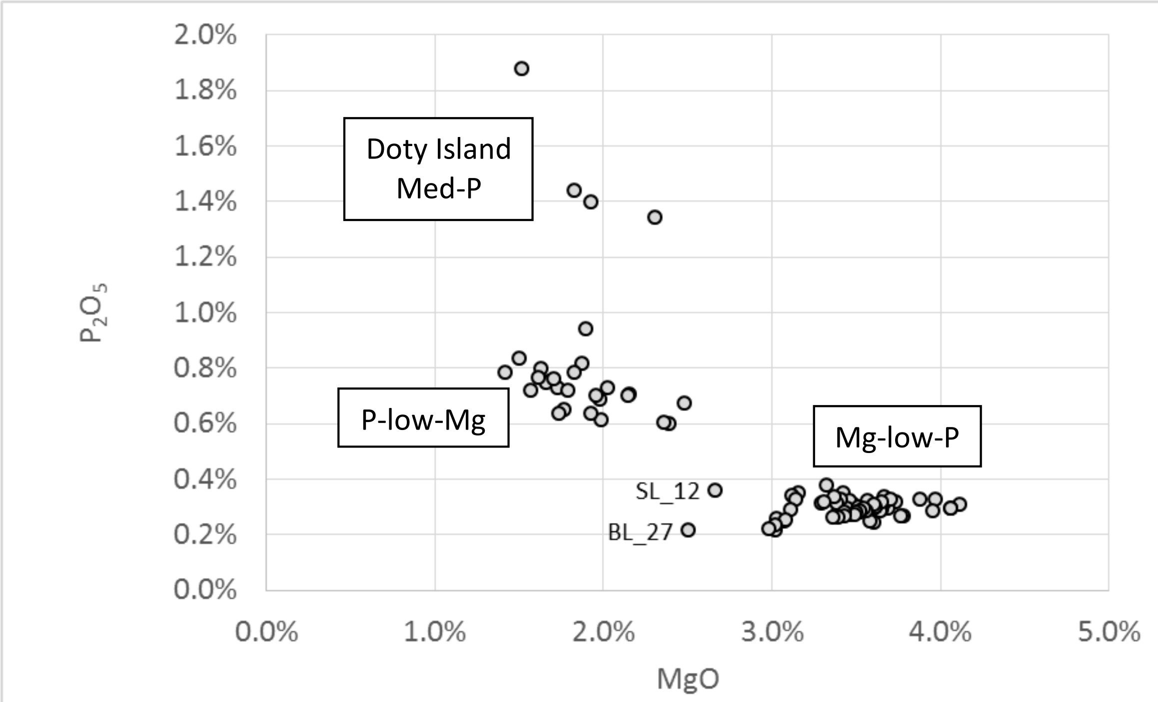


Figure 5.8: Magnesium versus phosphorus, illustrating P-low-Mg, Mg-low-P, and Doty Island Med P subgroups in Co+Sb glass. Two intermediate beads come from La Belle Shipwreck site (bead BL_27) and the associated on-shore Fort St. Louis site (bead SL_12).

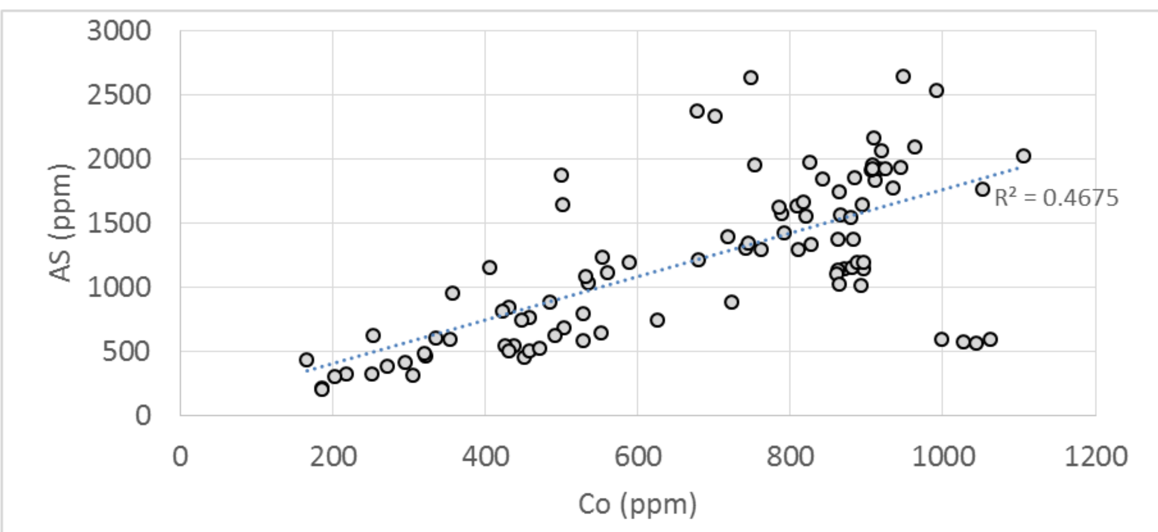


Figure 5.9: Moderately consistent cobalt and arsenic relationship in Co +Sb beads

Table 5.5: Summary Compositional data for Co-Colored + Sb bead subgroups. Major elements in weight percent of oxides, trace elements in ppm. Unique beads (subgroups where n=1) identified by sample ID here; see Appendix C for other bead sample IDs.

Subgroup ID	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	Sn	Pb	Ti	Co	As	Sb
Pb (n=1, DI_13)	13.21%	1.99%	1.33%	0.61%	3.62%	8.70%	241	19235	61	536	1033	23570
Pb-low-Sb (n=1, ZM_46)	10.94%	3.08%	1.64%	0.25%	7.53%	11.80%	646	7590	1042	500	1877	9790
Med-low Sn + Pb (n=1, ZM_49)	15.57%	3.49%	1.19%	0.27%	2.74%	10.76%	852	1581	248	1106	2027	22397
Sn+Pb (n = 1, ZM_54)	17.57%	3.02%	1.71%	0.23%	2.00%	9.12%	10155	10499	362	748	2636	18641
Med Sn + Pb (n=3)												
Average	16.07%	3.01%	1.69%	0.23%	2.07%	9.18%	9299	8007	316	775	2447	16602
(+/-)	1.50%	0.02%	0.07%	0.02%	0.21%	0.33%	65	1164	11	150	171	584
Med P (n=4)												
Average	12.84%	1.89%	1.34%	1.52%	4.24%	9.02%	7	2550	73	332	390	18666
(+/-)	1.04%	0.33%	0.16%	0.25%	0.39%	0.59%	3	737	12	85	80	3755
Mg-low-P (n=55)												
Average	13.86%	3.52%	1.52%	0.30%	2.43%	10.77%	25	987	246	765	1329	16388
(+/-)	1.27%	0.29%	0.32%	0.03%	0.56%	0.96%	18	844	83	219	485	5462
P-low-Mg (n=23)												
Average	12.32%	1.87%	1.33%	0.73%	4.62%	9.95%	11	2342	201	502	713	22064
(+/-)	1.32%	0.29%	0.15%	0.08%	0.77%	0.96%	10	2287	127	231	388	8888

Table 5.6: Published values (ppm) for light blue, Sb-rich beads from Fort Niagara (Shugar and O'Connor 2008:63) compared with all 93 beads in the Upper Great Lakes (UGL) Co+Sb group

	Mn	Co	Cu	As	Sn	Sb	Pb	Ca
Ft. Niagara (n=14) Average:	1175	196	273	72	-290	19683	1361	62718
(+/-)	499	107	341	29	73	2196	753	19774
UGL (n=93) Average:	1680	679	377	1215	498	17968	2151	74339
(+/-)	1184	252	300	627	1947	6657	2994	7599

Previous archaeometric studies of trade beads in North America have identified other Co-colored, Sb-opacified beads (Kenyon et al. 1995; Shugar and O'Connor 2008). Using pXRF, Shugar and O'Connor identified a total of 14 Co-colored, Sb-opacified beads from Fort Niagara in Western New York, dated to the latter half of the eighteenth century. These are the only published values for Co-colored, Sb-opacified North American glass trade beads comparable to beads in my study sample (Table 5.6), although Shugar and O'Connor classified the Sb+Co beads as turquoise, type IIa37 (2008:59), rather than as I have, as light blue type IIa46/47. For Sb+Co beads, in Table 5.6 standard deviations in measurements of Sn, Sb, and Pb are greater in the Upper Great Lakes dataset compared to the Fort Niagara beads because the Upper Great Lakes beads come from a variety of archaeological sites dated to the historic era, rather than a single site. In the Fort Niagara dataset, As values increase along with Co, as previously identified in Ontario beads (Kenyon et al. 1995; Hancock et al. 2000), but the R-squared value for this relationship in the Upper Great Lakes dataset is 47%, a relatively weak correlation (Figure 5.9). This may mean that workshops may have chosen different ingredients to produce the blue color.

On average, less Co was present in the Fort Niagara beads (196 ppm +/- 107) than in any subgroups of the Upper Great Lakes beads (Table 5.5). For Co+Sb beads, the post-1700 P-low-Mg subgroup contains less cobalt than the pre-1700 Mg-low-P subgroup in the Upper Great Lakes samples, so I suggest this result may indicate that glassmakers were able to decrease the amount of colorant used in Co-colored beads over time, making Co a temporally significant element. Average Co-levels for the Med-P group from Doty Island Village are the lowest in the Co+Sb category (332 ppm +/- 85), supporting my interpretation presented in the previous section, that beads from the Village portion of the Doty Island site may be the latest in the study sample, perhaps nearly contemporary with late eighteenth century Fort Niagara.

5.2.3 Copper-colored, turquoise blue opaque beads (IIa31 & IIa40/41)

A total of 325 glass beads in the Upper Great Lakes dataset were identified as colored predominantly with copper (Cu), not Co. Beads are considered part of this Cu-colored bead colorant category whenever >5000 ppm Cu were present, even if trace amounts of Co were also included in the glass recipe. Within the Cu-colored beads category, distinct opacifiers and Mg vs P subgroups corresponding to temporal periods differentiate glass recipes. Identified chemical subgroups correspond to Kidd and Kidd typological styles and bead shapes in some but not all instances, and discussions of subgroups point out when larger-size turquoise beads (of Kidd and Kidd types IIa40 and similar types) are considered separately from the smaller IIa31 type beads because of these compositional differences. Relevant elements used to distinguish subgroups in the Cu-colored beads are included in the summary table for this category (Table 5.7).

Some beads of types IIa40 and IIa31 in the Cu-colored category (n=51) contain higher than average levels of zinc (Zn). During initial exploration of the dataset using bivariate scatterplots, these beads were the first recognizable subgroup in the Cu-colored category. When Zn is present, it increases with Cu in a positive linear relationship, R-squared = 81%, indicating that either a brass alloy or a particular ratio of Cu to Zn (2.7:1) was required for certain glass types (Figure 5.10). Since Zn appears to be related to the colorant Cu, beads containing Zn were separated from the rest of the Cu-colored beads before sorting those into the Mg vs P subgroups. High Zn beads have not been identified in reference literature for compositions of North American glass trade beads. In the present study, beads containing Zn are further subdivided into high Zn, Zn+ Sn and other subgroups (Table 5.7).

Table 5.7: Summary Data for Cu-Color Subgroups. Major elements in weight percent of oxides, trace elements in ppm. Unique beads (subgroups where n=1) identified by sample ID here; see Appendix C for other bead sample IDs.

Subgroup ID	**Na_2O**	**MgO**	**Al_2O_3**	**P_2O_5**	**K_2O**	**CaO**	**CuO**	**Sn**	**Pb**	**Ti**	**Zn**	**Sb**
Sb+Zn+Pb (n=1, MM_024)	10.76%	2.90%	1.08%	0.25%	3.41%	7.57%	1.55%	12	13488	511	4763	20239
Med-Pb (n=1, RI_123)	14.57%	1.77%	0.95%	0.50%	4.95%	6.67%	1.50%	45	13522	58	42	627
High Zn (n= 7) Average	15.80%	1.61%	1.07%	0.18%	2.10%	5.47%	2.01%	7	390	773	6503	2
(+/-)	0.26%	0.02%	0.05%	0.03%	0.05%	0.33%	0.05%	2	86	60	291	0
Zn + Sn (n=34) Average	13.73%	2.17%	1.11%	0.25%	6.59%	8.11%	1.20%	7939	7528	887	3496	167
(+/-)	2.50%	0.31%	0.19%	0.12%	2.52%	1.29%	0.22%	3197	7968	368	775	480
Zn (n=5) Average	12.05%	2.57%	0.96%	0.29%	6.24%	9.08%	1.27%	182	419	685	4043	76
(+/-)	1.12%	0.17%	0.10%	0.14%	1.58%	2.02%	0.27%	388	548	136	1080	153
Zn + Sb (n=4) Average	13.14%	2.39%	1.39%	0.25%	6.59%	8.95%	0.88%	623	1661	664	2838	1833
(+/-)	0.34%	0.04%	0.20%	0.05%	0.85%	1.12%	0.13%	145	802	415	430	441
IIa40 Mg-low-P + Ca (n=13) Average	16.44%	2.75%	1.25%	0.20%	1.24%	8.94%	0.96%	354	1202	169	65	174
(+/-)	0.61%	0.22%	0.25%	0.03%	0.55%	0.53%	0.08%	480	1787	87	30	68
IIa40 Mg-low-P low Ca (n=25) Average	16.38%	1.79%	1.09%	0.19%	4.16%	5.45%	1.37%	421	794	135	71	25
(+/-)	1.66%	0.29%	0.20%	0.06%	1.73%	0.95%	0.29%	440	661	62	103	12
Med P (n=2) Average	14.20%	1.25%	0.96%	1.49%	4.86%	6.05%	1.17%	259	3235	49	86	121
(+/-)	0.91%	0.11%	0.09%	0.08%	0.16%	0.06%	0.01%	176	1349	8	24	10
P-low-Mg (n=104) Average	15.23%	1.36%	0.81%	0.78%	4.07%	7.42%	1.22%	54	295	123	81	217
(+/-)	1.23%	0.13%	0.15%	0.15%	0.87%	0.54%	0.20%	40	495	59	37	252
Mg-low-P (n=127) Average	16.74%	2.34%	1.05%	0.20%	2.73%	7.41%	1.29%	68	342	192	41	180
(+/-)	1.33%	0.39%	0.35%	0.06%	0.88%	1.19%	0.25%	144	509	65	20	274

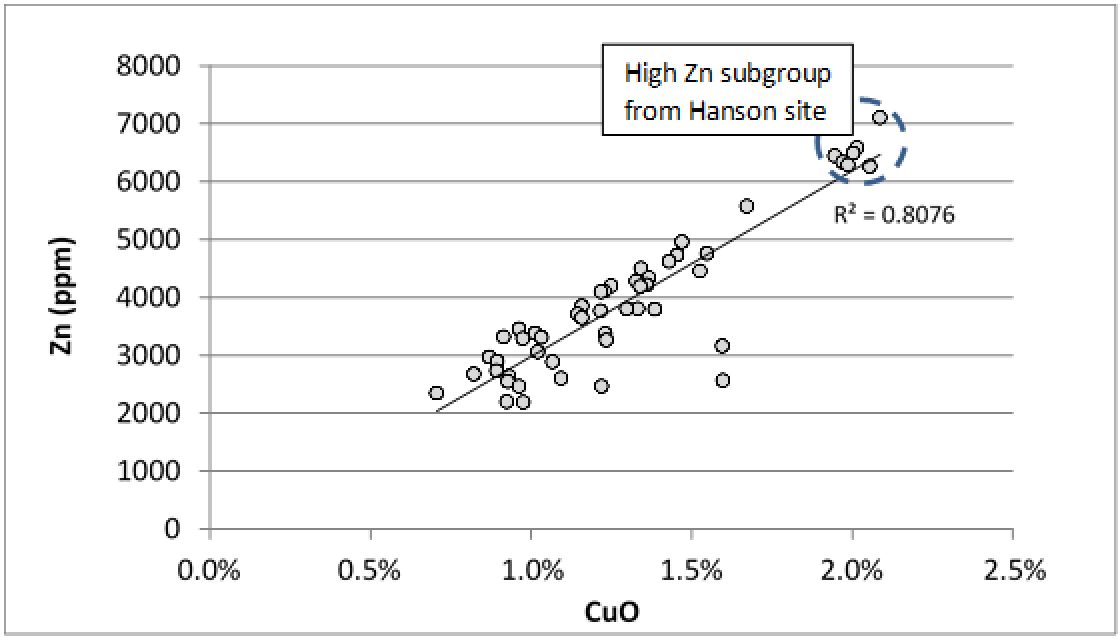


Figure 5.10: CuO vs Zn, showing positive correlation between these elements in high Zn beads, high-Zn subgroup from the Hanson site indicated by dashed circle.

Figure 5.11: High Zn bead (H_C76) from the Hanson site, illustrating shape and translucency

A few (n=7) beads from the Hanson site contained the highest Zn and Cu levels in the study sample. These beads were initially classified as type IIa55/56 because of their translucent appearance and deep blue color (Figure 5.11). However, the high Zn chemical subgroup represents a highly distinctive glass recipe not identified on any other sites in the study region. These beads are colored with Cu, not Co, like the type IIa55/56 beads discussed in section 5.2.1 above, and unlike most Cu-colored beads in the present study, the high Zn beads are translucent, not opaque. The shape of the beads in this group ranges from round to irregularly-shaped ovals; none are the more common donut-shape for beads of this size present at other sites in this region. The distinctiveness of the Hanson site glass bead assemblage may be the result of the migration of non-local Indigenous people who introduced trade items not otherwise obtainable in the Upper Great Lakes region. Further anthropological implications for the distinctiveness of the Hanson site beads are discussed in section 5.4

In the Zn+Sn subgroup, a continuous range of related Kidd and Kidd bead types are represented including small, donut-shaped (IIa31) seed beads, and larger round (IIa36/40), ovular (IIa38) and circular (IIa41) types (Figure 5.12). Some Cu-colored beads with Zn also contain high Sn (Sn>3400 ppm), and there are no high Sn beads without some Zn present (Figure 5.13).

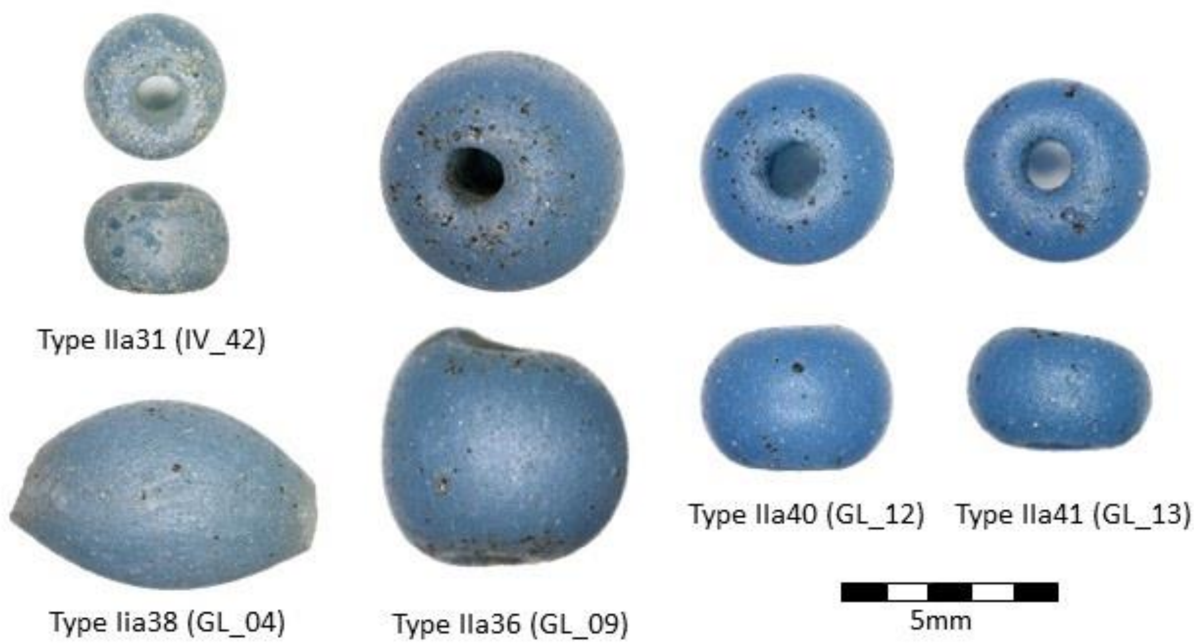


Figure 5.12:IIa40 and related Kidd and Kidd (1970) types in the Zn + Sn subgroup, bead sample IDs in parentheses. A continuous range of color and shape variation is present in these types.

Avocational bead collectors and some scholars refer to these IIa40 and related types as "early-blues" (Blair et al. 2009:75-79; Francis 1999), promoting a long-standing perception that these are hallmarks of initial trading activities between Europeans and Native Americans. Peter Francis considered IIa40s a long-lived type that lasted from c. 1560 – 1750 and suggested that there might be elemental variations within the type (1999:5). The chemical subgroups identified in the Upper Great Lakes IIa40 samples support Francis's ideas about the diversity of glass recipes within this typological category and its closely related variants (IIa36 through IIa42).

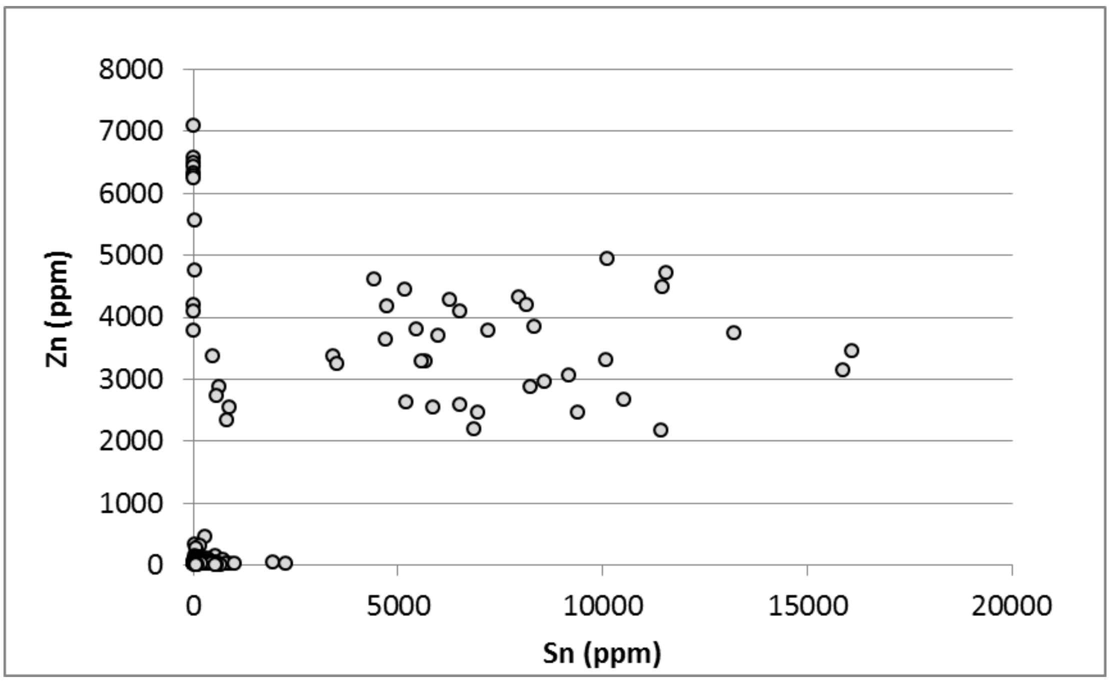
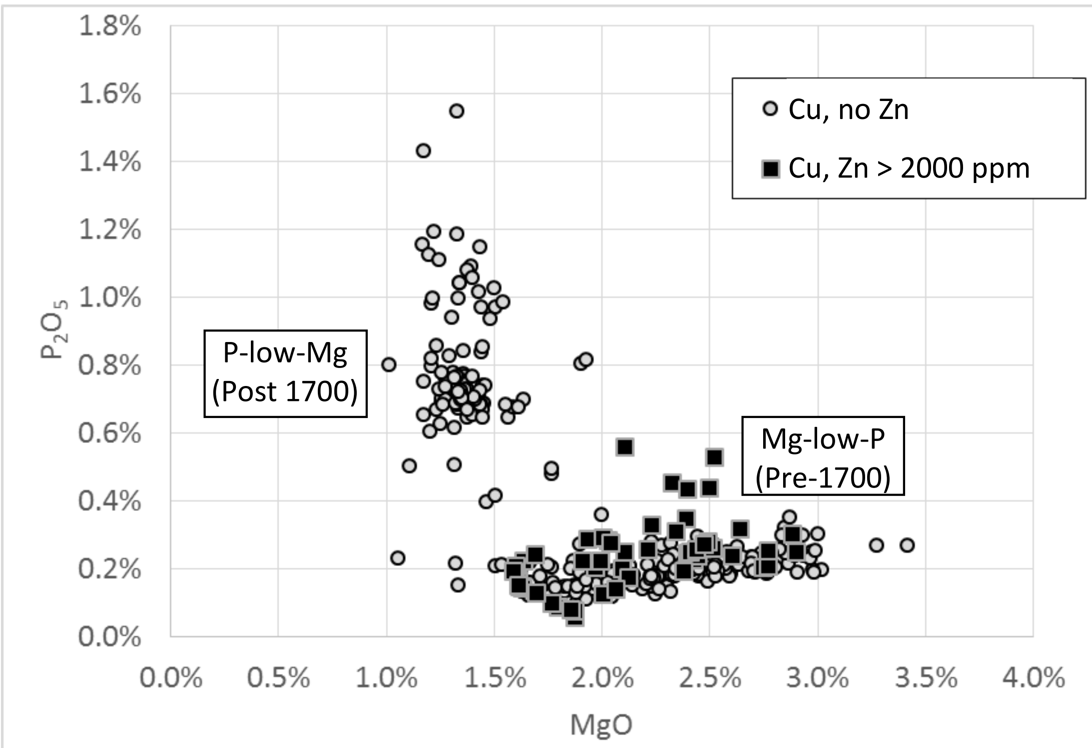


Figure 5.13: Sn vs Zn for all Cu-colored beads (n=325), showing that all beads with Sn > 2300 ppm also contain Zn > 2000 ppm, but not all high Zn beads contain Sn

Because Zn was the most distinctive chemical element present in the Cu-colored bead category, and since Zn appears to be related to the colorant Cu, all of the Zn-related subgroups were identified and separated from other samples before further sorting of the remaining beads into Mg-low-P and P-low-Mg subgroups. However, all beads in the Zn and Zn+Sn subgroups fall into the general pre-1700 Mg-low-P category, which is visible when Mg and P values for all

325 beads in the Cu-colored category (with and without Zn) are plotted (Figure 5.14). Based on the presence of the opacifier Sn, which fell out of use c. 1670 (Sempowski et al. 2000), and the Mg-low-P subgroup ratio, Cu-colored beads that included Zn, some of which were opacified with Sn, were probably produced before AD 1670, and definitely before AD 1700.



.

Figure 5.14: Mg vs P for all Cu-colored beads (n=325), showing that beads with Zn all belong to the pre-AD 1700 Mg-low-P subgroup

The Zn + Sn subgroup is diverse in levels of Sn and Pb, which could result from glassmakers experimenting with different glass opacifiers during the transitional period that previous researchers identified from c. AD 1650 – 1675 (Sempowski et al 2000). In the Zn + Sn group, Pb ranges from 4.65% PbO_2 (40000 ppm) to 2412 ppm, while Sn ranges from 16074 ppm to 3414 ppm. Because this variability in Pb and Sn takes place within an otherwise consistent group, I have not separated the Zn + Sn group into further subgroups. The larger size of IIa40 and related types relative to the IIa31 seed bead type means that the same batch of glass would produce fewer IIa40 than IIa31beads per production run. If glass recipes were not exactly replicated from batch to batch, this would explain the greater diversity in Sn and Pb levels identified in beads of the IIa40 types than in the IIa31 types. There also may be more intermittent trade in the earliest periods, which might produce archaeological assemblages of beads that are more chemically diverse, as beads would come from various trading and production sources. Diversity in these "early blues" may reflect a less-organized production process or less standardization in glass production in the early-mid seventeenth century in Europe.

After sorting out the Zn and Zn + Sn subgroups, some outliers were visible. Two beads (MM_024 and RI_123) are individually high in Pb, and have been separated out as outliers in Table 5.7. There is also a group of four Cu-colored beads with Zn and moderate to low levels of Sb present (Sb ranges from 1400 to 2400 ppm). Cu-colored, Sb-opacified beads are relatively rare in previous studies and Sb-levels in published types were much higher, in the range of >20000 ppm (Kenyon et al. 1995; Shugar and O'Connor 2008). The Zn+Sb group includes one bead each from Red Banks (RB_08), Cadotte (CAD_3_1), Wanampito (WA_01_1) and Point Sauble (PTS_1_1). Each of these artifacts comes from surface collections, not temporally-diagnostic features, and it is difficult to interpret the meaning of this subgroup. The subgroup may reflect the transition in the seventeenth century from Sn to Sb as an opacifier c. 1670, which would be consistent with the dates of these sites presented by their excavators. However, since it is possible that habitation activities continued later into the eighteenth and nineteenth centuries in these locales, it is impossible to rule out later deposition of beads in the Zn+Sb subgroup.

After removing the Zn, Zn+Sn, Zn+Sb subgroups and outliers, I was left with a set of both IIa31 and IIa40 type beads, which I sorted into Mg-low-P and P-low Mg subgroups using a bivariate scatterplot. However, the remaining IIa40 and IIa36 type beads that had been sorted in the P-low-Mg group did not follow the consistent 2:1 ratio of Mg:P present in the IIa31 beads. All of the IIa40 bead ratios of Mg:P were more similar to the Mg-low-P group, so I considered the IIa40 (and related types) separately at this point. PCA and cluster analyses also repeatedly separated the beads by type (IIa31 and IIa40), and I determined that Ca was the primary element responsible for this distinction. Among the IIa40 beads that contained neither Zn nor Sn (n=38), there are two identifiable subgroups: a IIa40 Mg-low-P +Ca and IIa40 Mg-low-Ca subgroup (see Table 5.7). Following Hancock et al. (1994), Francis (in Blair et al. 2009:77) noted that the earliest "early blues" were very low in Ca, and that Ca levels increased over time. This pattern is consistent with the dates of Upper Great Lakes sites contributing beads in each subgroup; beads from pre-1670 sites fit the IIa40 Mg-low-Ca subgroup, and beads from later sites fit the Mg-low-P+Ca subgroup. Therefore, calcium levels are another clear chronologically-sensitive element.

A cluster analysis of values recorded for all elements in the IIa40 beads without Zn and Sn, performed using Ward's method, cases standardized by Z-scores highlights the differences between the IIa40 Mg-low-P +Ca and IIa40 Mg-low-Ca subgroups (Figure 5.15). Beads in the top cluster come from the Bell site (n=4), Marquette Mission (n= 11), New Lenox (n=3), Markman, (n=1), and Zimmerman (n=1). Based on published dates, none of these sites have confirmed occupations prior to 1670, though excavators have suggested possible mid-seventeenth century dates for New Lenox, Markman, and Zimmerman. In the second major cluster, beads come from Red Banks (n=3), Iliniwek Village (n=1), Clunie (n=1), Peshtigo Point (n=4), Chautauqua Grounds (n=4), Hanson (n=1), Point Sauble (n=1), New Lenox (n=1), Rock Island Period 1 (n=1), and Rock Island Period 3 (n=1). Many of these are Door Peninsula sites and may represent some of the earliest locales of interaction between Europeans and Native peoples in the region; Red Banks is a long-standing candidate for the 1634 landing of Jean

Nicolet (Hall 1993; 2003; Lurie and Jung 2009; Mason 2014; Risjord 2001). The bead from Rock Island Period 3 (c. 1670 to 1760) is anomalous and unlike any other beads from Period 3 at that site; it may represent a curated object. The single blue bead from Rock Island period 1 (RI_032), and the single bead of this type from the Hanson site (TB_4) both come from components that excavators date to the 1650s (though Hanson may be as late as 1670). For these reasons, I date the second cluster to pre-1670. New Lenox is the only site contributing beads to both groups in the cluster analysis. The glass bead assemblages at most of the sites contributing to the pre-1670 cluster are less numerous than those in the post-1670 cluster. For example, the Markman, Clunie, and Rock Island Period 1 assemblages each contain only a single drawn blue bead. The small size of the assemblage supports down-the-line rather than direct trade.

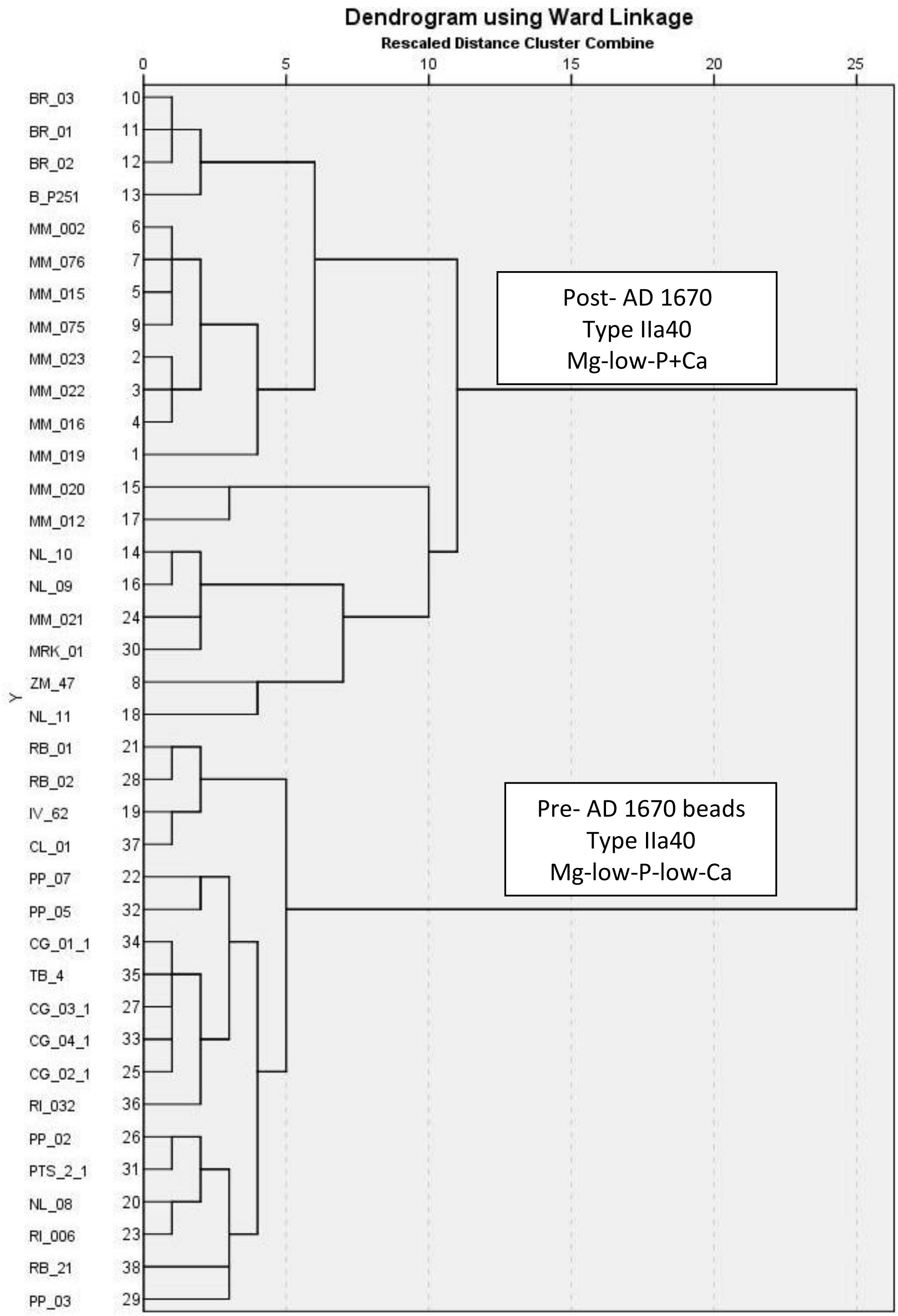


Figure 5.15: Cluster analysis of non-Zn IIa40 beads (n=38), performed using all measured elements, Ward's method, cases standardized by Z-scores, illustrating two main clusters

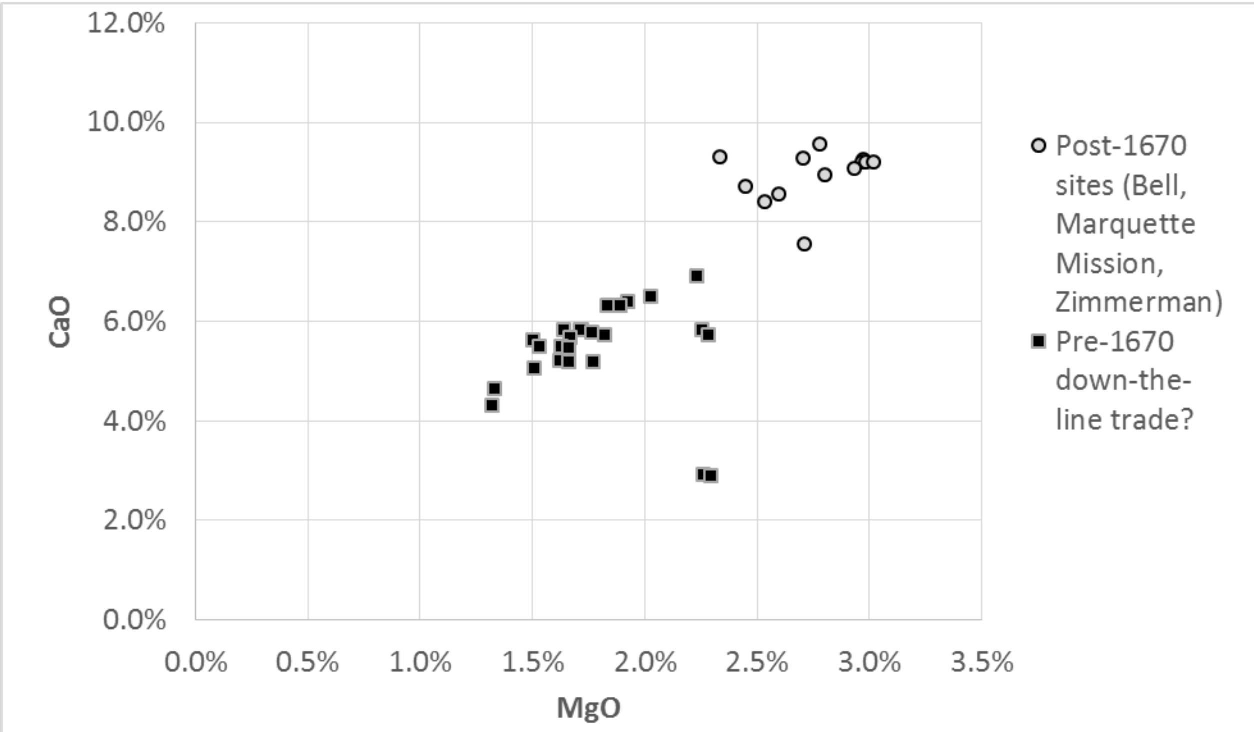


Figure 5.16: MgO vs CaO for non-Zn IIa40 beads(n=38) showing a temporal distinction in Ca levels that corresponds to the two clusters identified in Figure 15. The Mg-low-P+Ca group contains CaO > 7.0%, while the Mg-low-P-low Ca group contains CaO < 7.0 %.

A scatterplot of MgO versus CaO for the non-Zn IIa40 beads also shows two clear clusters of beads, and this biplot, not the cluster analysis, was used to make the final delineations for the IIa40 high and low Ca subgroups (Figure 5.16). Beads in the IIa40 Mg-low-P + Ca group (n=13; CaO > 7.0 %) come only from the large bead assemblages at the Marquette Mission, Bell, and Zimmerman sites, where European traders and explorers are known to have visited during the 1670s (Behm 2008; Branstner 1991; Rohrbaugh et al. 1999). In Figure 5.16, beads from all sites in the pre-1670 group defined using cluster analysis are present in the IIa40 Mg-low-P low Ca scatterplot group (n=25; CaO < 7.0%), and beads from New Lenox and Markman move into the pre-1670 scatterplot group. No historically-documented European interactions are recorded at any of these sites until the 1670s, and many of the sites may be locales of down-the-line exchange, or places where refugees briefly stayed. Therefore, I argue that the IIa40 Mg-low-P low-Ca subgroup represents some of the earliest identified compositional groups in the study sample. Single IIa40 low Ca beads from the Rock Island Period 1 and Hanson-site may signify participants in the Huron diaspora who would have brought their “early” beads with them from trading partners further to the east. The presence of beads of this type also circumstantially supports down-the-line trade rather than direct interaction because these beads are few in number and occur at the earliest sites in the study sample. This interpretation is weakened by the fact that samples from Peshtigo Point, Red Banks, Point Sauble, and Chautauqua Grounds all come from surface collections rather than well-provenienced archaeological contexts. However, given the lack of well-excavated archaeological sites dated to the early historic era, it is necessary to include these sites and to accept them as probable early-mid-seventeenth century assemblages.

After removal and sorting of the various IIa40 and related types, the remaining beads in the Cu-colored category (n=233) were type IIa31, with a few others visually identified as either types IIa55/56 or IIa45/47, but with glass recipes more consistent with other beads of the IIa31 type. The remaining Cu-colored beads sort into the Mg-low-P and P-low-Mg subgroups, with two beads from Doty Island Village (DI_51 and DI_50) again containing the highest amounts of P (>1.3%) placed in a Med-P subgroup (Figure 5.17). To clarify the affiliation of beads with Mg and P values that fell between the major subgroups, I again calculated ratios of Mg:P and found that in the P-low-Mg group, ratios of Mg:P ranged from 2:1 to 1:1, while they were between 12:1 and 19:1 beads in the Mg-low-P group. The three labeled beads (MP_01 and MP_02 from Mormon Print Shop and SJ_41 from Fort St. Joseph) have ratios of Mg:P of 3.9:1 or 4.9:1, placing them almost directly between both subgroups. I classify these three artifacts with the Mg-low-P beads, though it is possible that they represent a distinct transitional type indicative of the transition to P-low-Mg recipes at the beginning of the eighteenth century.

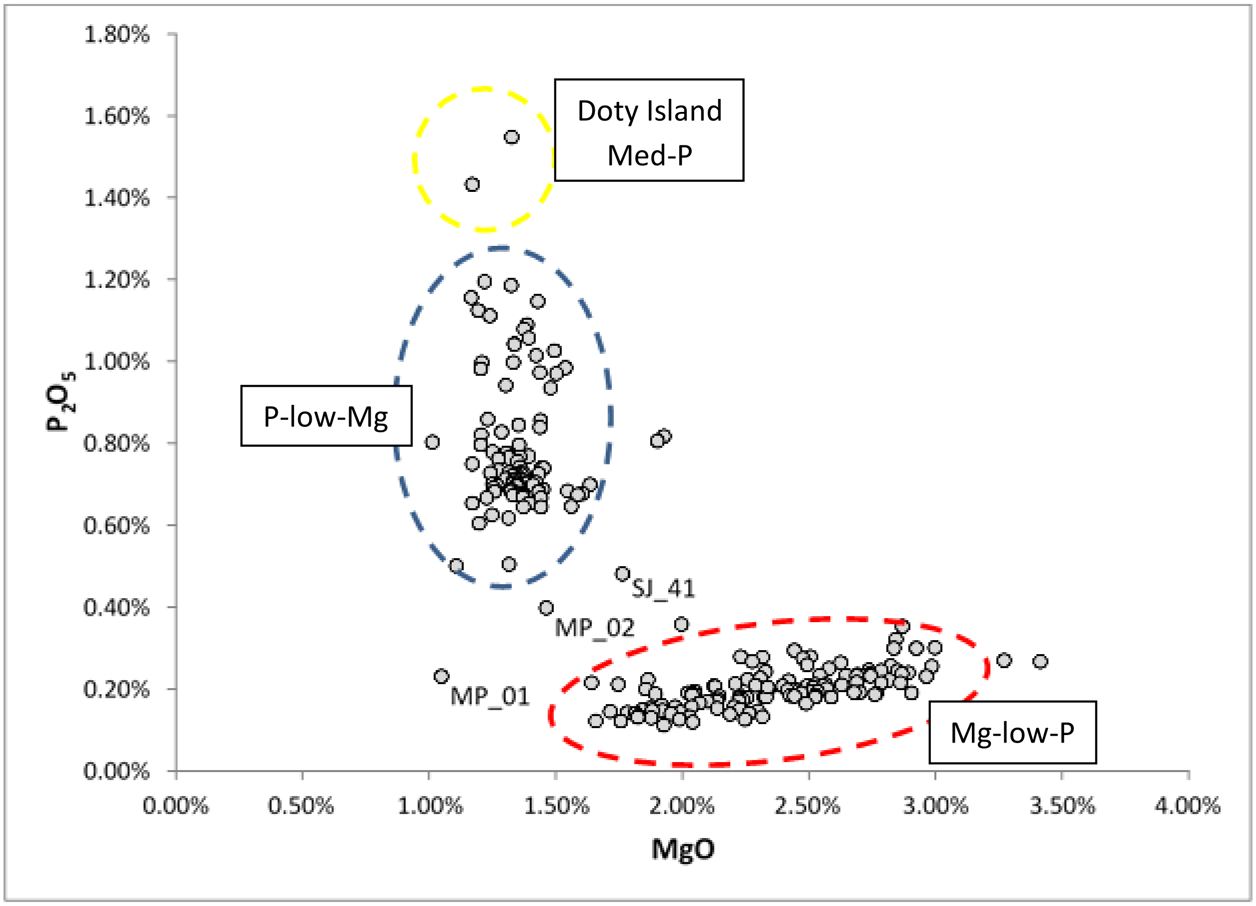


Figure 5.17: Type IIa31 beads in the Mg-low-P (pre-1700), and P-low-Mg (post 1700), and Med P (post 1760s?) subgroups and possible transitional beads MP_01, MP_02, and SJ_42. Dashed circles represent general clusters, not statistical relationships.

5.2.4 Manganese-colored black beads (IIa7)

Although black beads were not the primary focus of this study, a few were analyzed inadvertently when six black beads of varying Kidd and Kidd styles (Figure 5.18) were visually misidentified as dark blue beads during the sample selection process. Seven additional black soda-lime glass beads of the IIa7 type were analyzed for comparative purposes in the study of the La Belle and Fort St. Louis examples from Texas (See Appendix D for further discussion).

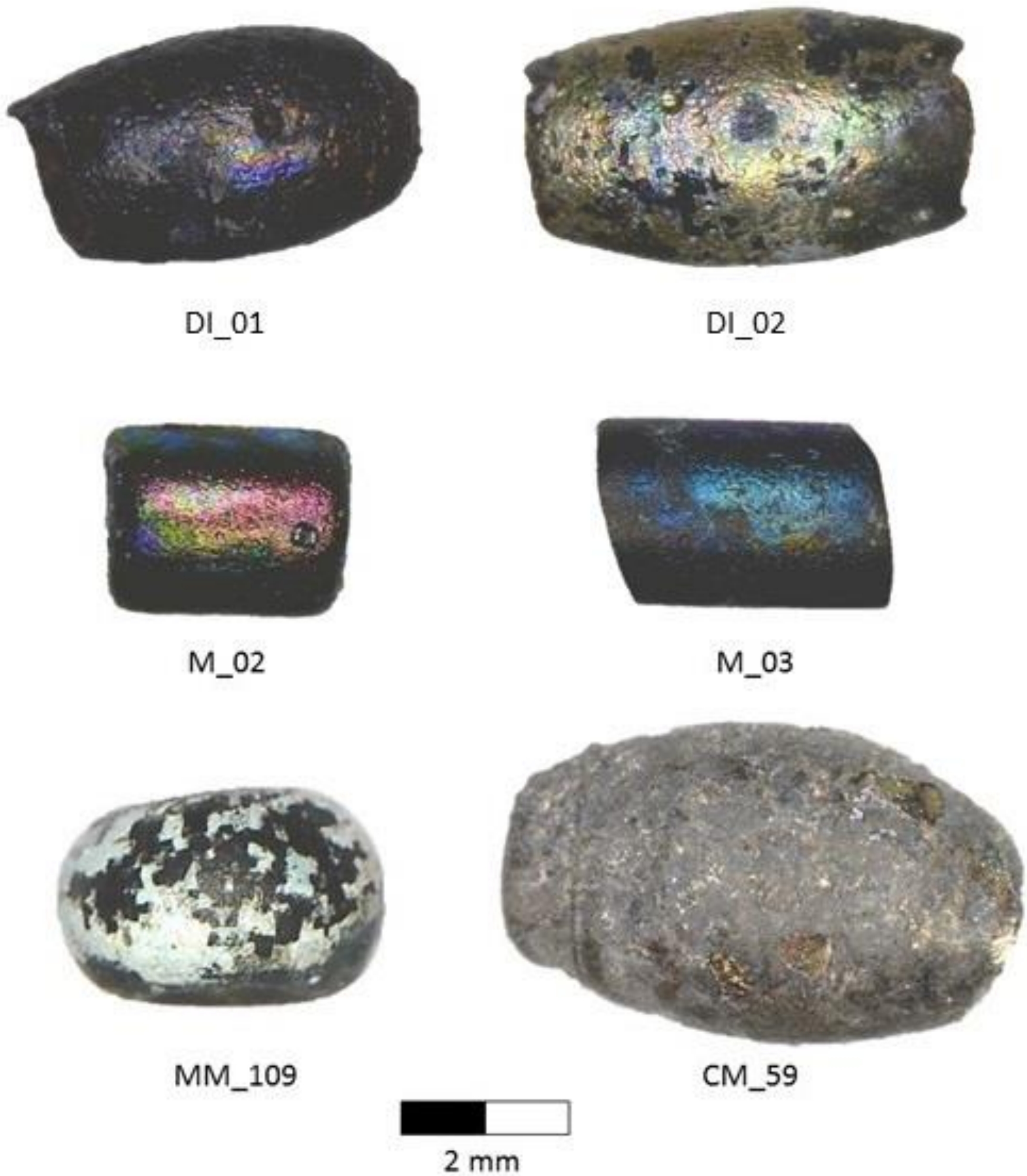


Figure 5.18: Black beads misidentified as dark blue beads

Visual misidentification of black beads as blue beads could have been a result of lighting conditions or possibly due to the iridescent patina of some artifacts. Images of these beads readily illustrate their visual ambiguity, demonstrating the subjective nature of bead color identification (Figure 5.18). Two of the six visually misidentified beads come from the Mahler portion of the Doty Island site (M_02 and M_03), two come from the Village area of the site (DI_1 and DI_2), one comes from Marquette Mission (MM_109), and one from Fort Michilimackinac (CM_59). Each was thought to be a very dark blue cobalt-colored variety until LA-ICP-MS analysis revealed high quantities of manganese oxide (MnO), which produces black-colored beads when added to glass recipes (Karklins et al. 2002:117). Manganese oxide (MnO) values were >5.0% for the six misidentified beads, consistent with the black beads included from the Texas sites.

Based on the finding of the black colorant Mn as a key ingredient in these artifacts, I have reassigned the six misidentified beads to appropriate Kidd and Kidd styles as follows: M_02 and M_03: Ia2 (medium, opaque, black); DI_01 and DI_02: IIa8 (medium, opaque, black); MM_109: IIa7 (small, opaque, black); CM_59: IIa8 (medium, opaque, black). CM_59 is a high-lead bead (PbO_2 > 40.0%), while the black seed bead MM_109 and two tubular beads M_02 and M_03 are the more common soda-lime glass types. DI_01 and DI_02 are also high in PbO_2, both about 30%, but they contain enough Na to be considered Pb-Na glass. These six visually misidentified beads exemplify a major known flaw in typologies such as the Kidd and Kidd system: identifying bead coloration is subjective and dependent on lighting conditions, researcher perception, and surface corrosion or discoloration of glass. A summary data table is not included for the small number of black beads analyzed, but as with all other bead samples, full compositional and provenience information for the black beads is located in Appendix B.

5.2.5 Antimony-opacified white beads (IIa13/14)

White soda-lime-silica glass seed beads were also beyond the primary focus of this project, but a few were included to compare their chemical composition to that of white portions of refired glass pendants to better understand the sources of beads used for pendant-making.

White beads were also sampled at the request of some curating institutions in an attempt to clarify site chronologies. Like the black beads, six white beads from *La Belle* and the Fort St. Louis site in Texas were analyzed to obtain representative glass recipe samples of all major bead types present at these well-dated French-colonial trade sites (see Appendix D). Because only a few white beads were analyzed, no summary data table is included here, but full compositional and provenience information for the white beads is found in Appendices B and C.

Eleven beads (CM_60 to CM_70) from Fort Michilimackinac were included for comparison with the blue and white pendants from the site, and one bead each from Gillette Grove (GG_13) and the Mormon Print Shop site (MP_03) were included to provide more chronological information about these locales. NAA of white beads in northeastern North America demonstrated that the ingredient used to opacify a clear base glass shifted over time from Sn (> 30000 ppm) to Sb (> 40000 ppm) between c. AD 1625 to 1640 in western New York State (Sempowski et al. 2000:561). No Sn-rich white beads were recovered from archaeological sites in the Northeast dated post- 1675 (Sempowski et al 2000:562). Comparably high levels of Sn or Sn were not detected in white beads in the present study, with the exception of a single bead from La Salle's presumed colony in Texas (SL_16, discussed further in Appendix D). Levels of Sb in the range of 200 to 5000 ppm were present in the white beads from the Upper Great Lakes sites, but no bead had > 10 ppm Sn present. Based on the chronology for opacifiers that Sempowski and her colleagues developed for the Northeast, Sb is lower than expected for white beads from post-1670 sites in the Upper Great Lakes.

Lower than expected levels of Sb could be explained by the bead construction, and differences in NAA and LA-ICP-MS analysis techniques. White glass beads are sometimes made of multiple layers of glass, with a transparent outer layer over an opaque white glass core only visible with magnification or cross-sectioning the bead (Shugar and O'Connor 2008). Both the Mormon Print Shop and the Gillette Grove samples appear to have an opaque core when viewed with magnification. Three of the eight samples from Michilimackinac seemed to have a more solid, non-cored appearance but visual identification was ambiguous. Despite the observed differences (Figure 5.19), cored and apparently solid types were chemically similar, except for the varying levels of Sb. It is possible that the laser ablation method sometimes, but not always, extended deep enough into the artifact to cut through a clear outer layer of glass and into the Sb-rich core. SL_16, the only definitively non-cored bead, was as Sb-rich as the examples from the Northeast. Sampling a cored bead with NAA, as Sempowski and her colleagues did, produced results that aggregated the chemical elements present in all the glass layers, while LA-ICP-MS analyzes sample material only from the points near the bead surface ablated by the laser.

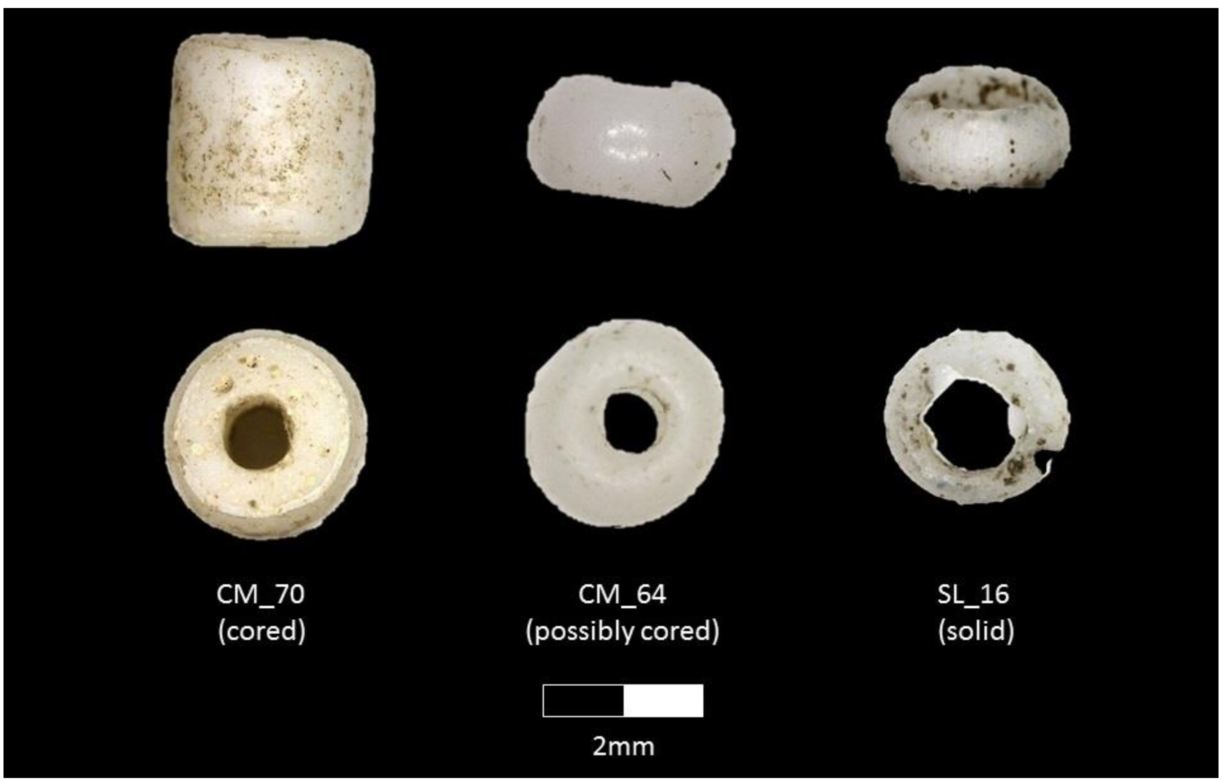


Figure 5.19: White beads magnified, showing cored, possibly cored, and solid production methods

Cross-section analysis and microscopy have exposed the glass bead layers and distinguished chemical differences between layers (Shugar and O'Connor 2008). Shugar and O'Connor note that, "examination of the mounted and polished [cross-sectioned] beads clearly indicates the potential for significant misclassification and improper Kidd assignments by visual examination alone" (2008:61). This is because cored types are classified as "compound" (IVa-variety) in the Kidd system, but the coring involving a transparent outer layer and opaque core is not visible to the naked eye. Shugar and O'Connor reported that coring was not visible under a microscope without cross-sectioning the beads; however, it is possible to see the cores clearly at least for some beads using a Dinolite digital microscope (Figure 5.19).

Despite the challenges to dating cored white beads by opacifiers identified with LA-ICP-MS, the distinction between pre- and post-1700 dating on sites and correlation with Mg-low-P and P-low-Mg subgroups applies to the white bead category as well. White beads from the unambiguously dated Fort Michilimackinac, c. 1715 – 1761, maintain the P-low-Mg patterning, while the beads from *La Belle*, which sank in 1686, represent the pre-1700 subgroup of Mg-low-P. This clarifies the Gillett Grove and Mormon Print Shop (MPS) occupation dates (Figure 5.20). The white bead from MPS fits the post-1700 P-low-Mg subgroup, while a single IIa31 Cu-colored blue bead from that site fit the pre-1700 Mg-low-P subgroup for Cu-colored beads. This may indicate that the two historic-era features that yielded beads at this site span the turn of the eighteenth century. The Gillett Grove white bead fits the pre-1700 Mg-low-P subgroup, which is unsurprising given the protohistoric Oneota occupation recorded at the site (Shott et al. 2002).

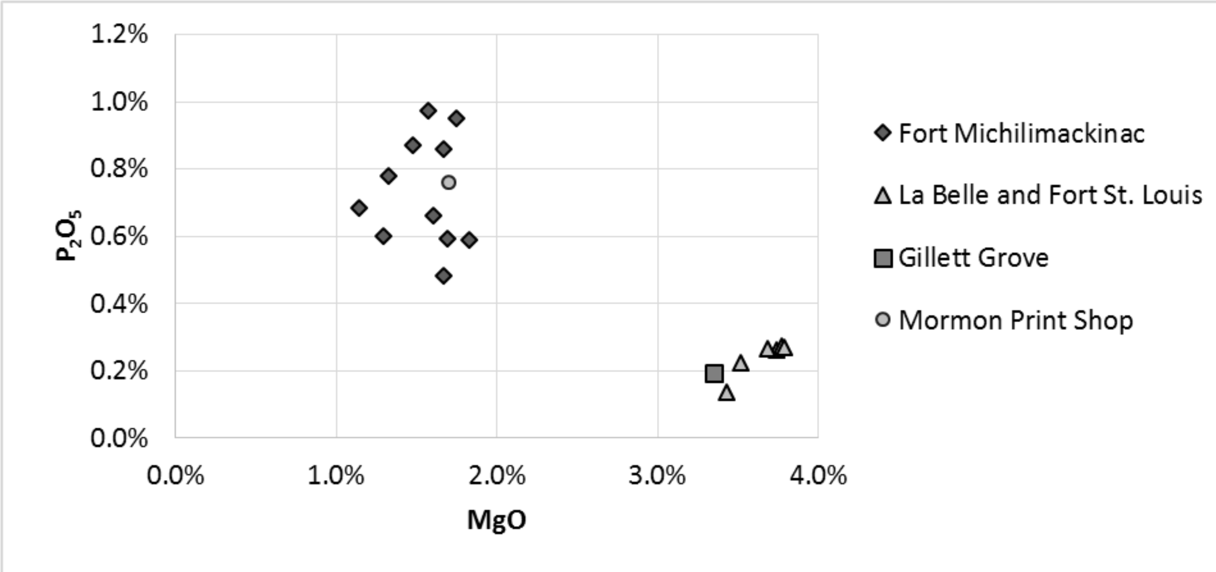


Figure 5.20: Scatterplot of Mg vs P in white beads analyzed, with beads labeled by site, illustrating how the temporal correlation of the P-low-Mg and Mg-low-P subgroups continues for white beads, based on dates of post-1700 for Michilimackinac and pre-1700 for La Belle

5.2.6 Miscellaneous compositional subgroups

This section includes some beads that are visually similar but chemically distinct from the soda-lime-silica blue beads in this study discussed in previous sections. Several additional bead types do not fit the stylistic categories above, and were included in the study set for various reasons, including comparison with visually similar glass types (i.e. translucent blue glass) in the data set, documenting the entire range of beads in an assemblage prior to repatriation, increasing the number of samples from a small assemblage, or exploring a unique type or object found in a collection. For each miscellaneous type, a brief section below describes the beads and connects them to others in the study and in reference literature when possible. Subsections describing miscellaneous bead types follow the order of presentation in the summary data table (Table 5.8). No compositional summaries are presented for miscellaneous bead categories, since each contains only one or a few beads, but Appendix C presents full LA-ICP-MS results.

Table 5.8: Miscellaneous Bead Types Summary Table

Distinctive elements	**Description**	**Kidd & Kidd**	**Site(s) and number of samples**
5.2.6.1 High Potassium Blue Beads (Wood Ash glass)			
High K_2O	Round, medium, transl.	IIa55	Cadotte (2), Point Sauble (2)
High K_2O	Star or "melon" fragment, transl.	WIIe6	Gros Cap (1)
High K_2O	"Doubled" oval, transl., 2 samples	WIc(?)	Red Banks (2)
K_2O + Zn	Melon shaped, transl.	WIIe6	Red Banks (1)
K_2O + Zn	Elongate, medium, transl.	IIa57	Hanson (1)
5.2.6.2 Moderate to High Lead Blue Beads			
High Pb	Round, medium, transl.	IIa44	Rock Island Pd. 3 (1), Bell (1)
High Pb	Round medium, transl.	IIa32	Bell (1)
Mod. Pb	Elongate, medium, transl.	WIc (?)	Doty Island (2)
Mod Pb +K	Round, large, transl.	IIa33	Gros Cap (1)
Pb + Cu/Co	Round, large, opaque	IIa48	Arrowsmith (1)
Pb + Na/Ca	Round, large, transl.	IIa28/29	Rock Island (1)
5.2.6.3 Antimony Opacified Cored Blue and White Beads			
Sb	Small, cored, opaque	IVa16	La Belle (5)
5.2.6.4 Soda-Lime Colorless Beads			
n/a	Small, tubular, translucent	Ia8	Hanson (5)

5.2.6.1 High Potassium Blue Beads (wood-ash and potash glass)

Eight LA-ICP-MS samples from seven Co-colored glass beads contain high enough potassium (K_2O) to be considered wood-ash glass, while one Cu-colored bead has K in the range of potash-soda glass (Table 5.8). As described above, most beads in my study are made of soda-lime or soda-ash glass, which use ashes derived from plants as the glass flux. The Co-colored beads in the high K_2O (> 15.5%) group contain much higher levels of K than those found in soda-lime glass, possibly indicating that wood ash was used as a fluxing agent instead. European glassmakers produced wood ash for glassmaking from burning beech trees (Wedepohl et al. 2011) and wood-ash glass was common in medieval Europe (Wedepohl and Simon 2010). The medieval wood-ash beads that Wedepohl and colleagues documented contain more CaO (avg. 19.7%) than the high K_2O beads in my sample (avg. 11.5%). Silica levels are also higher in the present study sample than in Wedepohl and Simon. Seventeenth century glass recipes may have required less CaO to stabilize the glass than in the medieval samples.

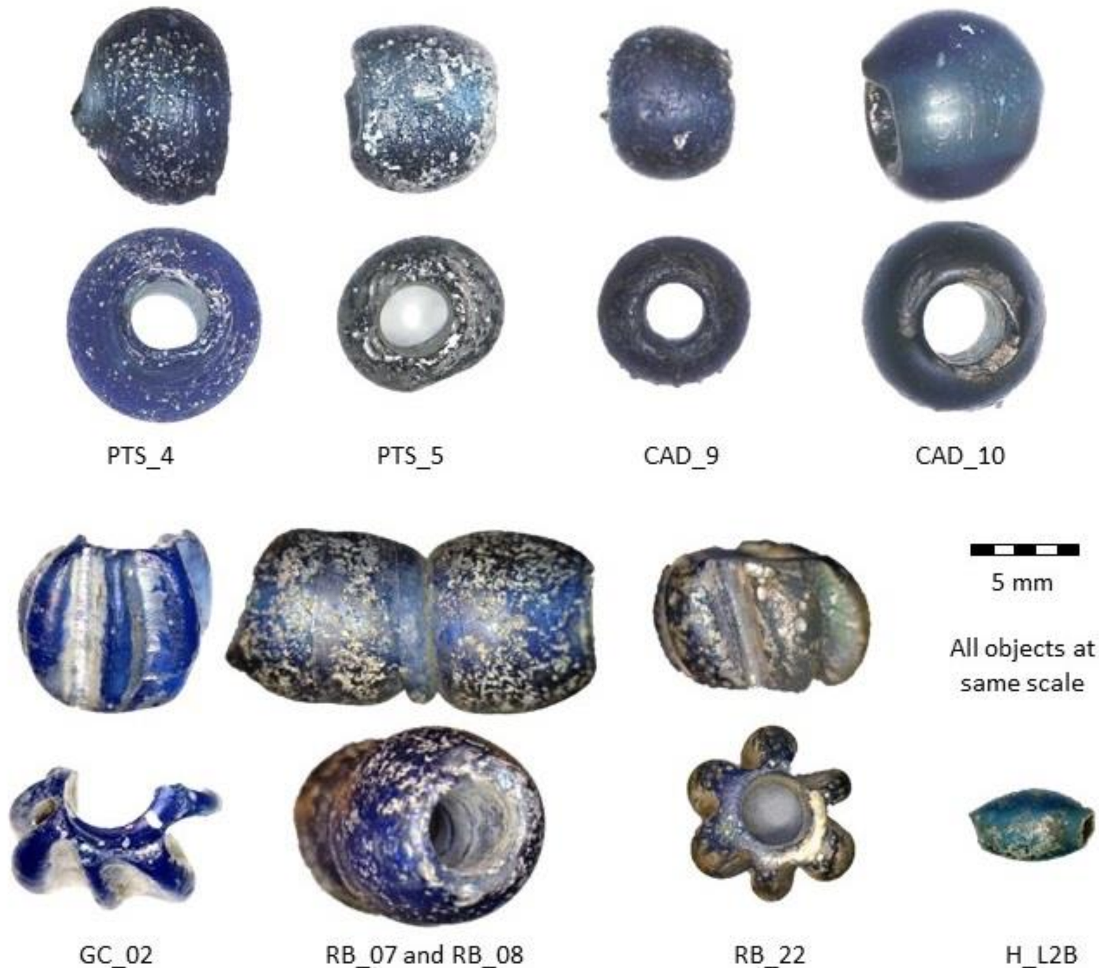


Figure 5.21: Profile and plan views of K_2O beads, H_L2B shown in profile only

None of the high K beads in my study are the simple drawn seed-bead types; several were identified as wound types, possibly indicating that wood-ash glass or potash-glass may have been favored for the larger or more labor-intensive beads (Figure 5.21). This is consistent with Karklins' earlier finding that potash-glass was preferred over soda-lime glass for wound beads because it would have been more plastic and easier to work with as it cooled during the winding or lampworking process (Karklins 1983:116). The possible wood-ash glass samples in the present study all come from sites in Wisconsin and northern Michigan with early but unconfirmed dates in the early to mid-seventeenth century. However, the surface-collected assemblages of Red Banks and Point Sauble might include artifacts deposited later as well, so wood-ash beads cannot be considered temporally diagnostic in this study.

The eight high K, Co-colored samples are distinctive in a scatterplot of K_2O versus NaO for all Co-colored beads, including the both non-wood plant-ash and wood-ash types (Figure 5.22). The Cu-colored oval-shaped bead from Hanson (H_L2B) may be better classified as potash-lime-soda glass rather than wood-ash glass, as it contains less K_2O and more Na_2O than others in the wood ash group. H_L2B and one Co-colored melon-shaped bead from the Red Banks site (RB_22) both contain moderate Zn to high Zn levels. The high Zn in bead H_L2B from Hanson (Zn = 3124 ppm) is much lower than beads in the Cu-colored high Zn subgroup from that site (mean 6503 ppm). The Zn level in RB_22 is much higher (8422 ppm), the highest level of Zn recorded for any bead in the full dataset. However, this bead was not colored with copper, as CuO is only 0.45%. The role of Zn in this recipe is unknown, but it does not follow the pattern of correlation between Cu and Zn observed in the high-Zn Cu-colored beads discussed previously in Section 5.2.3.

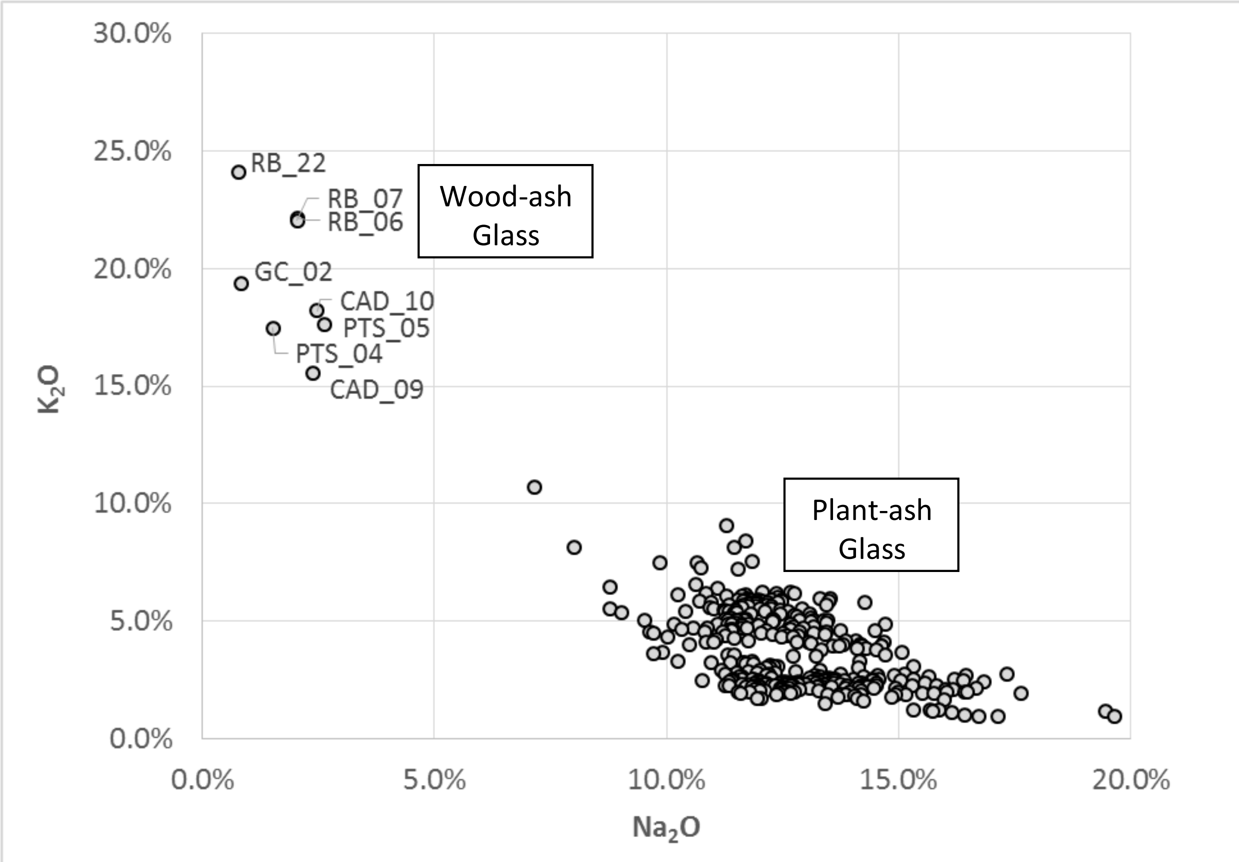


Figure 5.22: Scatterplot illustrating the distinctive wood-ash glass samples compared with soda-lime (non-wood plant-ash) glass bead samples that dominate the study. Note that the difference between high and low K beads, which corresponds to Mg-low-P-low-K and K+P-low-Mg subgroups, is visible within the plant-ash glass sample cluster.

5.2.6.2 Moderate to High Lead Blue Beads

Six blue beads containing moderate to high amounts of Pb, in some cases along with other ingredients, are distinct from most other beads in the dataset, as well as from one another. Other beads with moderate to low Pb levels (PbO 1-5%) are discussed as outliers in the Cu-colored and Co-colored bead sections above (5.2.1, 5.2.2, and 5.2.3), but the leaded beads presented in this section on miscellaneous glass recipes are the slightly larger, wound types (Figure 5.23) that were not the primary focus of this research project. The translucent blue glass used for these beads seemed visually similar to that of beads in the more common categories, and therefore to better understand variation among glass recipes and bead types, these samples were included in the LA-ICP-MS study. Diagnostic elements distinguish the leaded beads (Table 5.9).

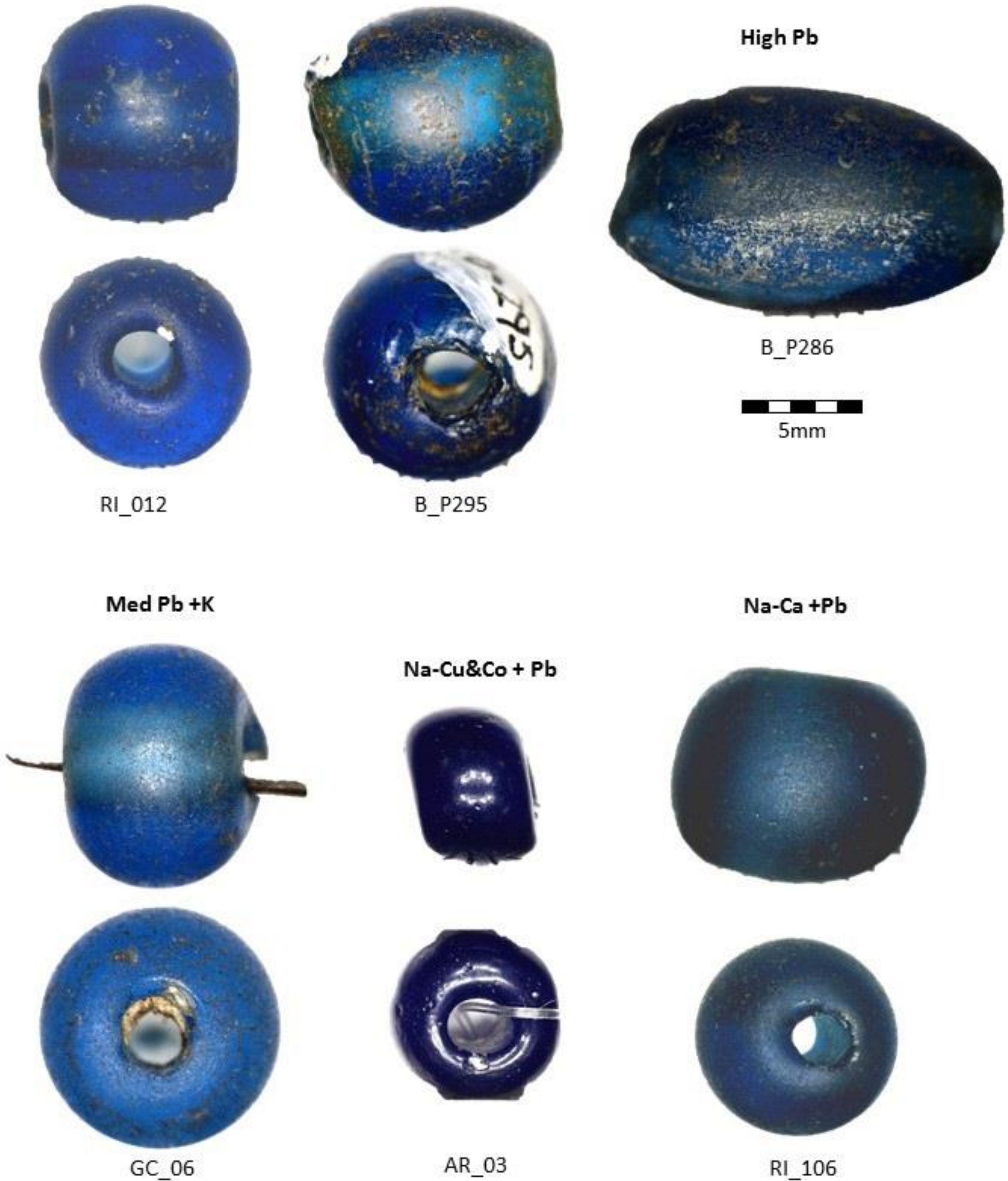


Figure 5.23: Leaded blue glass beads in profile and plan views

Table 5.9: Leaded glass bead summary table; full typological descriptions and compositional analysis results presented in Appendices B and C.

Sample ID	Weight Percent of Oxides for Major Elements										
	SiO_2	**Na_2O**	**MgO**	**Al_2O_3**	**P_2O_5**	**K_2O**	**CaO**	**MnO**	**Fe_2O_3**	**CuO**	**PbO_2**
High Pb											
RI_012	37.4%	0.6%	0.2%	0.4%	0.1%	7.2%	0.8%	0.0%	0.1%	0.8%	51.9%
B_P295	41.0%	0.8%	0.3%	0.5%	0.1%	7.7%	1.1%	0.0%	0.2%	1.0%	46.8%
B_P286	42.4%	0.5%	0.2%	0.5%	0.1%	8.4%	0.8%	0.0%	0.2%	0.8%	45.8%
Med Pb + K											
GC_06	60.7%	0.5%	0.2%	0.5%	0.1%	14.8%	0.7%	0.0%	0.2%	1.3%	20.1%
Na-Cu & Co + Pb											
AR_03	65.3%	17.2%	0.1%	3.8%	0.0%	3.0%	4.6%	0.2%	0.3%	1.7%	2.3%
Na-Ca +Pb											
RI_106	61.9%	6.9%	1.9%	1.1%	0.2%	7.4%	7.5%	0.2%	0.5%	1.4%	9.8%
	Trace Elements in Parts Per Million										
	Sn	**Ti**	**Co**	**Zn**	**As**	**Sr**	**Zr**	**Sb**	**Ba**		
High Pb											
RI_012	5	101	23	2119	41	44	40	439	39		
B_P295	9	67	3	2582	34	54	45	517	58		
B_P286	7	67	21	1867	49	34	42	358	42		
Med Pb + K											
GC_06	9	393	2	4512	5	32	64	1521	29		
Na-Cu & Co + Pb											
AR_03	211	131	2210	331	1762	53	22	6943	365		
Na-Ca +Pb											
RI_106	7	87	15	4766	54	327	42	415	112		

The blue glass used to produce the moderate to high Pb wound blue glass beads is visually similar in color and transparency to Co-colored glass used for drawn beads, yet the wound beads are highly distinct in compositional analyses. Three of the wound beads are very high in Pb (>45.0%) and have the lowest levels of silica (Si) in the bead dataset (SiO_2 = 37.5 to 42.5%). Another bead, GC_06, is distinguished by K_2O comparable with potash glass, but a with a Pb level of 20.1%, it does not fit into any high K subgroups. The AR_03 bead from the Arrowsmith site also has a unique glass recipe in the study dataset, containing both Co and Cu as colorants, with very high Na_2O (17.2%) and some Pb (2.3%). The RI_106 bead is considered soda-lime-leaded (Na+Ca+Pb) glass and it is likewise dissimilar to all other glass recipes in this study. These major glass recipe differences are not evident in visual examination, and if the distinctive striations that result from winding glass around a mandrel were obscured by corrosion or missed under poor lighting conditions, the leaded wound beads could easily be mistaken for slightly larger versions of beads in drawn bead categories or types, causing further typological confusion within the Kidd and Kidd system.

It is not possible to identify the temporal affiliation or Old World provenience of the unique wound, leaded beads based on their compositions because there are few comparative compositional samples of leaded glass beads. NAA glass bead studies undertaken during the 1990s and 2000s were unable to record Pb levels directly without using levels of radiation that would make artifacts unreturnable to museums. However, Karklins reported on three high-Pb Dutch beads in his 1980s energy dispersive x-ray fluorescence (EDX) study (Karklins 1983). The Dutch beads Karklins analyzed are compositionally most similar to the high-Pb group identified here, although the typological categories of the leaded beads differ, and there are no close chemical matches to the leaded beads analyzed from the Upper Great Lakes sites.

5.2.6.3 Antimony Opacified Cored Blue and White Beads

Sb-opacified cored blue and white beads are a unique type identified only from *La Belle* but not the Fort St. Louis colony, and not identified in any of the Upper Great Lakes glass bead assemblages. The presence of this type on *La Belle*, but not at any sites where La Salle is thought to have reached in the Upper Great Lakes might mean that *La Belle* was stocked with beads of different types or from different workshops than those La Salle used to stock his ships for earlier expeditions. Since the Sb-opacified cored blue and white beads are only found on *La Belle*, I present further discussion and interpretation of these artifacts in Appendix D.

5.2.6.4 Soda-Lime Colorless Beads

Figure 5.24: Representative image of a colorless soda-lime tubular bead. Scale in mm.

Five drawn, tubular, pale yellow or colorless beads from the Hanson site were analyzed prior to repatriation of the ancestral remains and associated grave goods from that site. The pale yellow color of these unique beads does not appear to come from any particular ingredient detected in the glass recipe. No colorants (Co, Cu, Mn) or opacifiers (Sb, Sn, As, or Pb) are present in quantities high enough to affect the visual appearance of the beads. The coloration may reflect the base glass or it may be a result of soil staining or other depositional processes. The base glass is a standard soda-lime-silica glass similar to that used in the majority of other drawn bead examined in this study (Na_2O = 13.1% +/- 1%; K_2O = 4.8% +/- .5%; CaO 8.5% +/- .3%). No beads that are typologically or compositionally similar to the Hanson site tubular translucent beads have been identified in the Upper Great Lakes study sample or in searches of comparable published glass bead assemblages from North America.

5.2.7 Summary of chronological relationships of glass recipe compositional groups

In Section 5.2, I defined glass recipes subgroups based on variation in diagnostic elements that indicate shifts in ingredients and proportions of ingredients in European glass workshops producing trade beads. For Co-colored and Cu-colored blue glass beads, known occupation dates for archaeological contexts of beads match patterns in elemental values that correspond to base glass ingredients, Mg, P, K, and Ca; opacifiers, Sn and Sb; and colorants, Co, Cu, and Zn (Table 5.10). These patterns reflect changes in European glass bead recipes over time, and also may relate to recipe differences among workshops (Dussubieux 2009; Hancock 2013). By identifying temporal relationships corresponding to the recipe patterns, the LA-ICP-MS glass bead data collected from Upper Great Lakes sites provide a new way for archaeologists to date other sites in this region where glass beads are present but temporal affiliations are lacking or to verify dates obtained from documentary evidence and other dating methods. The identified glass recipe patterns and compositional subgroups are also useful for clarifying production processes for reworked glass pendants, as I will discuss in Section 5.3, and for tracing the exchange of glass beads and the movement of people in the historic-era Upper Great Lakes.

The most important temporal correlation to the glass bead subgroups is the Mg vs P distinction. In the present data set, beads that yielded P_2O_5 less than 0.5 % with higher MgO (> 1.5 – 2.0 % depending on bead style) came from sites that generally predate A.D. 1700, while beads with P_2O_5 greater than 0.5% with lower MgO (< 1.5 %) came from sites occupied after A.D. 1700. At the well-dated Rock Island site, stratigraphic levels of the Period 3 Potawatomi occupation have been subdivided into Period 3a, from ca. A.D. 1670 to 1700, and Period 3b, from ca. A.D. 1700 to 1730 (Mason 1986). This temporal subdivision corresponds with variation in Mg and P levels in blue beads from each layer, supporting the use of the year A.D. 1700 as the approximate time of glass recipe shift. The shift in Mg and P concentrations could result from a change in the kinds of plants used to produce plant ash, or the way the plant ash was prepared (Henderson 2013:22-42; Moretti and Hreglich 2013). The shift from Mg-low-P to P-low-Mg corresponds directly to the dates of occupation for each of the archaeological sites in the study. To illustrate this pattern, I have enumerated beads from all of the Cu-colored and Co-colored subgroups, sorted according to archaeological provenience and whether they fall into the Mg-low-P or the P-low-Mg subgroups (Table 5.11).

In the next section (5.3) I compare the chemical compositions of refired glass pendants to subgroups identified in glass beads, in order to investigate if glass pendants were produced using beads of the same types available at archaeological sites where pendants were found. I also discuss additional artifact evidence for pendant production processes and experimentation with heating and reforming glass that may have taken place in the historic-era Upper Great Lakes.

Table 5.10: Summary of identified temporal ranges for glass subgroups

	Est. temporal range (AD)	Subgroup	Diagnostic elements (mean values in oxides or ppm)	Sites or components that define the date range
Co-colored (Section 5.2.1)	Pre-1670?	Sn > 350	Sn = 1600 +/- 1800 ppm Co = 1100 +/- 390 ppm	Farley Village, Goose Lake Outlet #3, Hanson, Red Banks
	Pre-1700	Mg-low-P	MgO = 3.4% +/- .4; P_2O_5 = 0.3% +/- .1	Rock Island Pd. 3a; Marquette Mission; Cloudman; Zimmerman
	Pre-1700?	Mg-low-P	Co = 700 +/- 290 ppm	Rock Island Pd. 3a; Marquette Mission; Cloudman; Zimmerman
	Post-1700	P-low-Mg	MgO = 1.7 +/- .3; P_2O_5 = 0.7% +/- .1	Rock Island Pd. 3b & 4, Ft. Michilimackinac; Doty Is. Mahler
	Post-1700?	P-low-Mg	Co = 600 +/- 140 ppm	Rock Island Pd. 3b & 4, Ft. Michilimackinac; Doty Is. Mahler
	Post-1760?	Med-P	P_2O_5 = 1.7% +/- .3; Co = 620 +/- 120 ppm	Doty Island Village; post Rock Island Pd. 4 (c. 1760)
Co+Sb-opacified (Section 5.2.2)	Post-1660s	All Co+Sb	Sb = 18000 +/- 6660 ppm (all Sb > 6000 ppm)	Zimmerman, Iliniwek Village, Marquette Mission
	Pre-1700	Sn + Pb	Sn =9300 +/- 65 ppm	Zimmerman, Marquette Mission
	Pre-1700	Mg-low-P	MgO = 3.5% +/- .3; P_2O_5 = 0.3% +/- .03	Rock Island Pd. 3a; Iliniwek Vil.; Marquette Mission; Zimmerman
	Pre-1700?	Mg-low-P	Co = 770 +/- 220 ppm	Rock Island Pd. 3a; Iliniwek Vil.; Marquette Mission; Zimmerman
	Post-1700	P-low-Mg	MgO = 1.9 +/- .3; P_2O_5 = 0.7% +/- .1	Rock Island Pd. 3b & 4, Ft. Michilimackinac; Doty Is. Mahler
	Post-1700?	P-low-Mg	Co = 500 +/- 230 ppm	Rock Island Pd. 3b & 4, Ft. Michilimackinac; Doty Is. Mahler
	Post-1760?	Med-P	P_2O_5 = 1.5% +/- .3; Co = 330 +/- 85	Doty Island Village; post Rock Island Pd. 4 (c. 1760)
Cu-colored (Section 5.3.2)	Pre-1670	Mg-low-P-low Ca	CaO = 5.5% +/- 1.0	Rock Island Pd. 1, Hanson, New Lenox
	Post-1670	Mg-low-P + Ca	CaO = 8.9% +/- .5	Marquette Mission, Zimmerman, Bell
	Pre-1700, Pre-1670?	Sn + Zn	Sn = 7900 +/- 3200 ppm; Zn = 3500 +/- 780 ppm	Goose Lake Outlet #3, Iliniwek Village, Cadotte
	Pre-1700	Zn	Zn = 4000 +/- 1080 ppm	Marquette Mission; Iliniwek Vil.
	Pre-1700	Mg-low-P	MgO = 2.3% +/- .4; P_2O_5 = 0.2% +/- .1	Rock Island Pd. 3a; Iliniwek Vil.; Marquette Mission; Zimmerman
	Post-1700	P-low-Mg	MgO = 1.4 +/- .1; P_2O_5 = 0.8% +/- .2	Rock Island Pd. 3b & 4, Ft. Michilimackinac; Doty Is. Mahler
	Post-1760?	Med-P	P_2O_5 = 1.5% +/- .1;	Doty Island Village; post Rock Island Pd. 4 (c. 1760)

Table 5.11: Summary table soda-lime glass beads in Mg-low-P and P-low-Mg subgroups, in rough chronological order of site occupation (from published dates or suggestions from excavators)

Sites	Est. dates of occupation (AD)	Mg-low-P (Pre-1700)			P-low-Mg (Post 1700)		
		Co-colored	Co +Sb	Cu-colored	Co-colored	Co +Sb	Cu-colored
Goose Lake Outlet #3	c. 1630-1650	3	0	10	0	0	0
New Lenox	c. 1630-1660	5	0	7	0	0	0
Iliniwek Village	c. 1640-1683	21	15	34	0	0	0
Hanson	c. 1650-1680	9	0	8	0	0	0
Zimmerman	c. 1650-1690	12	18	27	0	0	0
Cloudman	Early 17th C?	16	0	0	0	0	0
Clunie	Early 17th C?	0	0	1	0	0	0
Gillett Grove	Early-mid 17th C?	2	1	8	0	0	0
Wanampito	Early-mid 17th C?	0	0	1	0	0	0
Milford	Early-mid 17th C?	5	0	0	0	0	0
Red Banks	17th -18th C?	9	0	9	0	0	0
Peshtigo Point	17th -18th C?	0	0	11	0	0	0
Point Sauble	17th -18th C?	0	0	2	0	0	0
Chautauqua Grounds	17th -18th C?	0	0	4	0	0	0
Farley Village	Mid-late 17th C?	3	0	0	0	0	0
Cadotte	Mid-late 17th C?	1	0	4	0	0	1
Mormon Print Shop	Mid-late 17th C?	1	0	2	0	0	0
Rock Island Pd. 1-3a	c. 1650-1700	11	4	4	1	0	4
Markman	c. 1665-1680	0	0	1	0	0	0
Carcajou Point	17th – 18th C?	1	0	0	0	0	0
La Belle Shipwreck	1683-1686	53	8	1	1	1	1
Mormon Print Shop	Mid-late 17th C?	1	0	2	0	0	0
Gros Cap	Mid-late 17th C?	2	0	1	0	0	0
Norge Village	17th – 18th C?	0	0	1	0	0	0
Marquette Mission	c. 1670 – 1701	46	15	54	0	0	0
Chickadee	c.1670-1730	1	2	6	0	0	0
Bell	c. 1680 - 1730	12	0	8	14	0	0
Doty Island	c. 1680 - 1780	5	1	2	45	10	11
Fort St. Joseph	c.1691-1781	6	0	2	15	5	17
Rock Island Pd. 3b - 4	c. 1700-1760	14	0	3	27	6	40
Marina	c.1715-1775	2	0	3	2	0	8
Fort Michilimackinac	c. 1715-1781	2	0	0	24	7	25
Arrowsmith	c. 1730	1	0	1	0	0	0
TOTALS		244	64	217	129	29	107

5.3 Analyses of reworked pendants – data and interpretations

During the seventeenth and early eighteenth centuries in the North American Upper Great Lakes region, interactions among diverse peoples were manifested in the exchange of European-made items such as copper and brass kettles, glass trade beads, cloth, firearms, and other commodities. Indigenous people often treated these items as “raw materials” that could be transformed by applying existing and innovative technological practices (Bradley 1987; Ehrhardt 2005; Turgeon 1997). Glass trade beads, which were produced in European workshops in Amsterdam, Venice, Paris, and elsewhere (Dussubieux 2009), also sometimes served as raw material for ornament production (Walder 2013a). Archaeologists have identified small glass pendants apparently made of reworked European trade beads in historic-era assemblages from archaeological sites across the Plains and Midwest regions of North America (Brown 1972; Ubelaker and Bass 1970). Most complete pendants from the Upper Great Lakes region are trapezoidal in shape, opaque, and either solid turquoise blue or striped blue and white.

The origin of the glass reworking technology has been a point of debate (Brown 1972; Ubelaker and Bass 1970) but remains unclear. With available evidence, it is not possible to determine if the knowledge of remelting glass was developed indigenously or introduced by Europeans along with the beads themselves. Ethnohistoric and archaeological evidence places production in the Plains region at least as early as 1730 (Brown 1972). Refired glass fragments from the Zimmerman site, dated to the mid-late seventeenth century in Illinois, and the roughly contemporary Gillette Grove site in northwest Iowa show that this technology was present across the region earlier than Brown’s estimate, but this does not clarify if the technology developed in the Plains and spread eastward or vice versa. More investigation of production waste and other evidence of pendant manufacture in the Great Lakes region could clarify this question.

In a previous ethnohistoric and archaeological study, it was suggested that Plains peoples, particularly the Arikara who lived along the Missouri River, specialized in a process of powdering, reshaping, and heating glass re-formed glass on metal pans to make trapezoidal blue glass pendants (Ubelaker and Bass 1970). Archaeologists then argued that peoples of the Plains then traded the finished pendants eastward into the Midwest through down-the-line exchanges along the Mississippi River and its tributaries (Brown 1972; Howard 1972). Local production in the Great Lakes was not proposed. In the course of my research I tested the assumption that only Plains peoples produced refired glass pendants by searching for evidence of on-site pendant production at locations in Wisconsin and Michigan. To do this, I compared the chemical composition of refired glass pendants and fragments to the compositions of glass beads from sites in the Upper Great Lakes region in order to identify specific types of blue glass trade beads that could have been used to produce the pendants. I also searched for possible tools or waste from pendant production in assemblages of copper-based metal from archaeological sites where glass pendants had also been recovered. Based on my findings of chemical similarities between glass beads and refired glass artifacts, and probable glass residue adhering to several metal fragments, I have argued that on-site glass pendant production took place in the Upper Great Lakes region in at least one location, the Rock Island site (Walder 2013a).

In this section, I present the complete findings of my glass pendant analysis, which consisted of 35 LA-ICP-MS samples from 27 pendants and refired glass fragments recovered from eight different archaeological sites in the research area (Table 5.12). I compare the composition of the refired pendants to the glass bead recipe compositional subgroups identified in section 5.2 of this chapter in order to identify similarities and differences in the glass recipes of beads and pendants and assess the possibility of pendant production in the Upper Great Lakes.

Table 5.12: Summary of pendants and refired glass fragments possibly from pendants

Sample ID	Site	Key elements and subgroups	Description
CM_71	Ft. Michilimackinac	Co; P-low-Mg	Striped blue & white trapezoidal fragment (blue portion)
CM_72	Ft. Michilimackinac	Sb; P-low-Mg	Striped blue & white trapezoidal fragment (white portion)
CM_73	Ft. Michilimackinac	Cu; P-low-Mg	Solid turquoise blue trapezoid, point A
CM_74	Ft. Michilimackinac	Cu; P-low-Mg	Solid turquoise blue trapezoid, point B
CM_75	Ft. Michilimackinac	Cu; P-low-Mg	Solid turquoise blue iridescent fragment
CM_76	Ft. Michilimackinac	Co; P-low-Mg	Striped turquoise & white pendant (blue portion)
CM_77	Ft. Michilimackinac	Mg-low-P (no opacifier)	Striped turquoise & white pendant (white portion)
GG_01	Gillett Grove	Cu; Mg-low-P; Sn-Pb-Zn	Striped (?) blue & lt. blue fragment (blue portion)
GG_02	Gillett Grove	Cu; Mg-low-P	Striped (?) blue & lt. blue fragment (lt. blue portion)
GG_03	Gillett Grove	Cu; Mg-low-P; Sn-Pb-Zn	Solid blue irregularly-shaped fragment
GG_04	Gillett Grove	Cu; Mg-low-P;	Solid light blue irregularly shaped fragment
GG_17	Gillett Grove	Cu; Mg-low-P; Zn	Solid turquoise blue, irregular, pendant or bead fragment
GC_04	Gros Cap	Cu; Mg-low-P; Sn-Pb-Zn	Solid blue trapezoidal pendant fragment
GC_05	Gros Cap	Cu; Mg-low-P; Pb-Sn-Sb	Solid turquoise bead or pendant fragment with metal (?) adhering
MA_13	Marina (La Pointe)	Cu; Mg-low-P	Solid blue trapezoidal pendant
MA_14	Marina (La Pointe)	Cu; Mg-low-P	Solid blue trapezoidal pendant
M_24	Doty Island (Mahler)	Cu; Mg-low-P	Solid blue geometric fragment
MM_025	Marquette Mission	Cu; Mg-low-P	Solid turquoise trapezoidal or triangular pendant
MM_026	Marquette Mission	Cu; Mg-low-P; Pb-Sn-Sb	Solid turquoise trapezoidal or triangular pendant
MM_027	Marquette Mission	Cu; Mg-low-P; Zn	Solid turquoise trapezoidal or triangular pendant
MM_028	Marquette Mission	Cu; Mg-low-P; Zn	Solid turquoise rounded trapezoidal pendant
RI_023	Rock Island 3 or 4	Cu; P-low-Mg	Striped turquoise & white pendant fragment (blue portion)
RI_024	Rock Island 3 or 4	Co; P-low-Mg	Striped blue & white pendant fragment (blue portion)
RI_025	Rock Island 3 or 4	Sb; P-low-Mg	Striped turquoise & white pendant fragment (white portion)
RI_026	Rock Island 3 or 4	Sb; P-low Mg	Striped blue & white pendant fragment (white portion)
RI_027	Rock Island 4	Cu; P-low M	Solid iridescent blue fragment, point A
RI_028	Rock Island 4	Cu; P-low Mg	Solid iridescent blue fragment, point B
ZM_01	Zimmerman	Cu; Mg-low-P	Solid blue irregularly-shaped fragment
ZM_02	Zimmerman	Cu; Mg-low-P; Sn-Pb-Zn	Solid blue irregularly-shaped fragment
ZM_03	Zimmerman	Cu; Mg-low-P	Solid blue irregularly-shaped fragment with metal (?) adhering
ZM_04	Zimmerman	Cu; Mg-low-P; Sn-Pb-Zn	Solid blue irregularly-shaped fragment
ZM_05	Zimmerman	Cu; Mg-low-P	Solid blue irregularly-shaped fragment
ZM_06	Zimmerman	Cu; Mg-low-P	Solid blue irregularly-shaped fragment
ZM_07	Zimmerman	Cu; Mg-low-P; Sn-Pb-Zn	Striped (?) blue & lt. blue fragment (lt. blue portion)
ZM_08	Zimmerman	Cu; Mg-low-P	Striped (?) blue & lt. blue fragment (blue portion)

As described in ethnohistoric records, including an account from Meriwether Louis dated to c. AD 1805 (Thwaites 1905), the glass pendant production process used by Plains peoples required grinding beads to a powder, re-shaping the powder mixed with water into the appropriate shape, and heating the pendants in an open fire on metal or clay pans until fused (Gilmore 1924; Thwaites 1905:272-274; Wied et al. 1843 [as cited in Ubelaker and Bass 1970]). In efforts to replicate this process, Ubelaker and Bass completely fused a re-formed powdered glass paste at a temperature of about 1500°C by using a modern kiln (1970:472-473), but their study does not take into account range of temperatures and heating conditions of an open fire, which might result in only partial glass melting. Glass will sinter or partially fuse at approximately 650 to 800°C in a process known as fritting (Miller 2007:137), and this could be achieved in an open fire without the need for a kiln or glass furnace. No matter what firing temperature was used to fuse glass pendants, the initial step of powdering the glass beads and reforming them into pendants would effectively homogenize the original glass recipes of whatever European bead types were used as raw material, resulting in pendants with a chemical composition that may not closely match any particular bead compositional subgroups.

Evidence from visual examination of refired glass artifacts supports the production method of low-temperature fusion of powdered glass on metal firing-pans. Prior to LA-ICP-MS analysis, each pendant or refired fragment was documented on the obverse, reverse and in close-up, using a Dinolite digital microscope. When pendants are magnified, grains of ground glass appear to be incompletely fritted together rather than fully melted; this is especially visible at the interface of different colors of glass in striped pendants (Figure 5.25). Furthermore, some pendant fragments appear to have metal adhering to their surfaces (Figure 5.26), and metal with probable glass residue on it was identified (Figure 5.27).

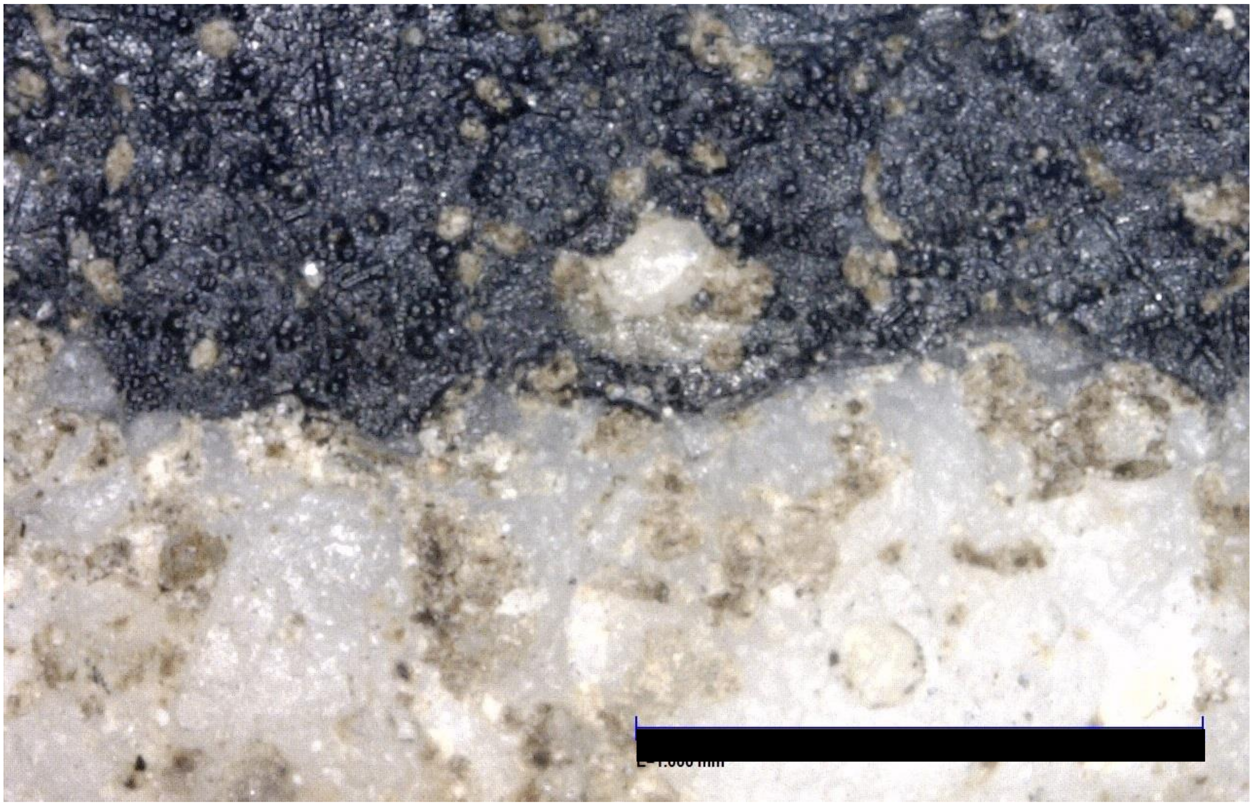


Figure 5.25: Interface between blue and white glass stripes of a glass pendant, showing grains of glass, heated until it fritted or sintered until it fused but did not fully melt.. Scale bar = 1 mm.

Figure 5.26: Pendant fragment from the Gros Cap site (GC_05) with possible metal adhering

The possible metal "firing pan" (Figure 5.27) and several pieces of metal with a blue substance adhering were identified during the reworked copper-based metals analyses of materials from the Rock Island site (see Chapter 6). These metal artifacts with blue residue are associated with an Odawa house structure dated c. 1760, a context from which two refired glass pendant fragments also were recovered. The blue residue has sand grains stuck to it, and there is a trapezoidal discoloration that might result from differential cooling of a hot pendant on the metal surface. The compositions of the presumed glass material adhering to the metal "pan" (artifact ID HW-02301) and the metallic substance adhering to the Gros Cap pendant fragment (GC_05) have not yet been verified using archaeometric methods. Both discoveries were made late in the course of the research project, and verification would require the use of SEM-EDS, which was not available to me at that point and would have been beyond the scope of funded analyses approved for this project. Metal artifacts with possible glass residue and pendants with adhering metal will be prioritized for future archaeometric research.

Several physical characteristics of the pendants themselves provide indications of their production methods. The pendants are generally very flat on one side (when present, this is the side with metal adhering) and have rounded edges on the obverse (Figure 5.28). This shape would result from the heating of a glass paste, which would hold together with the surface tension of the glass on the side not in contact with the metal pan, producing the rounded edge. Bubbles or other imperfections are present on the "back" of the pendant in Figure 5.28, where it would have been in contact with the pan, but none appear on the obverse surface. Not all refired glass fragments have such a distinctive edge shape, and different craftspeople may have had multiple methods to heat and solidify the glass paste. The heating methods used to produce refired glass pendants remain poorly understood and should be prioritized for future study.

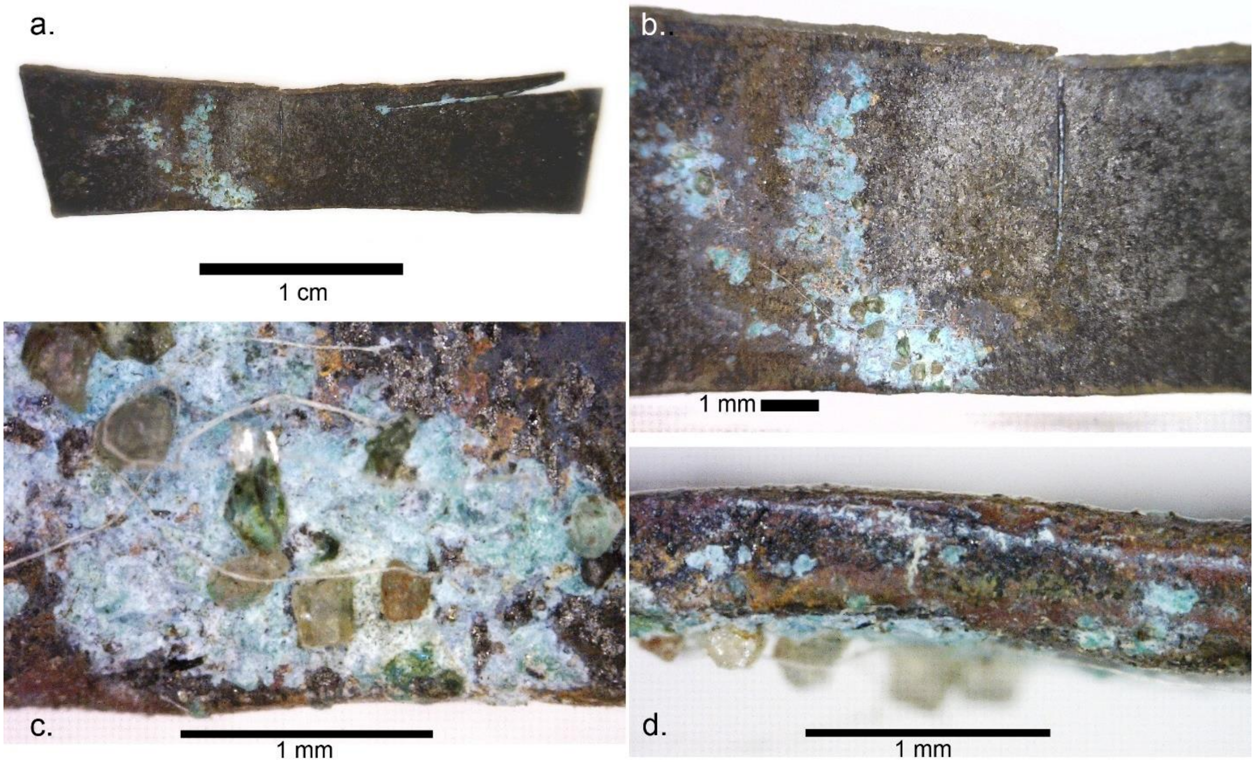


Figure 5.27: a) Metal artifact with blue glass adhering to the surface, possibly a "firing pan" for pendant production b) Trapezoidal discoloration, possibly resulting from glass heating on the metal surface; c) sand grains, possibly part of the production process, adhering to the glass and d) glass residue on the cut basal edge of the artifact

Figure 5.28: Pendant sampled in CM_73 and CM 74 illustrating the flat "back" of the pendant with bubbles or air pockets from heating, and the rounded profile of the object, which could result from partial melting or intentional shaping of the cooling glass paste.

If refired pendants were produced in some kind of kiln or furnace, complete melting of glass at temperatures above 1500°C would produce a homogeneous glass with the same composition throughout, but pendants heated at lower temperatures might have a more heterogeneous composition because glass particles from various bead types would be "stuck together" but not blended. If such a heterogeneous pendant were sampled with LA-ICP-MS, the result would only reflect the average composition of the artifact at the four adjacent individual laser ablation points sampled (Figure 4.3), not the composition of the pendant as a whole. To examine the heterogeneity of glass pendants, two tests were conducted with LA-ICP-MS. One Rock Island pendant fragment was sampled with LA-ICP-MS, using the standard four-point method, in two different area (RI_027 and RI_028); no major differences occurred between the results for the two samples. I applied the same technique for an artifact from Fort Michilimackinac (Figure 5.28) that is visually similar to refired glass pendants but was catalogued as a blue stone pendant in the site master database After testing this artifact in two areas, identified as samples CM_73 and CM_74, I found that the pendant was made of glass, and that results from the two areas were again comparable, although the Fort Michilimackinac artifact was slightly more heterogeneous than the Rock Island pendant fragment (Table 5.13).

Two analysis areas may not be sufficient to determine whether or not a refired glass fragment is heterogeneous in all cases, but since results were comparable in the Rock Island and Michilimackinac examples, I decided that it would be acceptable to use single LA-ICP-MS samples for all other pendants and refired fragments included in the study. Additional or repeated sampling would be cost-prohibitive and could potentially result in visible traces of the analysis process on the surface of artifacts. Since only one sample would be available for the majority of refired glass artifacts, I chose to use only samples RI_027 and CM_73, the first of the two samples taken for each artifact, as the representative compositional results of these artifacts for comparative statistical analysis between glass beads and refired glass objects. Using both samples would bias PCA results with "extra" refired artifacts, while an average of the two samples would create a new compositional signature in a way that is not consistent with the sampling method applied to all other glass artifacts in the study.

Table 5.13: Comparison of LA-ICP-MS results for relevant elements from sampling at two different points of refired glass artifacts from Rock Island and Fort Michilimackinac

	Major elements (weight percent of oxides)							
Sample ID	**SiO_2**	**Na_2O**	**MgO**	**Al_2O_3**	**P_2O_5**	**K_2O**	**CaO**	**CuO**
RI_027	68.7%	13.0%	1.2%	1.3%	0.7%	4.5%	7.7%	1.3%
RI_028	68.5%	13.3%	1.2%	1.2%	0.7%	4.5%	7.6%	1.2%
(+/-)	0.2%	0.2%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%
CM_73	69.7%	14.0%	1.4%	0.8%	1.0%	3.6%	7.3%	1.4%
CM_74	69.2%	15.1%	1.4%	0.8%	0.7%	3.9%	7.2%	1.1%
(+/-)	0.3%	0.8%	0.0%	0.0%	0.3%	0.2%	0.1%	0.2%

	Trace elements (parts per million)									
Sample ID	**Mn**	**Fe**	**Sn**	**Pb**	**Ti**	**Co**	**Zn**	**As**	**Sr**	**Sb**
RI_027	268	3513	35	76	154	34	53	69	608	311
RI_028	276	3815	34	82	160	33	54	57	617	314
(+/-)	5	214	1	4	4	1	1	8	6	2
CM_73	192	3732	182	399	140	56	78	116	567	412
CM_74	223	3419	31	50	164	58	79	91	644	71
(+/-)	22	221	107	247	17	1	1	18	54	241

The two-area sampling experiment demonstrated that there is some heterogeneity present in the composition of glass pendants. Furthermore, if glass beads of several different chemical subgroups were used as material for the same pendant, the composition of the pendant might not match any of the subgroups identified for glass beads. Despite the possibility that multiple types of blue beads of distinct chemical compositions might have been used to produce glass pendants, and the fact that LA-ICP-MS is a point-based analysis that might not detect heterogeneity within a single pendant, I attempted to determine if glass pendant compositions were similar to the chemical subgroups identified for glass beads present on the archaeological sites where glass pendants were recovered. To clarify the kind(s) of beads selected as raw material for pendant production, and in an attempt to account for the possibility that more than one glass bead type could have been used as raw material for a single pendant, I compared all 874 beads in the dissertation data set to all 27 pendants and refired glass fragments.

In the following sections, I discuss the chemical analysis results for glass pendants. LA-ICP-MS indicates that 28 samples owe their blue color to the presence of Cu in the beads that were used as raw material, while the blue color of three samples is due to Co. Three samples of white glass in pendants are Sb-opacified, while one contains no identifiable opacifier. For all refired glass samples, the pre-1700 Mg-low-P and post-1700 P-low-Mg temporal distinction identified in glass bead subgroups continues (Figure 5.29). As expected based on the somewhat heterogeneous and composite nature of the glass pendants, compositional samples from pendants did not closely fit glass bead compositional subgroups in all cases. Because I was working within relatively homogenous glass bead subgroups, I used the multivariate statistical methods of PCA and cluster analyses to explore patterns in the pendant compositional data and to identify elements responsible for variation and similarity between bead and pendant compositions. Since glass pendants are directly compared to colorant categories in order to determine their level of similarity to beads, discussion of refired glass samples proceeds by first by colorant category: Cu-colored, turquoise blue; Co-colored navy blue; and Sb-opacified or no opacifier, white; then by provenience and archaeological site. I also discuss high-Ca partially melted glass samples that might be results of experimentation with melting bottle glass. The full compositional results for each of the LA-ICP-MS samples from the refired glass artifacts, including the duplicate analyses conducted to test pendent homogeneity, are presented in Appendix C.

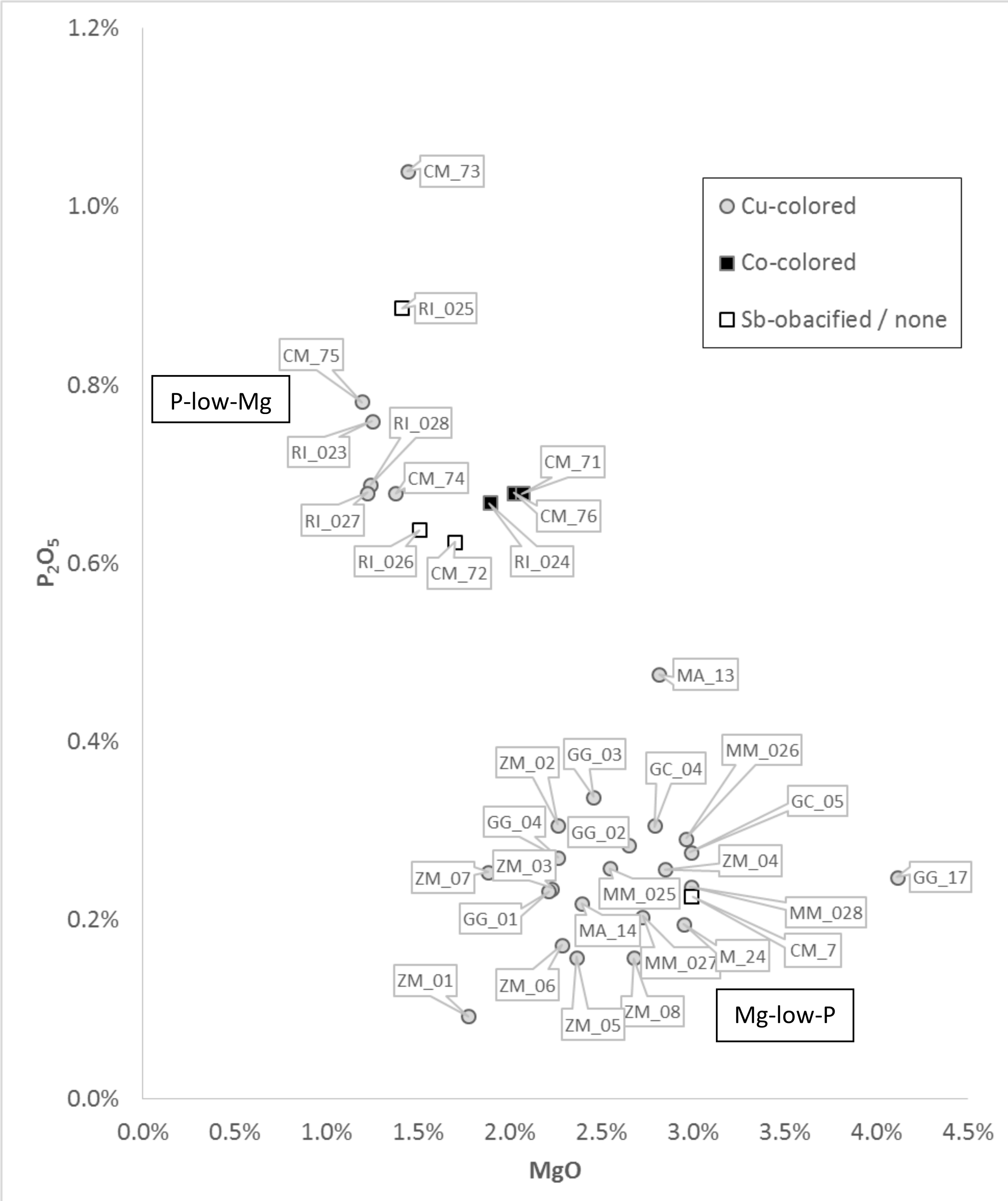


Figure 5.29: Mg vs P distinction for all LA-ICP-MS samples from refired glass pendants or fragments.. Samples are sorted by colorant category and labeled with Sample ID.

5.3.1 Cu-colored blue glass pendants or fragments

The 28 Cu-colored refired fragments fall into both the Mg-low-P and P-low-Mg subgroups (Figure 5.29). Six LA-ICP-MS samples of four artifacts from Rock Island and Fort Michilimackinac fit the post-1700 P-low-Mg pattern, while the remaining 22 samples of individual artifacts fall into the pre-1700 Mg-low-P group. This patterning is consistent with the previous interpretations of the dates of occupation for the find-spots of each of the pendants or pendant fragments. First, I compare Cu-colored P-low-Mg pendants to Cu-colored glass beads in that subgroup, and then I repeat the process with the Cu-colored Mg-low-P pendants and beads.

5.3.1.1 Cu-colored P-low-Mg pendants or fragments

The four pendants in the Cu-colored P-low-Mg subgroup are compositionally similar to the Cu-colored P-low-Mg beads (n=104) identified in section 5.2.3, Table 5.7. Two LA-ICP-MS samples each were taken from single pendants from Rock Island (RI_027 and RI_028) and Fort Michilimackinac (CM_73 and CM_74) in order to understand heterogeneity in pendant composition, but I only use one sample from each pendant when conducting statistical analyses. The two other Cu-colored P-low-Mg pendants also come from Rock Island (RI_23) and Michilimackinac (CM_75) (Figure 5.30).

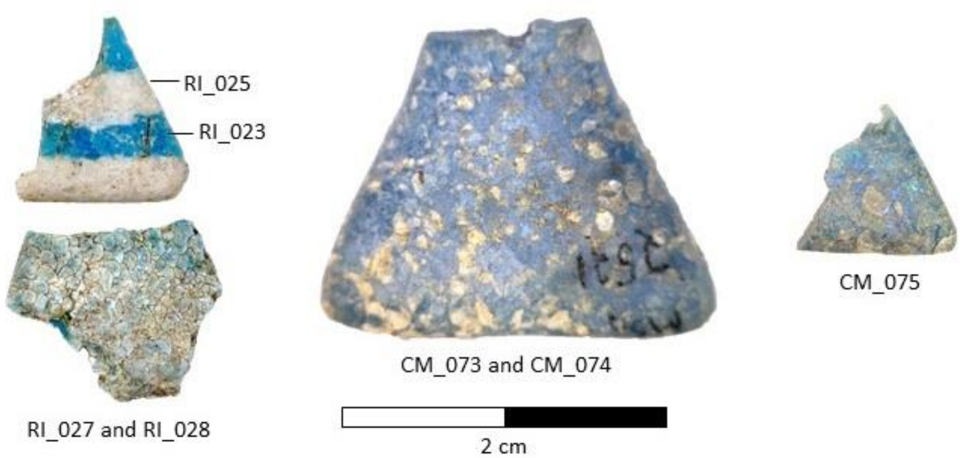


Figure 5.30: Cu-colored P-low-Mg pendants from Rock Island and Fort Michilimackinac

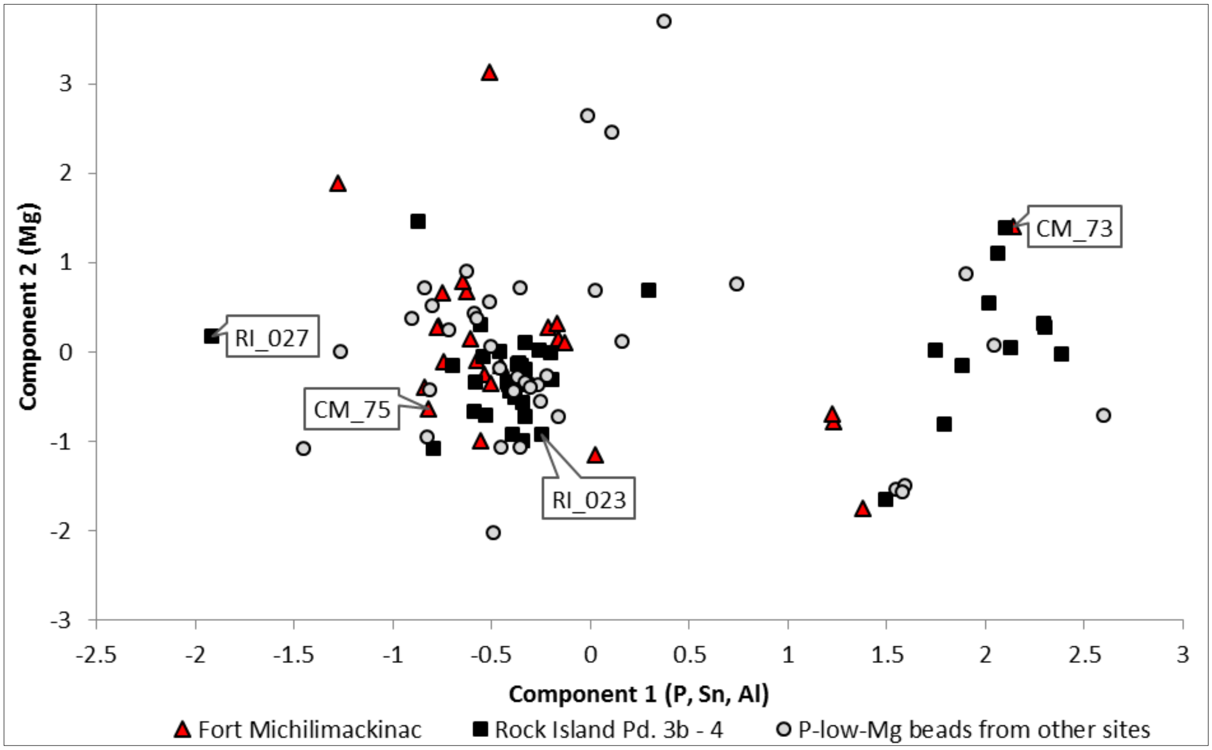


Figure 5.31: PCA of samples from four Cu-colored P-low-Mg pendants and 104 Cu-colored P-low-Mg beads, showing very close compositional similarity between pendantsRI_023, CM_75, and beads of the P-low-Mg subgroup, and less similarity for pendants CM_73 and RI_027.

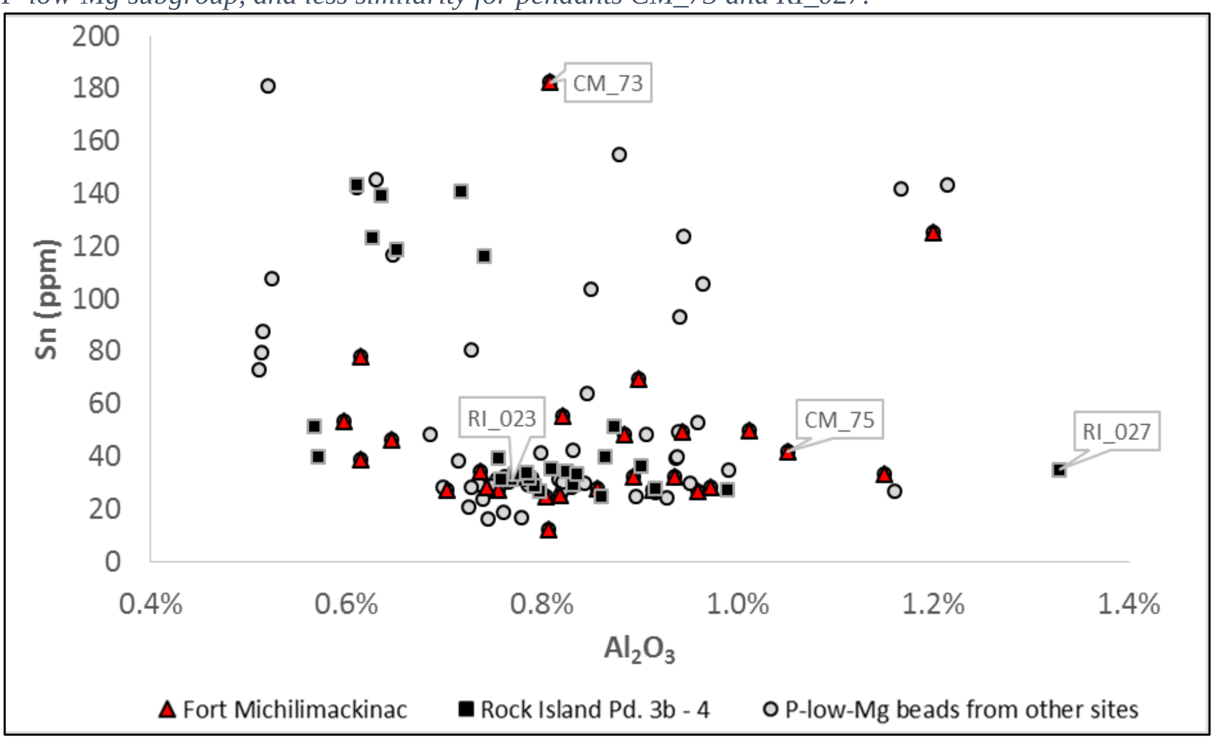


Figure 5.32: Biplot of Al and Sn for Cu-colored P-low-Mg beads and pendants, illustrating the similarity between some pendants and beads, as in Figure 5.31.

Table 5.14: Component matrix and Eigenvalues for PCA of Cu-colored P-low-Mg pendants and beads

Component Matrix			**Total Variance Explained**			
	Component			Initial Eigenvalues		
	1	2	Component	Total	% of Variance	Cumulative %
Al	-.700	.350	1	1.791	44.781	44.781
P	.886	-.133	2	1.069	26.728	71.509
Mg	.124	.895	3	.783	19.585	91.094
Sn	.708	.357	4	.356	8.906	100.000

To determine if beads from the same sites as the pendants were most similar to the compositions of pendants, or if glass compositions were relatively uniform across the regional landscape during the eighteenth century, I consulted bivariate scatterplots and conducted iterative PCA runs on the Cu-colored P-low-Mg beads and pendants (Baxter 1999; Hancock et al. 2008; Michelaki and Hancock 2011) following the same methods used to sort the glass beads into subgroups, as described in Chapter 4, section 4.2.3. The P-low-Mg bead subgroup is very homogenous, but PCA indicated that Al, P, Mg, and Sn were responsible for the most variation in the data set. Two components with Eigenvalues >1 explain 71.5% of the variation (Figure 5.31 and Table 5.14). Mg and P values contributed some variation, but since these had already been used to delineate the P-low-Mg subgroup, I plotted Al and Sn values for the Cu-colored P-low-Mg pendants and beads (Figure 5.32). Based on these analyses of the Cu-colored P-low-Mg pendant compositions, at least one pendant from each site is compositionally very similar to beads from the same site.

The RI_023 sample from the turquoise portion of a striped white and blue pendant from strata associated generally with Periods 3 and 4 at the Rock Island site, c. AD 1700 – 1760. PCA and bivariate scatterplot analyses demonstrate that the blue glass of this fragment is compositionally very similar to Co-colored P-low-Mg beads from that site. These beads are turquoise blue seed beads of type IIa31 (in Kidd and Kidd) recovered from Period 3b and 4. The

RI_027 sample from a visually more-heterogeneous-appearing blue pendant fragment less clearly matches beads from the same archaeological contexts. Higher than average levels of Al in this fragment make it somewhat distinct from Cu-colored P-low-Mg beads from Rock Island and from other sites in the Upper Great Lakes study sample.

Of the two Cu-colored P-low-Mg pendant samples from Fort Michilimackinac, CM_75 is the closest in composition to the Cu-colored P-low-Mg beads from that site. As at Rock Island, beads from Michilimackinac in this glass recipe subgroup are mainly classified as type IIa31. The CM_73 pendant is less similar in composition to the beads from Fort Michilimackinac because it contains slightly elevated levels of Sn. However, the Sn level of 182 ppm in the pendant is very low when compared to early, Sn-opacified bead types such as IIa40. It is possible that a small proportion of beads used as raw material for the CM_73 pendant were the earlier, Sn-opacified type.

In summary, beads made with glass that fits the post-1700 P-low-Mg chemical subgroup would have been readily available to craftspeople at Rock Island and Fort Michilimackinac, and the composition of all four Cu-colored P-low-Mg pendants corresponds well with the dates of the archaeological contexts from which pendants were recovered. There seems to have been little reliance on older bead types, such as IIa40 and related styles. The close similarity of the CM_75 pendant to Michilimackinac beads, and the RI_025 sample to Rock Island beads supports the possibility of on-site pendant production at these locations.

5.3.1.2 Cu-colored Mg-low-P pendants or fragments

The 22 Cu-colored Mg-low-P refired glass samples all come from sites with pre-AD-1700 components, which is consistent with the temporal affiliation of this glass subgroup. Mg-low-P glass fragments or pendants were identified from Marquette Mission (n=4), Gillett Grove (n=5), Zimmerman (n=8), Gros Cap (n=2), Marina (La Pointe; n=2) and the Doty Island Mahler site (n=1). Like beads in the Cu-colored Mg-low-P, these pendants are compositionally diverse; some refired pendants or fragments contain levels of Zn and Sn consistent with the Zn+Sn Cu-colored bead subgroups, while others fit the more general Mg-low-P group (Table 5.15). The varying levels of Sn and Zn indicate that the raw material for many of these pendants may have been a mixture of type IIa40 and type IIa31 beads. Subgroups in the IIa40 and the related types of beads sometimes known as "early blues" have lower Ca and greater levels of Sn, Zn, and sometimes Sb than the IIa31 beads. Based on levels of Zn, Sn, Sb, and Ca, I assigned each pendant or refired fragment to the closest bead subgroup identified in section 5.3.2, but the assignment of pendants to bead glass subgroups does not indicate that the pendant was made only from beads of that subgroup. Rather, pendants were assigned to the bead subgroup with the closest mean values based on Zn, Sn, Sb, and Ca (Figure 5.33).

I used PCA to explore the relationship between the Cu-colored Mg-low-P refired glass artifacts and beads with the Mg-low-P signature described in Section 5.2.3. Iterative runs of PCA first revealed compositional differences associated with Zn, Sn, Sb, and Ca, elements common in IIa40 type beads but not in type IIa31, which reinforced the validity of subgroups already identified with the bivariate method. Acknowledging that IIa31 beads may have been included in some pendants, I removed all IIa31 beads from the dataset and then used PCA to compare the Cu-colored Mg-low-P pendants only to IIa40 and related types, a total of 78 beads or bead fragments. A PCA run with Na, Mg, Sn, Zn, Sr, and Zr produced two factors with Eigenvalues greater than 1 that explained 78.6% of the variance in the dataset (Figure 5.34 and Table 5.16).

Table 5.15: Cu-colored Mg-low-P pendants compared with Cu-colored Mg-low-P bead subgroups

Sample/ Bead Subgroup ID	**Site / Bead Subgroup Mean**	**Na_2O**	**MgO**	**Al_2O_3**	**P_2O_5**	**K_2O**	**CaO**	**CuO**	**Sn**	**Pb**	**Ti**	**Zn**	**Sb**
Zn	Subgroup Mean (n=5)	12.0%	2.6%	1.0%	0.3%	6.2%	9.1%	1.3%	182	419	685	4043	76
MM_027	Marquette Mission	11.7%	2.7%	1.0%	0.2%	5.3%	7.0%	1.2%	7	229	558	3365	99
GG_17	Gillett Grove	15.1%	4.1%	0.8%	0.2%	2.3%	9.5%	1.3%	4	732	276	3401	880
Zn+Sn	Subgroup Mean (n=34)	13.7%	2.2%	1.1%	0.2%	6.6%	8.1%	1.2%	7939	7528	887	3496	167
GG_03	Gillett Grove	12.7%	2.5%	1.5%	0.3%	7.0%	8.1%	1.1%	16570	4811	408	2880	100
GG_01	Gillett Grove	16.0%	2.2%	1.4%	0.2%	4.8%	7.1%	1.5%	14562	6092	459	3792	10
ZM_07	Zimmerman	11.7%	1.9%	2.2%	0.3%	9.9%	7.4%	1.3%	13333	5981	1017	3984	6
ZM_04	Zimmerman	14.7%	2.8%	1.0%	0.3%	2.8%	10.6%	0.8%	11309	2826	821	2723	816
GG_04	Gillett Grove	12.8%	2.3%	1.0%	0.3%	6.0%	8.8%	1.1%	9081	5271	365	2908	8
ZM_02	Zimmerman	11.8%	2.3%	1.0%	0.3%	10.4%	9.2%	1.0%	9070	4912	808	3373	6
GC_04	Gros Cap	12.5%	2.8%	1.1%	0.3%	6.0%	8.6%	1.0%	7066	9309	571	2245	1593
GG_02	Gillett Grove	13.9%	2.7%	1.3%	0.3%	5.1%	8.5%	1.0%	6333	3773	391	2482	83
Med Zn+Sn	(no subgroup)												
MM_025	Marquette Mission	16.6%	2.5%	1.3%	0.3%	2.5%	6.8%	1.8%	790	676	215	268	175
Sb+Zn+Pb	(MM_024)	10.8%	2.9%	1.1%	0.2%	3.4%	7.6%	1.5%	12	13488	511	4763	20239
MM_026	Marquette Mission	10.1%	3.0%	1.1%	0.3%	3.6%	7.8%	1.4%	13	19372	525	4792	23759
GC_05	Gros Cap	7.9%	3.0%	1.1%	0.3%	7.8%	8.1%	1.3%	8	17945	549	5091	19995
Mg-low-P (IIa40 low CaO)	Subgroup Mean (n=25)	16.4%	1.8%	1.1%	0.2%	4.2%	5.4%	1.4%	421	794	135	71	25
ZM_01	Zimmerman	22.8%	1.8%	0.8%	0.1%	0.8%	4.8%	1.5%	200	384	140	30	114
ZM_06	Zimmerman	18.7%	2.3%	0.8%	0.2%	4.3%	5.5%	1.4%	33	193	145	24	149
ZM_03	Zimmerman	17.6%	2.2%	0.8%	0.2%	4.4%	5.6%	1.4%	36	314	169	29	159
ZM_05	Zimmerman	16.5%	2.4%	1.2%	0.2%	1.9%	6.8%	0.9%	528	1263	220	56	37
ZM_08	Zimmerman	15.8%	2.7%	1.0%	0.2%	1.6%	7.4%	1.2%	210	273	207	40	18
Mg-low-P (IIa40 + CaO)	Subgroup Mean (n=13)	16.4%	2.8%	1.3%	0.2%	1.2%	8.9%	1.0%	354	1202	169	65	174
MA_14	La Point (surface)	16.6%	2.4%	1.2%	0.2%	2.2%	8.9%	1.3%	162	858	318	58	297
MM_028	Marquette Mission	16.8%	3.0%	1.1%	0.2%	1.0%	9.4%	0.9%	225	381	205	46	221
M_24	Mahler	13.5%	3.0%	1.1%	0.2%	4.3%	10.0%	0.9%	29	245	222	42	273
MA_13	La Point (surface)	14.7%	2.8%	1.0%	0.5%	2.5%	10.8%	1.3%	128	1886	308	65	212

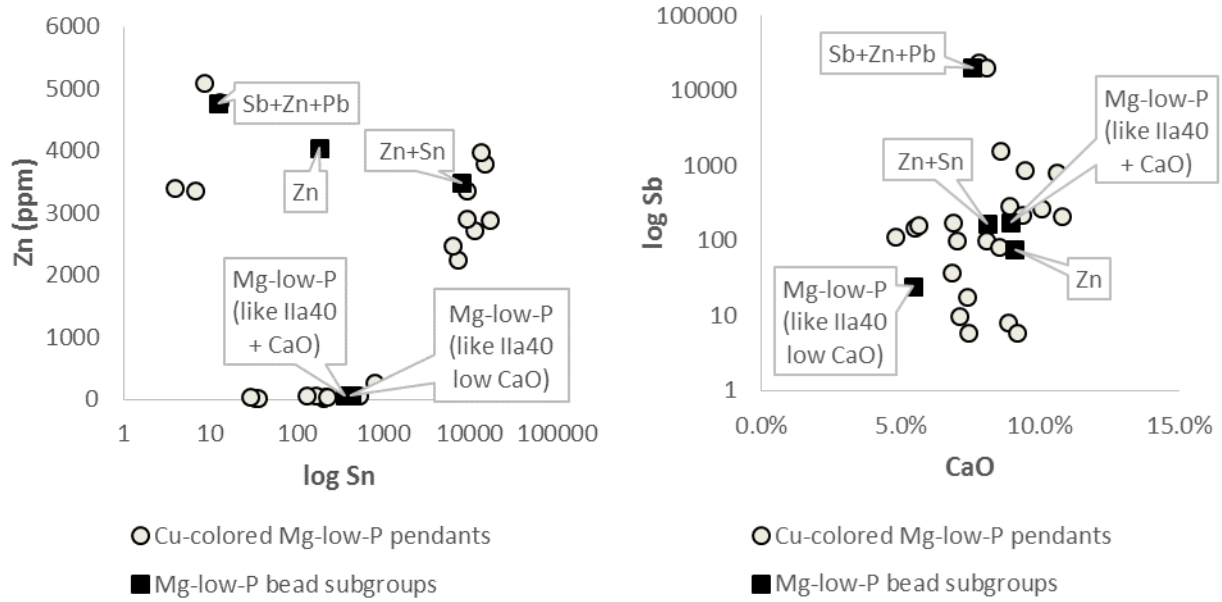


Figure 5.33: Biplots of Zn vs Sn (left) and CaO vs Sb (right) illustrating similarities between Cu-colored Mg-low-P refired glass fragments and mean values for bead subgroups. Sn and Sb logged to show better separation between groups and to illustrate how bivariate plots were used to sort the Cu-colored Mg-low-P pendants into subgroups

Table 5.16: Component matrix and eigenvalues for PCA of Cu-colored P-low-Mg pendants and beads

Component Matrix			**Total Variance Explained**			
	Component			Initial Eigenvalues		
	1	2	Component	Total	% of Variance	Cumulative %
Na	-.685	-.150	1	2.959	49.323	49.323
Mg	.346	.889	2	1.755	29.245	78.567
Sn	.737	-.427	3	.689	11.476	90.044
Zn	.907	-.198	4	.381	6.354	96.398
Sr	.593	.731	5	.149	2.490	98.888
Zr	.808	-.433	6	.067	1.112	100.000

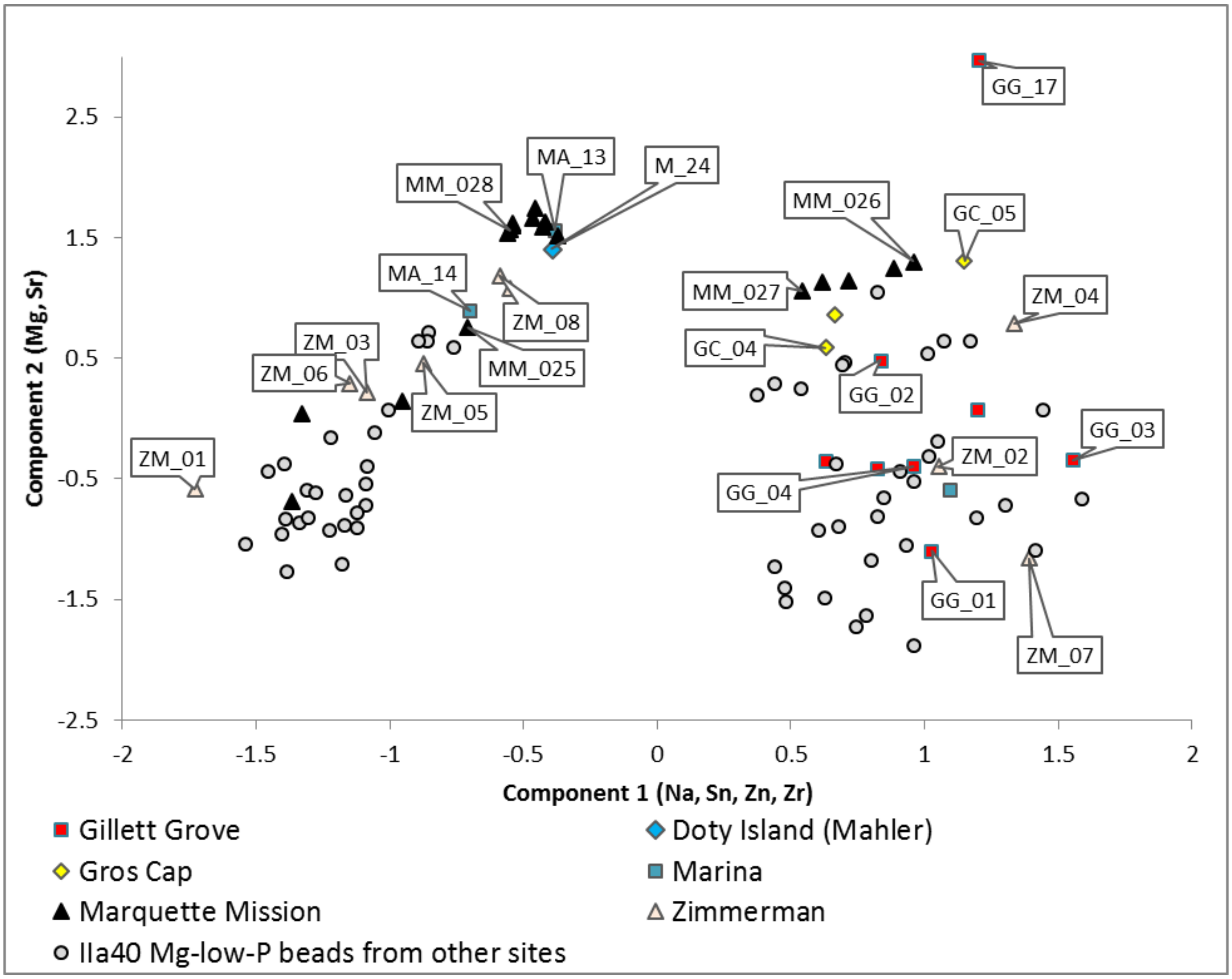


Figure 5.34: PCA run of Cu-colored Mg-low-P pendants and IIa40 Mg-low-P beads, illustrating compositional similarities and differences between beads and pendants

Based on the results of PCA and bivariate scatterplots data exploration (Figure 5.34), Cu-colored Mg-low-P pendants from the Marquette Mission and Gillette Grove are very similar in composition to IIa40 and related types of turquoise blue opaque beads from those same sites. There were four pendants analyzed from the Marquette Mission site (Figure 5.35). Based on levels of Zn, Sn, Pb, and CaO each pendant fell into a different chemical Cu-colored Mg-low-P subgroup (Table 5.15), but glass beads of similar composition to each subgroup are all present at Marquette Mission. MM_026 and MM_027 both contain more Zn than other pendants from that site, but high Zn beads were also recovered, indicating that these pendants may include some but not exclusively high Zn beads as raw material. There is no single glass bead subgroup that matches MM_025, the Med Zn+Sn sample; rather the composition of this artifact might represent the outcome of combining IIa31 and IIa40 type beads. A few Zn+Sn IIa40 beads combined with Mg-low-P beads of type IIa31 could result in a compositional signature similar to MM_025. MM_028 is similar to MM_025 in that it contains relatively low amounts of Sn, but MM_028 contains CaO levels comparable to IIa40 beads of the Mg-low-P+Ca subgroup. Although pendants from Marquette Mission sort into two PCA groups (Figure 5.34), there are glass beads from both groups present. Based on the close similarities between bead and pendant composition, the Marquette Mission site probably was a locale of pendant production.

Figure 5.35: Cu-colored Mg-low-P pendants from the Marquette Mission site

Pendants produced at the trade hub of the Marquette Mission at St. Ignace may have moved westward through exchange networks. Two pendants (MA_13 and MA_14) from surface collections at La Pointe near the Marina site, on Madeline Island, and a tiny refired glass fragment from the Doty Island site Mahler portion (M_24) (Figure 5.36) are compositionally similar to MM_028 from Marquette Mission. All fall into the Mg-low-P + CaO subgroup. There are IIa40 beads from Marquette Mission matching this composition, but no beads from this

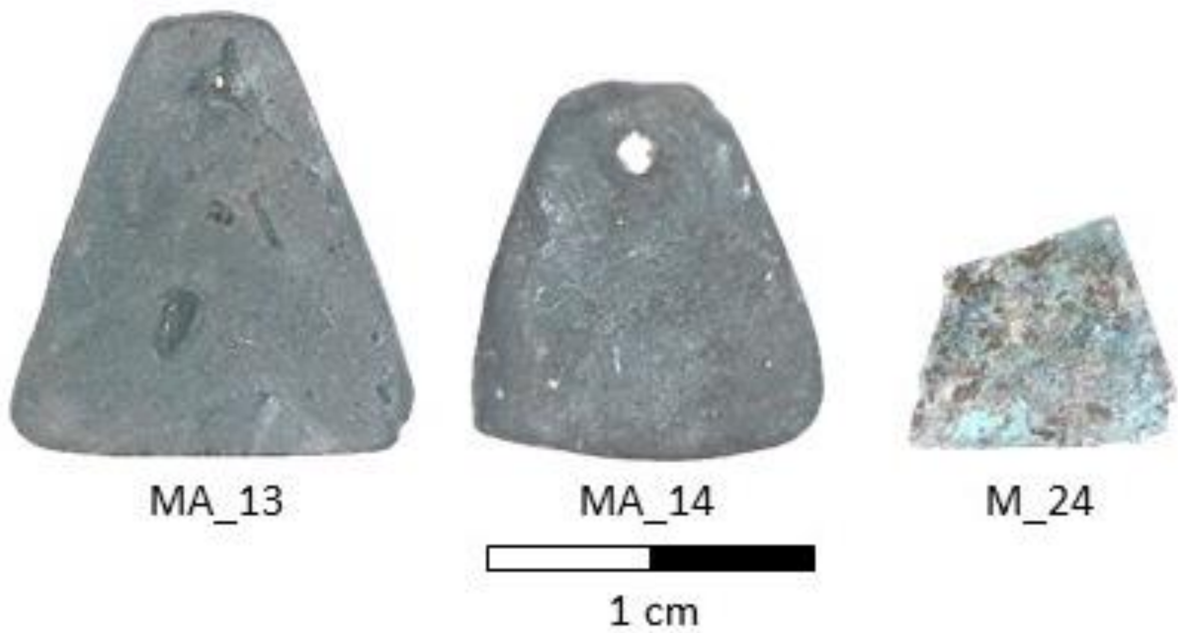


Figure 5.36: Pendants from Madeline Island and the fragment from Doty Island Mahler

subgroup were identified in the glass beads sampled from Doty Island or the Marina site. The pre-1700 temporal affiliation of this subgroup fits well with the dates of occupation of Marquette Mission (c. 1670 – 1701) and overlaps less well with the Doty Island Mahler component (c. 1680 – 1710) and the Marina site (c. 1715 – 1775). Since the Marina site pendants come from a surface collection, it is possible that they were deposited by earlier inhabitants of Madeline Island, possibly individuals living at the nearby Cadotte site. There is no evidence for pendant production on Madeline Island or at the Doty Island site.

Two pendant fragments from the Gros Cap site (Figure 5.37) were analyzed. Pendant GC_04 is classified in the Zn+Sn subgroup, which is compositionally similar to the single IIa40 bead (GC_03) analyzed from that site. Following the temporal designations I have assigned to Sn and Zn in blue beads, the Zn+Sn subgroup is dated prior to c. AD 1670, though pendants could certainly be produced using curated or "old" beads. Gros Cap pendant GC_05 belongs to a different, slightly later compositional subgroup, Sb+Zn+Pb. The closest compositional matches

Figure 5.37: Pendant fragments from Gros Cap; Reverse of GC_05 illustrated in Figure 5.26.

for GC_05 are a pendant (MM_026) and a IIa40 type bead (MM_024) from the Marquette Mission site. The presence of Sb with Zn and Pb dates the Sb+Zn+Pb subgroup to c. AD 1670s, close to the transition in opacifiers from Sn to Sb (Sempowski et al 2000). The dates of the compositional subgroups for both Gros Cap pendants correspond well with the time that the site was occupied. However, given the close geographic proximity of the Gros Cap and the Marquette Mission site, the compositional similarity between GC_05, MM_024, and MM_026, and the behavioral context of Gros Cap as predominantly a mortuary locale as well as an intermittently inhabited site, it is possible that pendants recovered at Gros Cap were produced at Marquette Mission and not at the Gros Cap site.

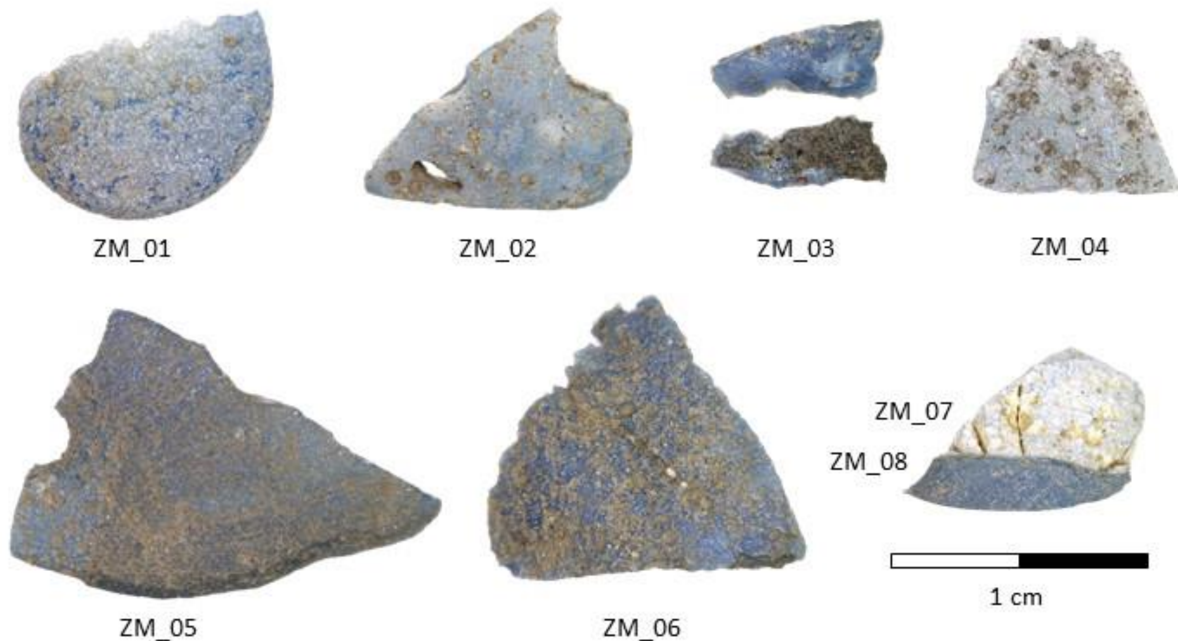


Figure 5.38: Refired glass fragments from the Zimmerman site. ZM_03 illustrated obverse and reverseto show possible adhering metal on reverse.

Seven Cu-colored refired glass fragments, including one bi-colored light and dark blue fragment sampled at two points (ZM_07 and ZM_08), were analyzed from the Zimmerman site (Figure 5.38). Fragment ZM_03 appears to have metal corrosion products adhering to one surface. Five LA-ICP-MS samples (ZM_01, ZM_03, ZM_05, ZM_06, ZM_08) are classified as Mg-low-P, with low-CaO levels like those found in the temporally earliest IIa40 beads. The single IIa40 bead analyzed from Zimmerman (ZM_47) contained higher CaO than was present in the fragments analyzed, though fragment sample ZM_08 approaches bead ZM_47 in CaO levels. These two samples plot nearest each other in the PCA run for Cu-Colored Mg-low-P beads and pendants (Figure 5.34). Samples ZM_02, ZM_04, and ZM_07 are compositionally most similar to the Zn + Sn glass bead subgroup, but no analyzed glass beads of any type from Zimmerman contained high levels of Zn or Sn. Compared to other refired glass pendants and fragments from the study sites, the Zimmerman site objects seem more irregular in shape, thickness, and consistency of the glass. There were no complete pendants present in the site collection that I examined (Rohrbaugh et al. 1999), nor were complete pendants recovered in earlier excavations at the site (Brown 1961; Brown 1975). Despite the lack of intact pendants and compositional matches between beads and refired fragments, the irregular nature and quantity of refired glass fragments recovered from the Zimmerman site make it seem possible that the inhabitants were experimenting with glass pendant production. However, of the 57 glass beads analyzed from the site, only one (ZM_47) is compositionally similar to the refired glass samples. If production were taking place at Zimmerman, greater compositional similarities between beads and fragments would be expected. Additional samples of IIa40 type beads would be necessary to clarify the compositional relationship between beads and refired glass fragments at the site.

Figure 5.39: Refired glass fragments from the Gillett Grove site

I analyzed five Cu-colored Mg-low-P samples of four glass fragments from the Gillett Grove site in north-west Iowa (Figure 5.39). One bi-colored artifact was sampled twice (GG_01 and GG_02) to examine the compositions of both glass colors. This bi-colored fragment is similar in appearance to the Zimmerman site fragment that also included two glass colors, ZM_07 and ZM_08. All Gillett Grove glass fragments contained high levels of Zn, and four of the five samples also contained Sn, placing them in the Zn+Sn samples. Unlike at the

Zimmerman site, beads with high Zn and Sn were identified in the Gillett Grove assemblage, and the bead and pendant samples fall into the same compositional clusters in PCA (Figure 5.34) and bivariate scatterplots (Figure 5.33). The High Zn sample without Sn (GG_17) is smooth and translucent, not opaque like other Cu-colored refired glass samples, and it may be a broken, partially melted bead rather than a fragment made from powdered and reheated glass. Although no intact glass pendants were recovered from Gillett Grove, the close compositional similarity between glass beads and fragments supports an interpretation of on-site experimentation with glass refiring at this site.

In summary, the Marquette Mission and Gillett Grove are the only locations where there is compositional similarity between all identified Cu-colored, Mg-low-P pendant or refired fragment glass subgroups and the composition of glass beads recovered at the same sites. These two locations are the best candidates for possible on-site pendant production using Cu-colored beads produced prior to c. AD 1700 (the Mg-low-P subgroup).

5.3.2 Co-colored blue glass pendants or fragments

Three LA-ICP-MS samples come from the cobalt-blue portions of striped blue and white pendants or pendant fragments from Rock Island (RI_024) and Fort Michilimackinac (CM_71 and CM_76) (Figure 5.40). Like the Cu-colored pendant samples from Rock Island and Michilimackinac, the three Co-colored pendant samples correspond to the post-1700 P-low-Mg subgroup. Of all of the Co-colored beads in the study sample, beads from Fort Michilimackinac and Rock Island periods 3 and 4 are most common in the P-low-Mg subgroup (see Table 5.11). Therefore, the classification of the Co-colored pendants into the P-low-Mg subgroup suggests that at the time the pendants were being produced, P-low-Mg beads were readily available. Not all sites in the study sample, particularly those dated to before AD 1700, contribute beads to the

P-low-Mg subgroup, so the Co-colored pendant subgroup assignments further support on-site production at Fort Michilimackinac and Rock Island after AD 1700.

Figure 5.40: Co-colored P-low-Mg pendant and fragments from Rock Island (left) and Fort Michilimackinac (center and right). Samples from both blue and white portions are labeled.

To better understand how the individual Co-colored pendant samples relate to glass beads from the sites where they were recovered, and from throughout the Upper Great Lakes, I conducted PCA using the Co-colored pendants and the entire Co-colored, P-low-Mg bead subgroup (n=101). I determined that variations within the dataset were most related to the elements Mg, Al, Ca, Mn, Pb, Ti and Sr, producing two components with Eigenvalues >1 explaining 63.6% of variation in the dataset (Figure 5.41 and Table 5.17). Because the P-low-Mg glass bead subgroup is very homogeneous, minor variations in the glass recipe of beads from each site seem to be responsible for differentiating individual beads and pendants.

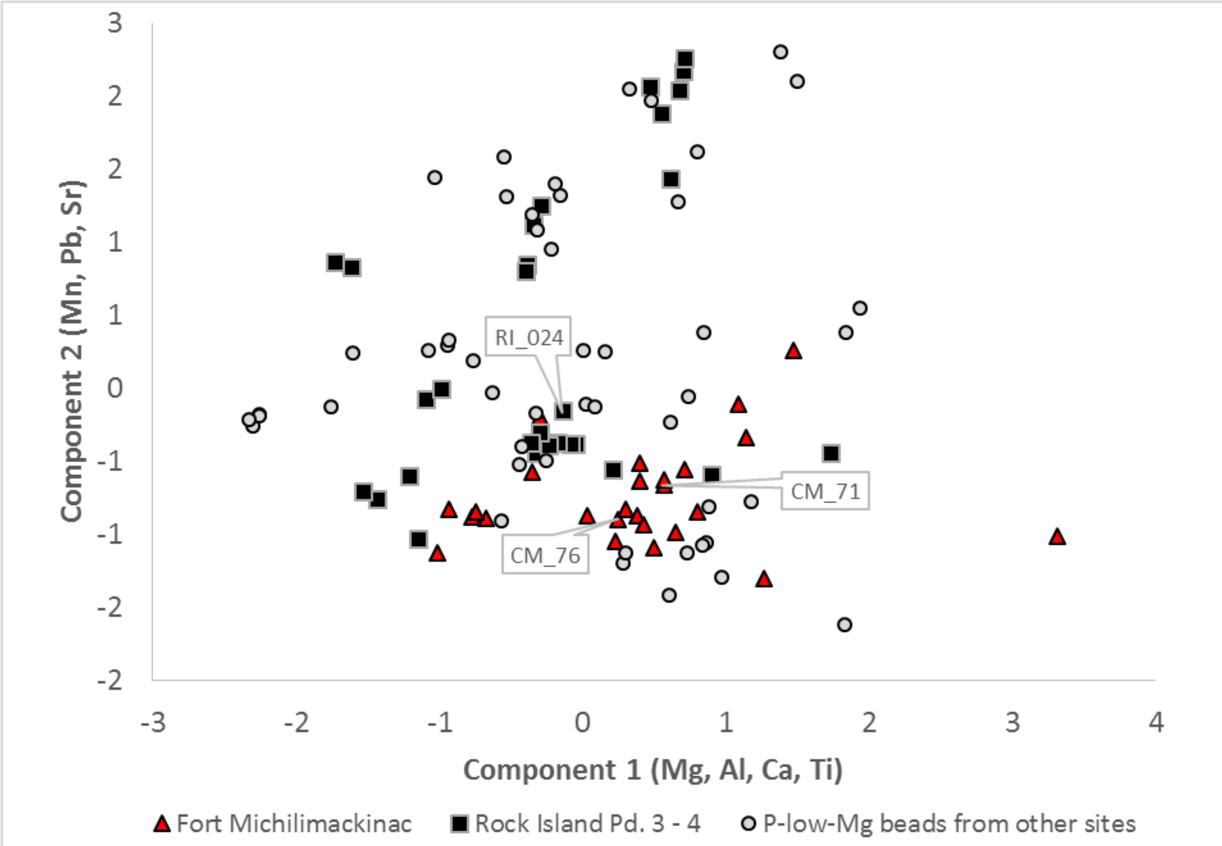


Figure 5.41: PCA of Co-colored pendants and P-low-Mg Co-colored subgroup, showing similarity in composition between pendants and blue beads from Rock Island and Michilimackinac

Table 5.17: Component matrix and eigenvalues for PCA of Cu-colored P-low-Mg pendants and beads

Component Matrix			**Total Variance Explained**			
	Component			Initial Eigenvalues		
	1	2	Component	Total	% of Variance	Cumulative %
Mg	.810	.297	1	2.465	35.212	35.212
Al	.715	.327	2	1.987	28.388	63.600
Ca	.805	-.223	3	.723	10.326	73.926
Mn	.438	.677	4	.652	9.313	83.239
Pb	-.092	.796	5	.475	6.791	90.030
Ti	.583	-.558	6	.390	5.565	95.596
Sr	.330	-.583	7	.308	4.404	100.000

Based on PCA, Co-colored beads from the same sites tend to be most similar to one another, though some sites, including Rock Island, have several compositional variants within the P-low-Mg subgroup. The Co-colored P-low-Mg pendants from Fort Michilimackinac and Rock Island are compositionally most similar to at least some beads from the sites where they were recovered. Because pendants are composites of powdered beads from each site, slight variations in batches or the use of beads acquired through multiple trading events would result in a combination of beads of slightly different glass recipes that all belong to the P-low-Mg subgroup. The compositional similarity between Co-colored beads and pendants of the same subgroups from Rock Island and Michilimackinac further supports on-site production of pendants after AD-1700 at these locations.

5.3.3 Sb-opacified white glass pendants or fragments

A total of four LA-ICP-MS samples of white glass were taken from pendant fragments, two from two pendants from Rock Island (RI_025 and RI_026), and two more from two pendants from Fort Michilimackinac (CM_072 and _077). These pendants are illustrated above in Figure 5.30 and Figure 5.40. Since I did not focus on analyzing white beads in my research project, it is not possible to compare the white glass samples to the larger LA-ICP-MS dataset in any meaningful way using PCA or cluster analysis. Furthermore, since it is possible that cored white beads with translucent outer layers and opaque white centers were a source of "raw material" for pendant-making, it is more difficult to compare the compositions of white beads and white portions of pendants to compare presumably solid, non-cored blue beads and blue pendant fragments. Nevertheless, it is possible to make some general temporal observations based on the known temporal correlations of white glass opacifiers (Sempowski et al. 2000).

The two white glass portions of Rock Island pendant fragments both contain Sb >10,000 ppm and insignificant levels of Sn at the points where they were analyzed with LA-ICP-MS. This indicates that Sb-opacified white beads were a raw material source used to produce the pendants. The ratios of Mg:P in the two artifacts match the P-low-Mg (post-1700) subgroup, which is consistent with the archaeological contexts of these fragments, dated to the mid-eighteenth century. Further comparative white bead samples from Rock Island could be taken to confirm that P-low-Mg, Sb-opacified white beads were available as raw material during the later occupation periods of Rock Island.

White beads were available from both French and British levels at Fort Michilimackinac, and as discussed in section 5.3.3, I included eleven white beads from this site in my study. Sample CM_72 is similar in its base glass recipe to these samples, falling into the post-1700 P-low-Mg subgroup. The analysis of the white portions of the Fort Michilimackinac pendants revealed much more Sb present than in any of the white seed beads analyzed. For samples from Michilimackinac and Rock Island LA-ICP-MS analyses of the white seed beads may not have reached the opaque, Sb-rich cores of the beads during the sampling process. Since the beads would have been powdered as part of the pendant-making process, the Sb-rich glass grains, which make up most of the volume of the white cored beads, would be intermixed with tiny fragments of the thin translucent outer layer of glass present on cored white beads. LA-ICP-MS would therefore detect high levels of Sb in the white portions of pendants, but not in cored beads.

A final LA-ICP-MS sample of white glass from Fort Michilimackinac, CM_77, comes from the white portion of a Co-colored colored pendant but contains no opacifiers such as Sn or Sb. The Mg:P ratio present in CM_077 places this sample into the Mg-low-P (pre-1700) group, possibly indicating that curated beads, or later beads of a composition not otherwise examined in this study have been used as the raw material for the white portions of the pendant. Note that CM_76, the sample of Co-colored glass taken from this pendant and discussed below, falls into the P-low-Mg (post-1700) subgroup, and the artifact comes from post-1700 archaeological contexts. This supports an inference that older white beads sometimes were used alongside newer blue beads as raw materials to create the striped pattern present in the pendant.

5.3.4 High Calcium glass fragments

While investigating possible production waste from the making of refired pendants at Rock Island, I examined a partially-melted glass fragment that had been classified with other refired pendant fragments recovered at the site (Mason 1986:192). The partially-melted fragment is variegated in shades of turquoise and royal blue, with a surface pocked by small bubbles. It was recovered from a floor surface context inside a c. 1760 – 1770 Odawa house structure. The excavator speculated that the partially-melted artifact was a piece of waste glass that was accidentally heated, rather than a very crude pendant fragment, but one of the other refired pendant fragments (sample ID RI_027 and RI_028) also comes from contexts associated with the Odawa house (Mason 1986: 204). The metal "firing pan" with possible glass residue adhering to its surface (Figure 5.27) also comes from inside that house context. Therefore, I speculated that pendant production might have taken place within or outside this structure. I used LA-ICP-MS to sample the variegated, partially melted artifact in three different color areas (sample IDs RI_029, RI_030, RI_031; Figure 5.42) to determine if the composition of the melted fragment matched glass beads or refired glass pendants from the site. For further comparison with the partially melted fragment, two additional glass fragments with variegated blue coloring were identified in the Rock Island collection and analyzed (RI_129 and RI_130; Figure 5.42). The curved shapes of these two fragments makes them appear to come from some form of glass container.

Figure 5.42:Partially melted glass object and similar glass fragments, both sides illustrated to show melting and patina

LA-ICP-MS analysis confirmed that partially melted variegated fragment and two similar curved glass shards are compositionally similar to one another but unlike the blue glass beads analyzed in this project. The partially melted fragment and curved fragments do not contain significant amounts of copper (Cu) or cobalt (Co), the two main ingredients used to produce blue color in glass trade beads. The relatively high iron (Fe) concentration (2.4% – 2.5% Fe_2O_3) in combination with manganese (MnO 0.2%) may have produced the blue hues usually associated with the use of Cu or Co as colorants. Furthermore, the Ca level of the partially-melted fragment (CaO 22.6% - 23.0%) is higher than any of the blue beads in data set but closely matches an olive green glass wine bottle dated to c. 1750 – 1800 (Sample ID: Brill #502) identified in the reference literature (Brill 1999:554).

Table 5.18 presents the major elements from the two additional Rock Island bottle glass samples, the mean value of the three LA-ICP-MS samples from the Rock Island artifact, and the Brill #502 bottle glass, which was analyzed with NAA. Values for all oxides measured that were common to the remelted fragment and the Brill bottle glass sample are similar, within +/- 1.0%, and the oxide values for the two additional Rock Island container glass samples are within +/- 1.5% of the average for all of the high Ca-glass samples. The two non-melted variegated blue container glass fragments from Rock Island are slightly lower in Fe and CaO than the partially remelted fragment and the bottle glass, but in general, there is close similarity among all of these high Ca samples. Heating olive green bottle glass in a campfire may have produced the variegated colorations, but additional research on the physical and chemical changes that might result from heating high Ca glass at campfire temperatures is necessary. It is not possible to determine if the partially melted fragment is simply a result of trash disposal or if it was an attempted experiment with a new source of glass for pendant production.

Table 5.18: Summary results and comparison of Brill sample #502 and high Ca glass samples. Elements in this table are those published in Brill (1999) and also measured using LA-ICP-MS.

Sample	SiO_2	Na_2O	MgO	Al_2O_3	K_2O	CaO	MnO	Fe_2O_3	CuO
Rock Island container glass fragments									
RI_129	62.23%	1.87%	4.31%	5.19%	2.38%	21.16%	0.23%	1.10%	0.01%
RI_130	61.98%	1.93%	4.42%	5.16%	2.38%	21.36%	0.24%	0.99%	0.01%
Comparison of remelted fragment and bottle glass									
AVG: RI_029, RI_030, RI_031	59.48%	1.95%	4.19%	5.05%	2.28%	22.88%	0.22%	2.44%	0.01%
BRILL #502	59.60%	3.28%	4.96%	4.49%	2.54%	22.10%	0.09%	2.36%	0.02%
(+/-)	0.1%	0.9%	0.5%	0.4%	0.2%	0.6%	0.1%	0.1%	0.0%
Average	59.5%	2.6%	4.6%	4.8%	2.4%	22.5%	0.2%	2.4%	0.0%
Comparison of all high-Ca glass samples (Rock Island fragments and Brill bottle glass)									
(+/- ALL)	1.5%	0.7%	0.3%	0.3%	0.1%	0.8%	0.1%	0.8%	0.0%
Average ALL	60.8%	2.3%	4.5%	5.0%	2.4%	21.9%	0.2%	1.7%	0.0%

5.3.5 Summary of glass pendant data and interpretations

All refired glass pendants and fragments match the compositions of beads recovered at the same site for the analyzed artifacts from Rock Island, Fort Michilimackinac, Marquette Mission, and Gillett Grove. I argue that individuals inhabiting at least one of these locales, if not all of them, were involved in the production of refired glass pendants using locally-available trade beads as raw material. For pendants from these sites, the temporal assignments of pendant glass recipe subgroups also match the known dates of occupation for sites where pendants were recovered, indicating that pendants from later sites are not curated objects. Probable pendant production waste has been identified in the copper-based metal assemblage from the Rock Island site, and additional examinations of copper-based metal artifacts from all potential locales of pendant production might could clarify the methods of heating the glass. It remains unclear if the technique of refiring glass was developed locally or was introduced by Europeans. Each site context where pendants match the compositions of glass beads is behaviorally and culturally different: Gillette Grove is a protohistoric Oneota settlement with no evidence of direct or sustained European contact, while Rock Island was a trading hub for many Native groups as well as Europeans, Marquette Mission was a Jesuit center with closely-affiliated Native community, and Fort Michilimackinac was a French and British military outpost with known Metis residents.

There is not enough localized contextual information available at any of these sites to speculate about the particular cultural identity or ethnic affiliation of individual pendant producers. The technological knowledge of producing glass pendants could have been exchanged widely, perhaps along the same routes as the artifacts themselves, or knowledge could have been restricted to local specialists at sites across the region. Based on compositional similarity, some pendants that may have been produced at Marquette Mission come from archaeological contexts on Madeline Island in northern Wisconsin, and at Doty Island in Lake Winnebago, highlighting the trade networks connecting the Upper Great Lakes region. Recipients of pendants obtained through trade would not necessarily have known how they were made, or their meaning to the original community producing them; traded finished objects could have sparked technological experimentation in places where the process of making pendants was otherwise unknown.

Ethnographically-documented production processes for refired glass pendants (Gilmore 1924; Thwaites 1905:272-274; Wied et al. 1843 [as cited in Ubelaker and Bass 1970]) included both metal plates and glass beads, but few researchers have addressed both of these material types in the same assemblages; this may be one reason the process is not well understood, since metals researchers may not recognize adhering glass material, while glass-specialists are not looking through non-glass assemblages for production waste. In addition, corrosion products of copper tend to be a similar blue-green hue as blue glass residue, and archaeologists not specifically looking for glass residue, a relatively rare form of production waste, may easily and understandably fail misidentify glass reside as corrosion products. Therefore, the investigation of both glass and metal artifacts in this dissertation allowed for the identification of previously unrecognized pendant production waste at the Rock Island site, which helps clarify the distribution of pendant production across the Upper Great Lakes landscape.

5.4 Interpretations of glass analyses as related to the research questions

I applied LA-ICP-MS analyses to glass beads and pendants to examine temporal relationships between glass recipes and known dates of site occupation, and to trace the movement of glass trade beads through socially-structured trade networks of the historic-era Upper Great Lakes. I investigated the glass pendants specifically to investigate if and how Native peoples of this region produced these hybrid material objects, or if they were obtained through trade with peoples outside the region. Below, I recap the research questions and expectations of this project as they relate to the exchange and modification of glass trade beads. Glass analyses proved to be most useful for addressing research question three, regarding the social and economic factors that influenced timing of trade in the Upper Great Lakes.

5.4.1 *Research Question 3*: In the Upper Great Lakes, when and where did non-local trade items arrive, and how did economic and social factors influence their distribution?

Since glass recipes for European-made trade beads are known to vary through time and across space (Hancock et al. 1996; Hancock et al. 1994; Kenyon et al. 1995; Sempowski et al.

2001), I expected to be able to trace the timing of the arrival of glass trade beads in the Upper Great Lakes region by linking patterns identified in glass recipe data to archaeological sites with good temporal control and known dates of occupation and to chemical patterns already documented by previous researchers. I also expected that the ethnic affiliations of communities, as assigned by historians and archaeologists, influenced the types of glass beads available at given locations, since different groups of European traders interacting with different cultural groups might provide glass beads from various glasshouses using distinct ingredients of ratios of ingredients in their proprietary recipes. These expectations were supported in my analyses and interpretations of patterns in glass recipe compositional subgroups for beads and pendants.

After identifying glass subgroups present in each colorant category of glass, I noted that the temporal affiliations of the Mg-low-P (pre-1700) and P-low-Mg (post 1700) are a robust pattern maintained throughout the dataset (Table 5.11 and Figure 5.43).

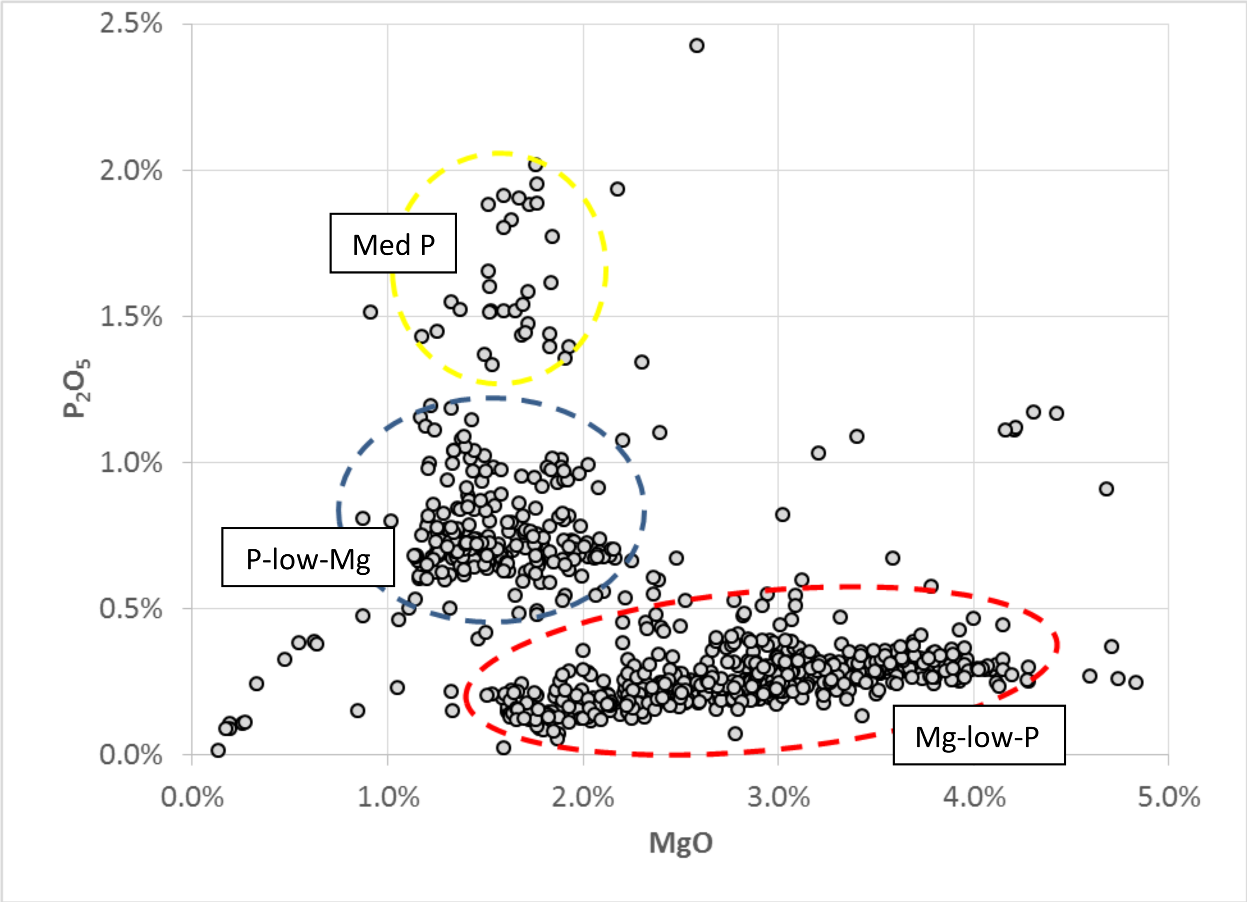


Figure 5.43: Mg vs P scatterplot of all LA-ICP-MS glass samples in the data set (n=887), illustrating the main glass subgroups identified as well as outliers. Dashed circles represent general clusters, not statistical relationships.

Although neither the Mg vs P patterning, nor any other single result, explicitly identifies the earliest beads to arrive in the Upper Great Lakes region, visualizing spatial patterns in the glass subgroups clarifies the timing and movement of trade items and patterns in networks and key locations. To illustrate this, I have mapped the archaeological sites contributing blue glass beads according to their general dates of site occupation, either mostly pre-1700 or mostly post-1700, as published or otherwise previously documented by the site excavators (Figure 5.44).

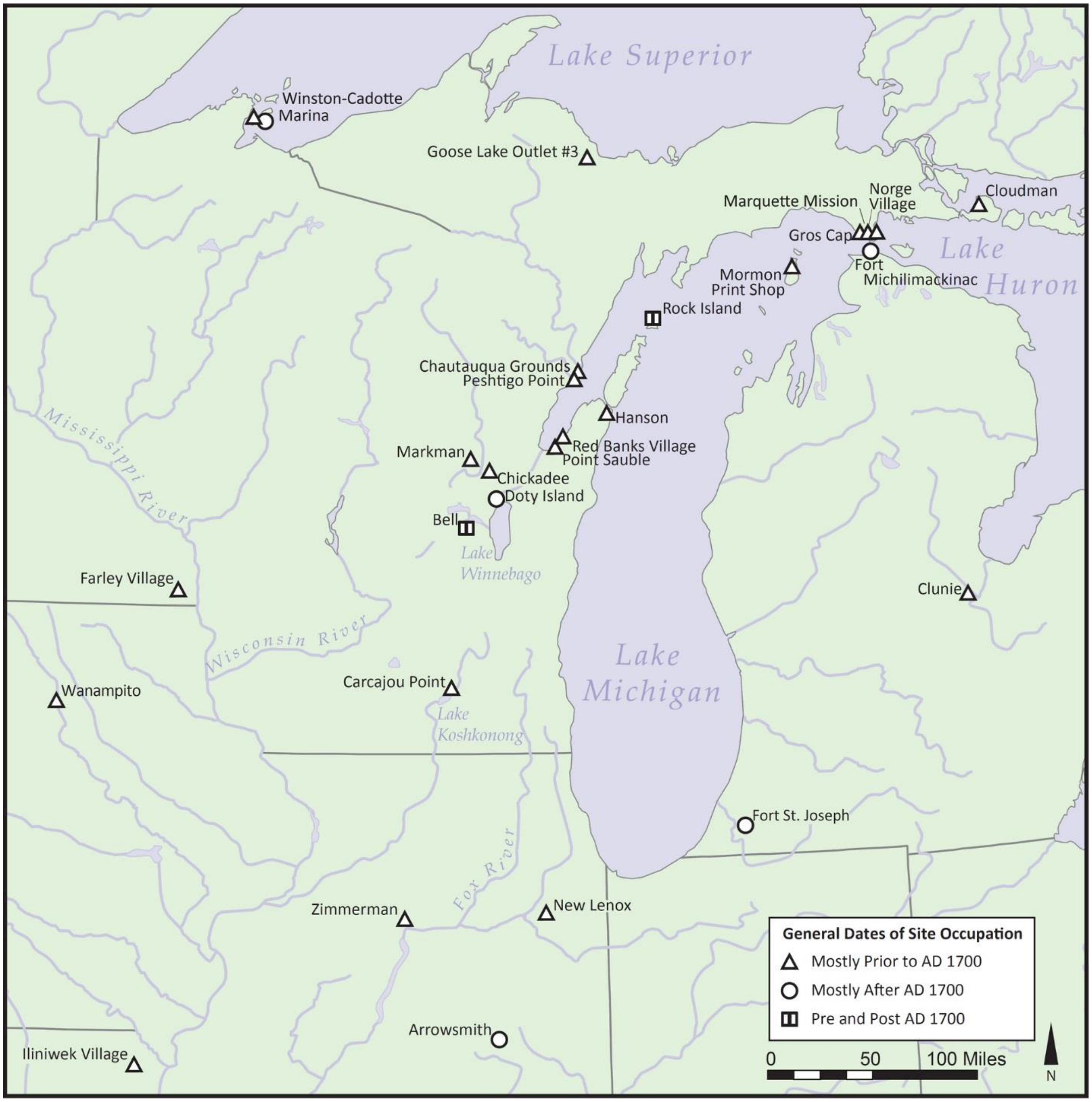


Figure 5.44: Map of sites for analyzed beads and pendants, with archaeological sites identified by the general period of occupation previously determined from archaeological and historical evidence. Two pre-1700 sites in northwest Iowa, Gillett Grove and Milford, are excluded from this map because beads from other known historic sites in Iowa were not analyzed.

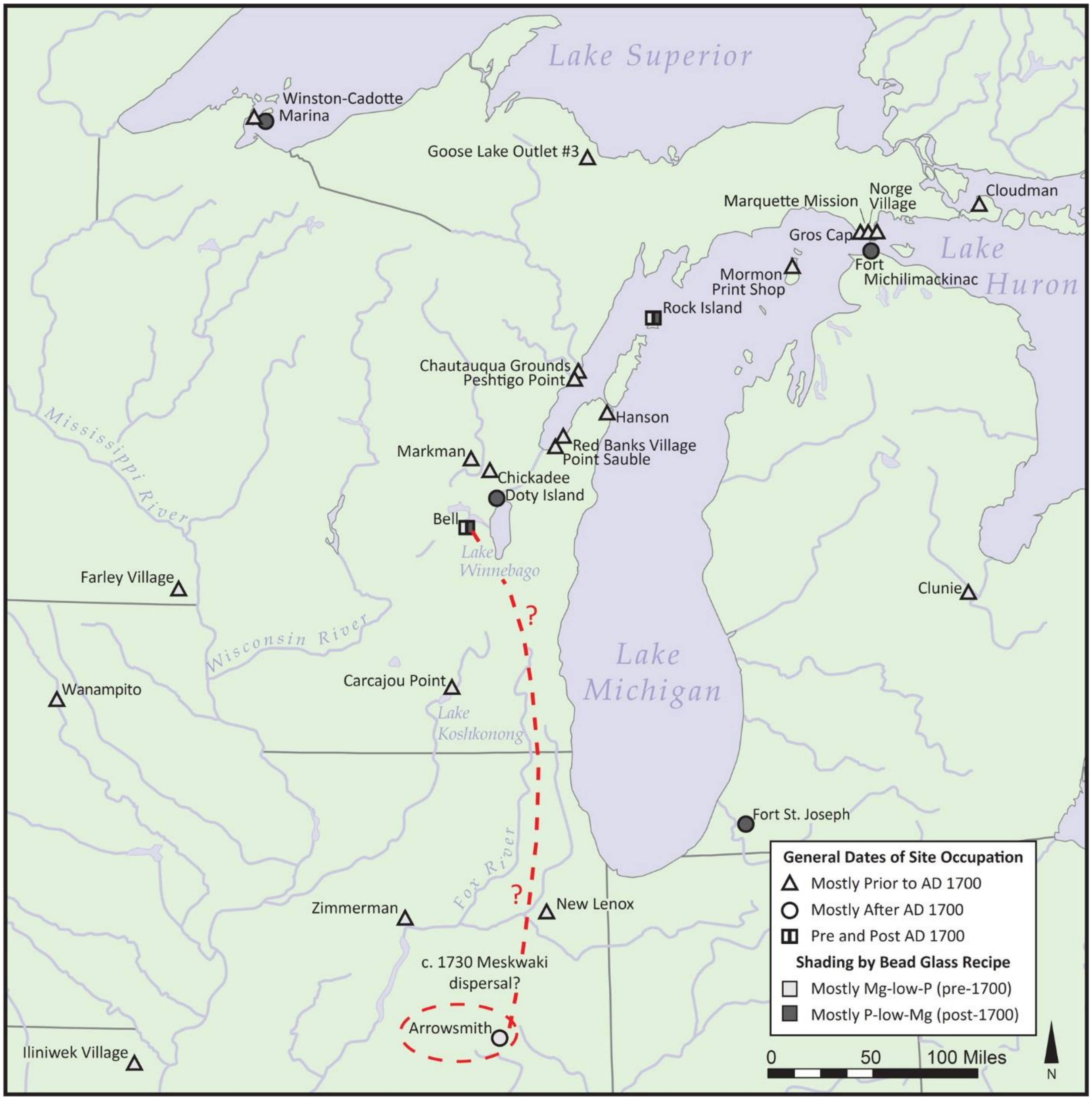


Figure 5.45:Map of sites for beads and pendants, with site symbols shaded according to the chemical subgroup (light gray: Mg-low-P, pre-1700 or dark gray: P-low-Mg, post-1700) of the majority of glass beads analyzed from the site. Most beads from sites occupied prior to AD 1700 fit the Mg-low-P subgroup, while the majority of beads from sites occupied post-1700 fit the P-low-Mg subgroup. The three beads analyzed from the Arrowsmith battleground site (dated c. 1730) fit the earlier subgroup (Mg-low-P) and may be curated objects brought by a Meskwaki group with limited access to trade items during the Fox Wars (c. 1712 to 1733).

When the results of chemical analysis and identified subgroups are mapped onto the excavator's interpretations of site occupation dates, the pattern is clear: sites or components that excavators date to pre-1700 had only Mg-low-P beads; bead assemblages from sites dated to post-1700 are dominated by P-low-Mg beads (Figure 5.45 and Table 5.11), although Mg-low-P beads are sometimes present in later assemblages and may be a result of curation. Note that for reasons of geography and sampling strategy, two sites in northwestern Iowa, Gillett Grove and Milford, and the beads from *La Belle* and the associated Fort St. Louis settlement in Texas, are not included on the map. Beads from the two Iowa sites all fall into the Mg-low-P category, but they were included in the study sample for only comparative purposes and do not fully reflect the historic occupations of Iowa. They have been excluded from these maps because other known protohistoric sites in the region would need to be included in order to make interpretations about regional interaction. Beads from *La Belle* and Fort St. Louis were not mapped because of their geographic distance from the other sites, but these beads also generally fit the Mg-low-P group, which is consistent with the date that the ship was stocked in France, c. 1684.

The glass bead subgroups identified at the Bell and Arrowsmith sites require additional explanation. Bell was occupied from about A.D. 1680 to 1730 (Behm 2008), so, along with the clearly stratified Rock Island site (Mason 1986), Bell has been given a symbol that indicates an occupation period spanning the turn of the eighteenth century. Of the beads analyzed from Bell (n=36), eleven artifacts are assigned to the later group (P-low-Mg) and 25 to the earlier group (Mg-low-P). This distinction may provide a way to distinguish earlier from later historic-era occupations areas of the site, which has not been possible through traditional lines of archaeological evidence such as radiocarbon dates, historic records, stratified soils, or the presence of diagnostic artifacts in features. The Bell Site has been identified as the “Grand Village” of the Meskwaki, where they maintained a presence during the “Fox Wars” until approximately 1730, when they moved south and made a stand at the palisaded Arrowsmith site

(Behm 2008; Stelle 2008; Stelle and Hargrave 2013). All three beads analyzed from Arrowsmith have the pre-1700 glass signature, which could be explained as the presence of a few curated beads obtained a generation or two earlier, before the trading relationship between the Meskwaki and French deteriorated into decades of conflict. Alternatively, the pre-1700 glass beads could have taken longer to reach Arrowsmith via down-the line trade networks, or these artifacts could even indicate limited continued use of this glass recipe into the eighteenth century in Europe. There are no known earlier historic-era components at Arrowsmith that could be responsible for the presence of pre-1700 beads, and curation seems like the most likely explanation for the presence of older beads at this particular site.

A single bead from Fort Michilimackinac further demonstrates how glass bead subgroups relate to the timing of trade items at various communities and provide evidence for communities not otherwise well-documented archaeologically. Of all the glass beads sampled from Michilimackinac (n=69), only one Mg-low-P (pre-1700) bead was identified. This IIa55/56 type cobalt blue seed bead (CM_13) is visually identical to other beads of that type from the site, but it was recovered from outside the west wall of the c. 1730 French fortification, a context traditionally associated with encampments of Native Americans (Evans, personal communication 2013). The context of this bead differs from all others analyzed from Michilimackinac, which were selected from Metis and French-associated strata within the fortification walls. The French fortification at Michilimackinac was not constructed until c. 1714 (Evans 2001:2), but Anishinaabeg, Odawa, Ojibwe, and other peoples had come together at the Straits of Mackinac long prior to European occupation (McPherron 1967). Other than test excavations, the area outside the walls has not been investigated by professional archaeologists, but bead CM_13 likely reflects the presence of a historic-era Native American activity area that predates the construction of Fort Michilimackinac by at least 15 years.

Opacifiers used in beads also vary through time and are useful in clarifying the occupation dates of sites. The transition from Sn to Sb as an opacifier which took place c. 1670 in European glass workshops (Hancock et al. 1997; Hancock et al. 1996; Sempowski et al. 2000) is documented in the Upper Great Lakes through beads in the type IIa40 Zn+Sn opacified subgroup. Beads of this type only appear on sites that were occupied prior to AD 1700, according to dates assigned by excavators and as identified from the presents of beads in the Mg-low-P glass recipe subgroups. The identification of bead opacifiers therefore helps tease apart chronology for sites with unknown dates of occupation, such as the Mormon Print Shop site, where a Sb-opacified white bead and a Cu-colored blue bead narrow the possible dates of bead production to post-1670 (because of the white Sb-opacified bead) but pre-1700 (blue Mg-low-P subgroup). Although the Mg-low-P bead could have been curated and deposited post-1700, no P-low-Mg beads were sampled from the site, supporting a pre-1700 occupation.

Zinc, which appears in some Cu-colored beads and may be introduced in some glass recipes as part of the coloring process, also may be a chronological marker, since it appears in beads only on archaeological sites dated to the mid-seventeenth century and none that date after 1700. However, not all pre-1700 sites have beads with Zn, and I suggest that Zn is a chronologically-sensitive ingredient that also corresponds to resource availability of glass trade beads from certain workshops or trading sources. Some sites dated to the seventeenth century have high Zn beads, while other contemporary sites along the same waterways do not. I interpret this patterning as a result of differential access to resources, which may be influenced by ethnic, social, or economic factors. Since not all IIa40 type beads contain Zn and Sn, the pattern of their distribution is not strictly a temporal difference, but rather it may be a result of some communities having access to different trade networks that circulated beads from different European production centers.

Figure 5.46 Map of sites yielding high Zn beads or pendants (High Zn > 2000 ppm; Low Zn < 2000 ppm). High Zn appears on some but not all pre-1700 sites, which may indicate that some communities or individuals had access to traders bringing High Zn beads while others did not.

Judging from the spatial distribution of beads and pendants with different levels of Zn (Figure 5.46), the seventeenth-century sites in the Door Peninsula region of Wisconsin and the northern Straits of Mackinac in Michigan, as well as protohistoric Illinois sites, had access to networks offering high-Zn beads, while inhabitants of the Lake Winnebago area, and the pre-AD-1700 inhabitants of Rock Island, WI did not obtain beads made with Cu and Zn or brass as a colorant. It is possible that the Meskwaki of the Lake Winnebago region, and the Potawatomi and related groups living on Rock Island did not trade with the same groups as those living nearby on the Door Peninsula near Green Bay, possibly the Ho-Chunk or the Menominee inhabitants of the seventeenth century. The single IIa40 high Zn bead from the Marina site may be a curated object or an intrusive object from earlier occupations on Madeline Island. IIa40 type beads from all pre-1700 sites are visually indistinguishable, regardless of the presence or absence of Zn, again demonstrating the utility of chemical analysis in concert with traditional bead classification typologies.

High-Zn beads link the Hanson site, a likely Huron, Petun, or Odawa burial site, with surface collected beads from the Door County and Green Bay sites of Peshtigo Point, Red Banks, and Point Sauble, all thought to be early locales of Native and European interaction in Wisconsin. A few high-Zn beads have also been identified from the Huron longhouse area of the Marquette Mission site. Therefore, high-Zn beads in Wisconsin might be indicative of the presence of Huron migrants displaced c. 1650 by the Iroquois Wars, down-the-line trade with groups connected to bead sources in eastern North America, or the arrival of some of the earliest European explorers in the Green Bay area, during the mid-seventeenth century. Chemical analysis in this instance seems to reveal differential participation in trade networks among contemporary sites across the Upper Great Lakes region, possibly reflecting the socially structured exchange networks of a "Native New World" (Witgen 2012).

I expected that if different social groups did have access to beads from only certain glasshouses, via their relationships with particular traders or middlemen, then the spatial distribution of chemical subgroups would reflect this, especially in the earliest instances of trade. The examples of the three Mg-low-P beads from the Arrowsmith site and the differing geographic distribution of Sn+Zn beads demonstrate how social and economic factors that influenced in the movement of trade items can be understood through identifying geographic patterns in the distribution of glass trade beads of different chemical subgroups. Chemical patterning identified in glass bead recipe subgroups therefore has clarified some poorly-understood historical relationships between glasshouses, explorers and traders, Euro-American middlemen, and Indigenous North American exchange networks.

5.4.2 Research Question 2: Do spatial and temporal patterns of variation in the chemical composition of glass beads and the reworking styles of metal objects correlate with present understandings of the locations of ethnic groups on the regional landscape?

To test present archaeological hypotheses about the ethnic identity of site inhabitants during the historic era in the Upper Great Lakes, I determined if patterns of chemical subgroups identified in the LA-ICP-MS glass bead data correspond with known locations of distinctive ethnic groups on the regional landscape. I expected that patterns of composition corresponding to known locations of historically-documented peoples would support those interpretations. I also tested whether or not there were compositional similarities between glass bead subgroups and the compositions of refired glass pendants recovered from the same archaeological sites. Similarities between some beads and pendants would demonstrate that some communities but not others were involved in the production of refired glass pendants. I expected to find such compositional similarity, especially at the Rock Island site, where metal production waste from pendant production was identified. The expectations about ethnic identity and pendants were supported.

Given the prevalence of the high Zn subgroups on some but not all mid-seventeenth century sites, it seems possible that the high Zn beads reflect the presence of socially or culturally distinct communities in the Door Peninsula and Green Bay area. Both Ho-Chunk and Menominee groups are considered the original occupants of the Green Bay area, but it has been difficult to link these historically-documented peoples to particular archaeological sites (Mason 1997; Overstreet 2009; Richards 2003). The Hanson site bead assemblage is physically and chemically distinctive from others in the area, with extremely high Zn + Cu blue beads and translucent tubular beads found only at that site, and Co + Sn beads also restricted to Red Banks, Goose Lake Outlet #3, and Farley Village. This distinctiveness indicates the community members who interred the ancestral remains recovered at the Hanson site had access to glass beads that were not otherwise widely available at the same time in the Upper Great Lakes region. Restricted access to certain bead types may be a result of several ethnically-structured circumstances, including migration, as Huron people spread out from eastern North America and brought beads with them; down-the-line trade that occurred among members of the same ethnic group, or direct interaction between the Hanson community or others in the Green Bay area and an individual European explorer or trade party during an early period of intermittent trade (c. 1630s – 1660s). The larger patterns of population movement and the Huron diaspora may in fact be represented in the bead assemblage from the Hanson site, and perhaps at other sites with Co-colored Sn beads as well.

Conversely, the absence of high Zn beads at other locales in the Upper Great Lakes region may indicate that some ethnic groups did not have access to beads of the high-Zn subgroups even during the temporal period (pre-1700, probably pre-1670) when such beads were available to other communities in the area. For example, high Zn beads have not been identified in the Rock Island collections, possibly indicating that those individuals who were able to obtain high-Zn beads did not rely on Rock Island as a trading locale, as the Potawatomi did throughout the last two thirds of the seventeenth century. No high Zn beads were identified at known Meskwaki sites, and several other sites dated to the mid-seventeenthth century, such as Farley Village, an Ioway habitation. Some ethnic groups, including the Potawatomi and Meskwaki, may not have had access to those traders who would have supplied the beads to individuals associated with the Hanson site, a possible Huron burial. The geographic proximity and connecting waterways between of sites in the Green Bay area and Meskwaki sites in the Lake Winnebago region make it likely that contemporary communities would have had physical access to the same traders, but if trade in high Zn beads were structured along ethnic lines and limited to the Huron diaspora community, and the Menominee and Ho-Chunk of the Green Bay area, it would explain the absence of high-Zn beads from Meskwaki sites and from Rock Island.

The technological process recycling of glass beads into glass pendants used for personal adornment might also reflect ethnicity, although the use of such pendants may not. Pendants and fragments of refired glass do not cluster on sites attributed to any particular ethnic group, coming from the Odawa levels of Rock Island, the colonial trading contexts of Fort Michilimackinac and Madeline Island, a predominantly Huron village at the Marquette Mission site, the Illinois Grand Village of the Kaskaskia at Zimmerman, a protohistoric Ioway site at Gillett Grove, and a single broken fragment from the Meskwaki-affiliated Mahler portion of the Doty Island Sites. This may indicate that pendants were traded freely among different Native and European peoples present in the area, or that interaction among groups let to loss and deposition of pendant fragments at sites across the region. However, based on compositional similarity between beads and pendants, pendant production seems to have been more limited, possibly taking place at Rock Island, Marquette Mission, Michilimackinac, and Gillett Grove. These sites were occupied by diverse ethnic groups, but the Meskwaki, as relative-newcomers to the region, are absent from any significant historical or archaeological presence at these possible pendant-production sites. In the cases of Rock Island c. 1760, Marquette Mission, and Michilimackinac, there was a direct and sustained European presence in the form of trading outposts, missionary activity, and French colonial fortifications. It is possible then that in the Upper Great Lakes region, refired glass pendants might have been produced at sites where there was significant European influence. This contrasts with the social context of limited direct interaction documented at the Leavenworth and Sully sites where pendants were produced in the Plains region (Ubelaker and Bass 1970). Since pendants come from French, British, and Metis contexts within the fortifications of Michilimackinac, European production of the refired glass pendants cannot be ruled out, though these artifacts are generally considered "Native-made" by archaeologists no matter the social context of their deposition (e.g. Brown 1972; Evans 2001:24).

The small pendant fragment from the Doty Island site Mahler portion, which was inhabited by a possible Meskwaki group c. 1680-1710, is an anomaly. There is no indication that glass pendants were produced or widely used at the Doty Island site during its occupation, nor have pendants or refired glass fragments been recovered on any other Meskwaki-affiliated sites. Compositionally, the Doty Island fragment matches pendants produced at Marquette Mission and those recovered on Madeline Island. The pendant could have been obtained by a Doty Island resident through trade, or worn by someone not of Meskwaki ethnicity, perhaps a visitor or trader, and broken or chipped at the Doty Island site. If production of glass pendants was restricted to certain locales like the St. Ignace area and Rock Island, which served as key trading hubs with significant European interaction, it would be unsurprising to find glass pendants widely distributed across the Great Lakes region. Without more information about the meanings of these adornments in their use-contexts, it is difficult to determine if wearing a refired glass pendant was a mark of ethnicity, social status, or some other aspect of social identity.

5.4.3 Research Question 1: In the region of study, is there archaeological evidence for commonly recognized historically-documented outcomes of colonial interaction, such as multi-ethnicity, hybridity, and ethnogenesis?

In the glass bead and pendant LA-ICP-MS dataset, I did not expect to identify particular chemical subgroups related to multi-ethnicity, hybridity, or ethnogenesis because the subgroups relate to glass recipes in use in European workshops by themselves and cannot provide evidence of blending or formation of ethnic groups. Although trade in glass beads of particular subgroups might be socially structured or restricted to certain archaeologically-visible cultures with the same material signatures, the presence of multiple different chemical subgroups of beads is not specific evidence of multi-ethnicity or hybridity at a site. Site occupants with diverse glass recipes present could have been particularly well-connected to multiple trading networks.

Therefore, to test this research question using my glass bead dataset, I determined if or how known multi-ethnic communities had different patterns of glass bead composition than communities attributed to a single group or culture. In my study of glass beads, the strongest evidence for outcomes of colonial interaction such as multi-ethnicity, hybridity, and ethnogenesis might be the finding that "multiethnic" colonial sites such as Fort St. Joseph, Fort Michilimackinac, and the Marina site shared beads of a similar chemical makeup (the post -1700 P-low-Mg subgroup), demonstrating how expanding trade networks of the eighteenth century extended the availability of glass beads to the edges of the *pays d'en haut.*

I expected that the compositional analysis study of "hybridized" material-culture, such as refired glass pendants, might yield new information about the technological outcomes of colonial interaction and the specific social or ethnic contexts of pendant production in the Upper Great Lakes region. Refired glass pendants and fragments of worked glass found on sites occupied by Native American groups may be considered "hybrid" objects in the sense that they transform a European-made material, glass trade beads, into a trapezoidal form that might be socially meaningful to Native groups, as evidenced by the repetition of this form in red stone, shell, and copper adornment objects. However, because the archaeological record provides only limited evidence of their production and use, it is difficult to assess whether refired glass pendants truly represent a hybridity of technological practices, raw materials, and ideological meanings.

It is possible that the idea of producing refired glass pendants came from people of European origin, but this would not detract from the hybrid nature of the finished adornments. For example, some documents indicate that the making of blue pendants was not a Native invention at all, but rather that the process of crushing glass was taught to the Arikara by a "Spanish prisoner" (Ubelaker and Bass 1970:472), but refired pendants became an integral part of burial rituals and ideological practices of Plains communities (Howard 1972). The original source of technological knowledge for pendant-making in the Upper Great Lakes region is unknown, but evidence of pendant production waste at Rock Island, in the form of probable glass residue on metal and compositional similarities between beads and pendants from that site indicates that the Odawa community was producing pendants on-site c. 1760. No refired glass pendants were identified in the Odawa cemetery excavated at Rock Island (Mason 1986), but structures with French-style wall construction are present, along with as are other "hybrid" artifacts such as a cross-shaped pendant covered cut from European sheet metal and covered in red pigment (see Chapter 6). The finding that there are compositional similarities between glass beads and refired pendants at four archaeological sites in my study sample demonstrates that the production of these hybrid objects was an important adornment practice in the Upper Great Lakes region, especially for Native and Metis communities regularly engaging in interaction with residents of Euro-American origins of the same areas.

5.5 Summary of glass bead analysis findings

This regional-scale LA-ICP-MS analysis of glass beads and refired pendants has revealed several key findings related to trade and exchange in these objects in the historic-era Upper Great Lakes region, and the ways that archaeologists classify glass beads using typological systems. Compositional analysis has demonstrated that visually identical blue beads can have very different chemical compositions, indicating that different glass recipes were used to produce the beads. Furthermore, discrepancies between compositional results and the visual classification of glass beads by type illustrate that typological systems are very dependent on lighting conditions, bead surface corrosion, and researcher skill, all of which make it possible to misidentify the color or type of a bead. Therefore, visual typologies based on observable attributes are a subjective method of bead classification that does not always correctly reflect the full range of variation in a bead assemblage, both in terms of the colors of beads and in describing the possible origins. Compositional analysis using minimally destructive methods such as LA-ICP-MS is a more objective method of classifying bead subgroups, and it can be used to understand temporal and geographic variation in glass recipes that cannot be detected using visual or attribute analysis.

Numerous compositional markers for time in the glass bead dataset were identified in the regional study, including a recipe shift c. AD 1700 in values for base-glass ingredients magnesium and phosphorus that was consistent for all glass samples in the study. Additional shifts in opacifier use were documented c. AD 1670, with the transition from tin to antimony as an opacifier previously-identified for white beads was demonstrated in opaque blue beads from the Upper Great Lakes. The presence of zinc, added to beads along with copper as part of a coloring process, appears differentially across some Upper Great Lakes sites and may be related to the ethnic identity of communities in control of trade networks prior to AD 1700 or to the intermittent early arrival of European traders. Low calcium levels that previous researchers documented in the earliest beads (type IIa40) were also documented in the oldest beads from this region. In cobalt-colored beads, amounts of cobalt also decrease over time in beads from across the area. This study has demonstrated the usefulness of compositional analysis for developing a chemical chronology for glass trade beads.

Research on refired glass pendants recovered in the Upper Great Lakes region has demonstrated that these artifacts may have been produced locally, using readily-available glass beads as raw material, rather than exclusively in the Great Plains region of North America . While the specific production process remains uncertain, evidence of glass residue on a metal "firing pan" from the Rock Island site corresponds well with processes documented ethnohistorically. Compositional similarities between refired glass pendants or fragments and glass bead assemblages were documented for four sites in the region. There are no specific ethnic associations for the use of refired glass pendants apparent in the Great Lakes region, but production may be limited to communities closely interacting with inhabitants of European origins. The identification of the "firing pan" in the metals attribute analysis of the Rock Island materials demonstrates the complementary nature of investigating metal and glass materials from historic sites. The full findings of the metals attribute analysis will be discussed in Chapter 6.

6. Chapter 6. Copper-base metal analysis results: implications for chronology, trade, hybridity, cultural affiliation and ethnic identity

In this chapter, I present results of qualitative and quantitative analyses of copper-base metal artifacts such as tinkling cones, rolled beads, and production scraps from sites in the study region. In order to address regional-scale research questions in this dissertation, it was necessary to study the exchange and modification of both metal and glass artifacts because historic-era sites in the Upper Great Lakes region are typically identified on the basis of the presence of "trade goods," and both glass beads and metal objects are some of the most commonly identified European-made materials found at early historic sites (Quimby 1966:64-65). Metal artifacts have been examined less frequently than glass beads, except in cases of unique or temporally diagnostic metal objects such as iconographic "Jesuit" rings or firearm parts (Bodoh 2004; Gladysz 2011; C. I. Mason 2009; C. I. Mason and Ehrhardt 2009). However, recently Ehrhardt (2005, 2013) and Anselmi (2008) have pioneered approaches to the analysis of copper-based metal artifacts tinkling cones, other adornments, and "scrap" metal that are often abundant on historic-era sites, and I adopted these methods in my own analyses of copper-base metal.

In the Upper Great Lakes region, several thousand years of copper-working experience provided a technological foundation for later Indigenous peoples, for whom copper-based metal was an important resource and well-known raw material during the historic era (C. E. Brown 1904; Cushing 1894; G. R. Fox 1911; W. A. Fox et al. 1995; Martin 1999; Pleger 2000). I conducted a qualitative and quantitative attribute analysis of 3,705 copper and brass objects from 25 Upper Great Lakes archaeological sites dated to the seventeenth and eighteenth century (Table 6.1 and Figure 6.1) in order to study the *chaîne opératoire* or the production sequence of copper-based metal objects in the historic era. I identified regional heterogeneity in the methods of production used to manufacture “hybrid” material culture forms that are recognized as hallmarks of colonial interaction, such as tinkling cones and projectile points fashioned from European-made trade kettles and other metals. Many factors affected these technological practices including availability of metal trade items at particular locations at certain points in time, contexts of use and deposition, and social aspects of trading partnerships structured by ethnic affiliation and other cultural influences. In some situations, influences of individual factors on technological practice were identifiable using contextual information from the historic record, but in other instances the effects of these factors could not be separated.

There are three organizational sections in this chapter. The first section (6.1) presents the results of the metal attribute analyses in three parts. Section 6.1.1 is a comparison of finished, unfinished, and partially worked forms present in assemblages of >50 or more copper-based metal artifacts organized by archaeological site and temporal period, illustrating both temporal and geographic differences in working methods applied to copper-based metal. Section 6.1.2 then compares attribute data for finished artifact types, while Section 6.1.3 addresses unfinished or scrap pieces; both of these parts further demonstrate that there are further regional and possibly ethnically or culturally-associated patterns of difference in metal ornament production identifiable using qualitative and quantitative attribute analysis methods. For readers most interested in the interpretations for each subsection as they relate to the research questions, please refer to the summaries and discussions at the ends of sections 6.1.1, 6.1.2, and 6.1.3.

The second section of this chapter (6.2) presents the results of two small-scale archaeometric studies in which 58 artifacts were analyzed to test the effectiveness of LA-ICP-MS and other methods in the investigation of copper-based metals. I found that pXRF is a fast and effective method of generally differentiating between native and smelted copper, but that

LA-ICP-MS was not suitable for distinguishing the individual composition of metal artifacts for the purpose of identifying pieces of the same original artifact, such as a kettle. The third section of this chapter (6.3) provides an overarching summary of the results of attribute and archaeometric analyses of copper-based metal adornments, tools, and production waste in relation to the research questions as applied to copper-based metal. These metal analyses clarify archaeological understandings of the availability of copper-based trade items across the region over time, document the effects of conflict and restricted trade on metal recycling practices, and provide evidence of cultural difference between French colonial and Indigenous habitations sites.

The majority of my metals research focused on physical attribute analyses to address the research questions about ethnic identity and hybridity by looking for patterns of difference related to technological style across culturally-distinct communities. As with the glass bead analyses, archaeological assemblages were selected using a snowball sampling strategy that sought to include as many different sites as possible within the region and timeframe under consideration. Unlike the glass beads chapter, metal artifacts from surface collections are not included from most sites unless a sample from controlled excavation was available for comparison. This chapter includes more qualitative discussion of technological style and similarities and differences among assemblages than the previous chapter because the metals attribute analysis method requires investigation at the assemblage-level, rather than a discussion of individual artifact compositions, as in glass bead chemical analyses. Equifinality is a major factor in the interpretive sections of this chapter because copper-base metal resource availability, differential participation in trade networks based on social ties or fictive kinship, migration, down-the-line-exchange, and culturally-defined technological style preferences all may have influenced the amounts, forms, and methods of reworking copper-based metals across the region.

Table 6.1: Summary table of all sites contributing copper-based metal artifacts to the study, with assemblages >50 artifacts in bold.

Site	Dates of occupation	Area[1]	Predominant ethnic group(s)	# of artifacts included
20 CN 51	c.1670 – 1730	MI	Unknown	15
47 WN 853	17th C?	LW	Oneota?	8
Arrowsmith	c 1730	LW	Meskwaki	27
Bell	**c. 1680 – 1730**	**LW**	**Meskwaki**	**958**
Cadotte	17th – 18th C.	LS	Huron, Odawa	29
Camp Shaginappi	17th – 18th C.	LW	Unknown	23
Cloudman	early 17th C.?	MI	Odawa	11
Clunie	early 17th C.?	MI	unknown	11
Doty Island (Mahler)	**c. 1680 – 1712?**	**LW**	**Meskwaki**	**60**
Doty Island (Village)	**c. 1720 – 1780**	**LW**	**Winnebago**	**247**
Elmwood Island	18th C?	FLK	unknown	28
Farley Village	17th C	W	Ioway	21
Ft. Michilimackinac	**1715-1781**	**MI**	**Multiethnic?**	**62**
Fort St. Joseph	**1691 – 1781**	**MI**	**Multiethnic?**	**81**
Goose Lake Outlet #3	mid 17th C	MI	unknown	2
Gros Cap	**17th C**	**MI**	**unknown**	**75**
Hanson	c. 1650 – 1680	GBDP	Huron?	325[2]
Marina	c.1715 – 1775	LS	Multiethnic?	33
Markman	c. 1665-1680	LW	Meskwaki	8
Marquette Mission	**c. 1670 – 1701**	**MI**	**Huron**	**536**
McCauley	17th – 19th c?	GBDP	Oneota?	33
Norge Village	17th and 18th c.	MI	unknown	2
North Shore Village	18th c.?	FLK	unknown	15
O'Neill	late 17th c?	MI	unknown	4
Peshtigo Point	17th and 18th c.	GBDP	Menominee?	15
Rock Island Period 1	Prehistoric - c. 1640	GBDP	Oneota, Potawatomi	21
Rock Island Period 2	1650/51	GBDP	Huron-Petun-Odawa	5
Rock Island Period 3	**1670-1730**	GBDP	**Potawatomi**	**652**
Rock Island Period 4	**1760-1770**	GBDP	**Odawa**	**112**
Rock Island general	c. 1650s – 1770s	GBDP	(mixed components)	156
Zimmerman	**c. 1650 – 1690**	**S**	**Illinois**	**130**
TOTAL:				**3705**

[1] Areas correspond to those described in sections below: MI = Michigan's Lower Peninsula and Straits of Mackinac; GBDP = Green Bay and Door Peninsula of Wisconsin; LS = Lake Superior area; LW= Lake Winnebago area and Arrowsmith; FLK = Fox Lake and Koshkonong area; W= Western neighbors; S = Southern neighbors; TX = Texas

[2] A single string of tiny, rolled metal beads discussed qualitatively in Section 6.1.2 but not included in metals database as individual artifacts

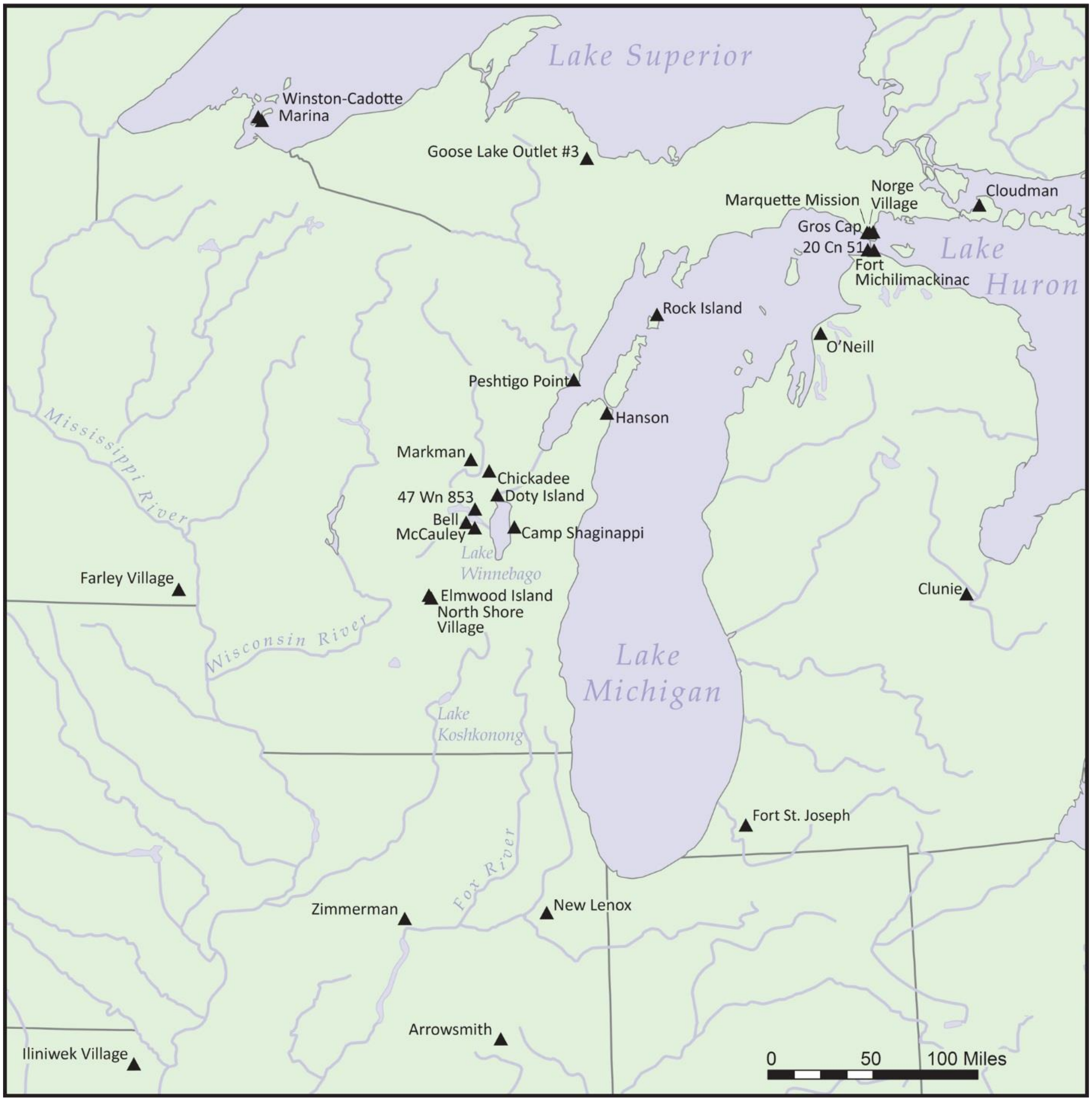


Figure 6.1 Map of all archaeological sites contributing copper-base metal artifacts to the attribute and archaeometric analyses

6.1 Metals attribute analysis results

In the following sections, through attribute analyses and comparative discussion, I identify chronological, regional, and ethnic patterning in the technological style of copper-base metal artifacts within the Upper Great Lakes study sample. Based on the ratios of finished to unfinished artifacts, the types of adornments and tools produced, the kinds of recycling conducted (e.g. patching), and the size of scrap pieces, I demonstrate that some regions may have had limited access to resources, while French fortification sites had greater access. Furthermore, there are variations in the forms and technological styles of finished artifacts that may relate to the predominant cultural affiliation of individual communities, or regional patterns of practice.

6.1.1 Attribute analysis data for copper-based metal assemblages > 50 artifacts

In this section, I compare the overall make-up of the largest contributing assemblages of reworked copper-based metal artifacts examined from seventeenth or early eighteenth century Upper Great Lakes sites. To reduce the "noise" from small sites or those with questionable dating or mixed components, I focus on assemblages of > 50 artifacts. Assemblages of >50 artifacts come from the sites with the best temporal control and most thorough archaeological investigations that produced assemblages of sizes sufficient to capture the diversity of artifact contexts. By focusing on the larger assemblages, I am able to compare a sufficient number of sites across the region and varying in dates of occupation, while excluding the smallest and therefore least representative assemblages. Comparing assemblages of >50 metal artifacts also minimizes the effects of differential resource availability due to time and geographic location by ensuring that broad geographic and temporal range of sites were compared; comparing only very large assemblages (e.g. >250 artifacts, n = 4) would restrict the geographic scope of the project. The two dating periods used to divide the sites are admittedly broad and overlapping, ranging from an "earlier" period covering the mid-seventeenth through the early eighteenth century, (1650s to 1730s) and a "later" period including most of the eighteenth century (1700s to 1780s). This broad dating range is necessary given the long occupation periods and ambiguous dates of habitation for many of the sites in the study sample.

To compare these different assemblages, I considered site formation and sampling factors that affected the kinds and amounts of artifacts that are present in each archaeological collection, to understand how assemblages might be differ from one another as a result of sampling, not past human behavior. Comparing large assemblages at the site level, rather than looking at particular features or the makeup of small assemblages, accounts for different excavation and site formation histories of the sites. I present the data in a way that is fully comparable with ongoing work in the Illinois region (Ehrhardt 2013) and according to Ehrhardt's functional typology (2005) in order to keep the focus on the technological choices of past people, rather than on differential deposition in the archaeological record or varied excavation practices. Ehrhardt's typology divided artifacts into finished and unfinished categories, then into intact or fragmentary subcategories, and finally assigns the object to a particular functional type (Figure 6.2).

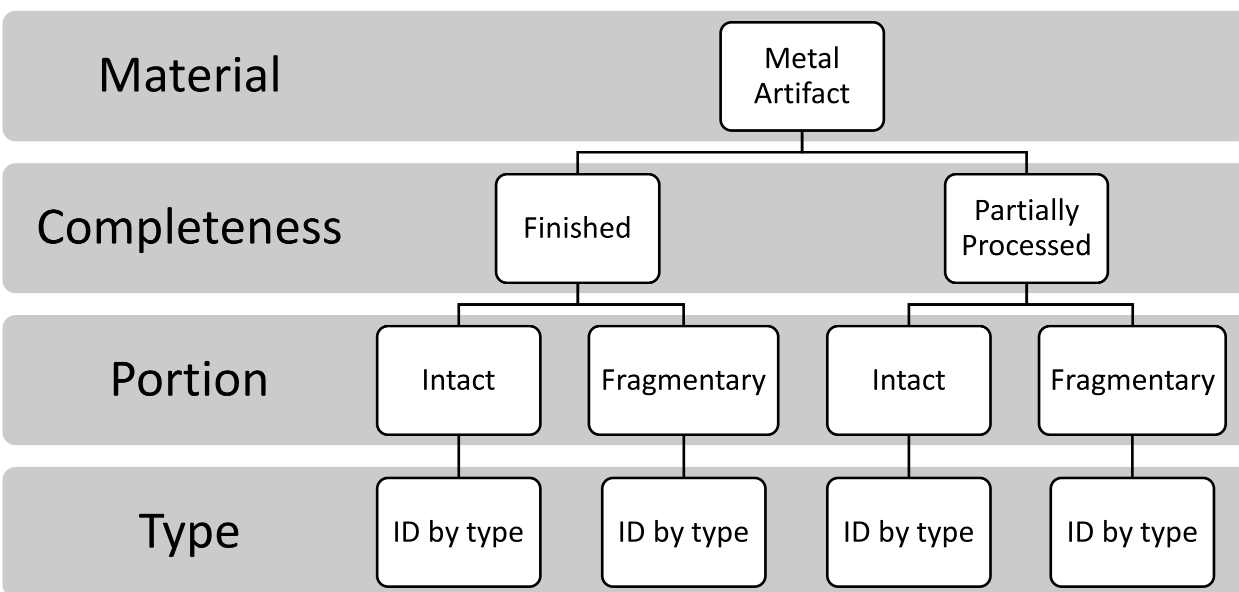


Figure 6.2: Schematic diagram of functional typology based on Ehrhardt (2005:105-106)

Types include finished objects like tinkling cones, beads, and tubes, while partially-processed items are blanks for ornament production, scrap, and other waste material. However, since artifacts are often curated by type (e.g. a box of tinkling cones), in practice, it makes more sense to apply the typology in reverse, beginning with a set of artifacts of the same type (and material), and then assessing completeness and portion. I compare the overall makeup of assemblages with >50 artifacts, sorted by estimated dates of occupation, following the format of Ehrhardt's most recent publication of the Iliniwek site materials (2013: Table 16-3), which are included in my comparisons (Table 6.2). I include Ehrhardt's tabulation of the Iliniwek site materials because they are directly comparable to the sites that I analyzed, especially the Zimmerman site, which was occupied at roughly the same time in the Illinois region.

Based on the general comparison of sites in this way, several patterns emerge. There is a regional, possibly culturally-influenced preference for tinkling cones at most Upper Great Lakes sites, but rolled metal beads predominate assemblages in Illinois country. The Bell Site has the greatest proportion of patches and patched pieces, possibly related to a sharp decline in resource availability precipitated by conflict. Partially processed or "scrap" pieces not worked into recognizable finished forms predominate the assemblages at Fort St. Joseph and Fort. Michilimackinac, which may be indicative of relatively easy access to trade items at these French Colonial sites. I discuss these and other findings in greater detail on a site-by-site basis by summarizing the copper-based metal artifact types present in each assemblage and considering particular site formation processes and excavation methods that might have affected the results of the proportions of artifact types recovered at each site. After the discussion of each of the major site assemblages, I conclude my discussion of the major assemblages with a regional and temporal comparison and summary of findings by making direct comparisons of the proportions of types and artifact completeness (finished vs partially processed artifacts) in section 6.1.1.9.

Table 6.2: Summary of artifact categories by time period and site for assemblages >50 copper-based metal artifacts, including comparative data for Iliniwek Village[2]

Mid 17th c. to early 18th c. (1650s-1730s):	Bell	Doty Island (Mahler)	Gros Cap	Marquette Mission[1]	Rock Island (Pd. 3)	Zimmer-man	Iliniwek Village[2]
Finished Artifacts:							
Beads (single beads or "mail" segments)	0[3]	13	1	3 (136)	2[4]	17	243
Spirals	0	0	0	0	1	0	2
Clips	0	0	0	2	3	7	173
Tinkling Cones	142	11	34	161 (182)	155	8	41
Bracelets	5	0	0	1	7	0	1
Rings	0	0	0	4	2	0	5
Tubes (long, tubular beads or "hair pipes")	33	2	1	29 (66)	16	1	10
Coils	0	0	0	1	2	0	3
Pendants	3	1	0	1	3	0	0
Projectile Points	0	0	3	7 (21)	14	0	0
Fragments (of finished artifacts)	3	1	0	0	9	1	136
Partially Processed artifacts:							
Blanks	145	13	12	78 (22)	147	29	333
Tubing	3	0	0	26	10	26	78
Wire	5	2	0	11	10	0	2
Scrap	432	12	18	195 (276)	219	35	353
Kettle Parts:							
Rivets/Kettle Parts	21	2	0	8 (9)	11	1	10
Patches and patched pieces (fragmentary)	112	1	5	6	34	0	0
Patches (whole)	54	1	1	0 (11)	5	0	0
Native Copper (attribute ID only)							
Finished	0	0	0	0	1	0	2
Unfinished	0	0	0	0	1	0	0
Other:							
Nodule/lump	0	0	0	0	0	0	1
Miscellaneous	0	1	0	3 (16)	2	0	0
TOTAL:	**958**	**60**	**75**	**536**	**652**	**125**	**1393**

[1]Identifies only artifacts examined and added to the copper-base metal database; data in parentheses are tabulations from published site reports (Table 6.11). If no parentheses, consider the value to be unknown. Value for blanks is a combination of "triangles/diamonds" and "discs." See further discussion of this assemblage in section 6.1.1.6
[2] Data from Ehrhardt (2013:382-383)
[3] Small rolled beads were recovered at Bell but not included in final counts; see section 6.1.2.2
[4] Includes a woven "mail" fragment with 8 rolled beads, counted as a single artifact and discussed in section 6.1.2.2

Table 6.2 (continued): Summary of artifact categories by time period and site for assemblages >50 copper-based metal artifacts

Mid 18th c. sites (1700s- 1780s):	**Doty Island (Village)**	**Fort St. Joseph**	**Fort Michili-mackinac**	**Rock Island (Pd. 4)**
Finished Artifacts:				
Beads (small rolled)	16	0	0	1
Spirals	3	1	0	1
Clips	5	0	0	0
Tinkling Cones	53	6	6	29
Bracelets	0	0	0	1
Rings	0	1	0	0
Tubes (tubular beads)	5	0	1	1
Coils	0	0	0	1
Pendants	0	0	0	3
Projectile Points	0	0	0	5
Fragments (of finished artifacts)	1	0	0	0
Partially Processed artifacts:				
Blanks	42	14	5	18
Tubing	2	0	0	1
Wire	10	10	0	1
Scrap	79	37	45	38
Kettle Parts:				
Rivets/Kettle Parts	2	4	1	6
Patches and patched pieces (fragmentary)	17	4	1	4
Patches (whole)	0	0	0	1
Native Copper (attribute ID only)				
Finished	1?	0	0	0
Unfinished	0	0	0	0
Other:				
Nodule	1	0	3	0
Miscellaneous	8	2	0	1
TOTAL:	**247**	**79**	**62**	**112**

6.1.1.1 Bell Site attribute analysis results

The extensive excavation history of the Bell Site (see Ch. 3, section 2.4.4) required special attention to artifact contexts and the effects of different recovery methods. To verify the general comparability of all collections from the Bell site, I systematically examined proportions of artifacts collected using uncontrolled surface collection and metal-detecting (the Petersen collection), feature-targeted excavation (Wittry 1963), and modern archaeological methods (UW-Oshkosh, Behm 1993, 1998, 2008). I standardized my inclusion of artifacts based on this investigation. For example, water screening and flotation conducted by UW-Oshkosh (UW-O) recovered small rolled metal beads, which were not collected by Wittry or Petersen. Therefore, these beads are not included in the final Bell Site artifact counts, and were not assigned database IDs but instead are discussed qualitatively below, in section 6.1.2.2. I compared the proportions of artifact types recovered through each excavation method and identified the greatest differences in proportions of assemblages were present in blanks, tinklers, and scrap (Figure 6.3).

To test the significance differences among assemblages, I conducted chi-square tests on proportions of blanks, tinklers, and scrap compared to all other copper-based metal artifacts in each collection. For the chi-square test, the null hypothesis is that the relative abundance of each type in a given assemblage would be the same as its relative abundance in the other assemblages, which were collected at different times and under different circumstances. If the null hypothesis is rejected it means that assemblages collected with different methods are not comparable for that type, but if it is accepted it means the assemblages are comparable. I found that the p-value for blanks and tinklers was <0.05, which means the null hypothesis is rejected, while the p-value for scrap was $p = .067$ (approaching significance) (Table 6.3). This means that for blanks and tinklers, the assemblages are different from one another in a statistically meaningful way.

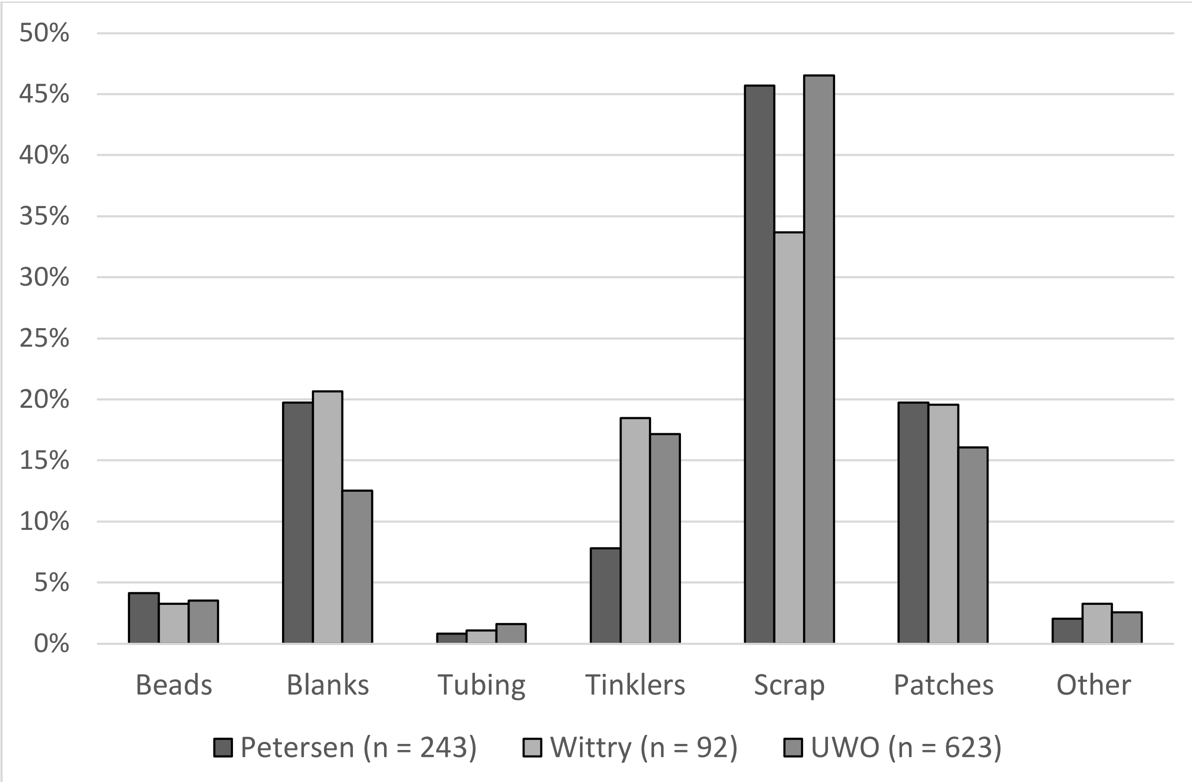


Figure 6.3: Proportions of assemblages in each general artifact category, showing that the differences among collections are greatest for blanks, tinklers, and scrap.

Table 6.3: Counts, percent assemblages, and chi-square test values for scrap, tinklers, and blanks. Method refers to collection method for artifacts (Petersen, Wittry, or UWO) and % within method is the % of the assemblage that each artifact category represents.

Method and counts for each test	**Scrap**		**Tinklers**		**Blanks**	
	Scrap	**Non-scrap**	**Tinkler**	**Non-tinkler**	**Blank**	**Non-blank**
Petersen (n=243):	111	132	19	224	48	195
% within method	45.7%	54.3%	7.8%	92.2%	19.8%	80.2%
Wittry (n=92):	31	61	17	75	19	73
% within method	33.7%	66.3%	18.5%	81.5	20.7%	79.3%
UWO (n=623):	290	333	107	516	78	545
% within method	46.5%	53.5%	17.2%	82.8%	12.5%	87.5%
TOTAL (n=958):	432	526	143	815	145	813
% of assemblage	45.1%	54.9%	14.9%	85.1%	15.1%	84.9%

Chi-Square results for Scrap, Tinklers, and Blanks compared									
	Value	**df**	**p-value**	**Value**	**df**	**p-value**	**Value**	**df**	**p-value**
Pearson Chi-Square	5.394	2	.067	13.061	2	.001	9.531	2	.009
Likelihood Ratio	5.513	3	.064	14.622	2	.001	9.229		.010
Linear-by-Linear Assoc.	.330	1	.566	10.759	1	.001	8.232		.004
N of Valid Cases	958			958			958		

Although there are statistically significant differences for tinklers, blanks, and to a lesser extent scrap, among the collections from each excavation method, proportions of other artifact types are similar across the collections. Differences in proportions of tinklers, blanks, and scrap might be explained by archaeological recovery methods. Peterson's metal detecting strategy may have preferentially located the larger scraps and missed the smaller tinkling cones. Wittry's investigations may have produced proportionally less scrap than Peterson or UW-O, and the greatest proportion of tinkling cones, because Wittry's excavations targeted features, most of which were mixed refuse pits or storage pits filled with refuse. Fragments of cloth with tinklers, loose tinkling cones, blanks, and other partially worked waste might be more common in such features than in non-feature contexts. Wittry's feature-targeted approach to excavations would then result in greater recovery of more tinklers and blanks than one might find in general discard patterns from the non-feature contexts investigated by Petersen and UW-O. Conversely, the UW-O excavations screened soils from both matrix and features; the greater proportion of tinklers in the UW-O collection as compared to Petersen might therefore come from the recovery of tinkling cones that entered the archaeological record as a result of loss across the site during daily use. This would incorporate them into the general site contexts but not necessarily result in their secondary disposal in a midden pit.

There is also a consistent underlying pattern in the abundance of each artifact type across the collections: within the Petersen and Wittry collections, scrap is most abundant, followed in order by blanks, patches, tinklers, beads, other, and tubing. The UW-O collection follows the same pattern, with the order of tinklers and blanks reversed (Table 6.4). Despite the statistically significant differences among the three collections in the proportions of particular artifacts recovered, this underlying pattern also makes it reasonable to combine the three collections.

Table 6.4: Table of abundance of artifact types for each of the three collection methods employed at the Bell Site. Shading highlights differences in abundance for blanks and tinklers.

Abundance of types (least → greatest)	Petersen	Wittry	UW-Oshkosh
	Scrap (45.7%)	Scrap (33.7%)	Scrap (46.5%)
	Blanks (19.8%)	Blanks (20.7%)	Tinklers (17.2%)
	Patches (19.8%)	Patches (19.6%)	Patches (16.1%)
	Tinklers (7.8%)	Tinklers (18.5%)	Blanks (12.5%)
	Beads (4.1%)	Beads (3.3%)	Beads (3.5%)
	Other (2.1%)	Other (3.3%)	Other (2.6%)
	Tubing (0.8%)	Tubing (1.1%)	Tubing (1.6%)

Therefore, although proportions of scrap, and to a lesser extent, tinklers and blanks are statistically different, I combined all analyzed Bell Site artifacts to provide a practical average of the materials present on the Bell Site that I assume to be a representative sample of Meskwaki activities there. No proportion for the individual assemblages differs from the combined mean proportions by more than +/- 6% (Table 6.5). In the context of this relatively large sample size, differences between collections are minimal, especially when collections are combined to produce a final assemblage that is most heavily influenced by the largest and most recent archaeological sample, the UWO assemblage.

Table 6.5: Bell site assemblages compared. A "Clips" column is included here for comparison since clips are present at other sites in the study sample. (+/-) is one standard deviation, which shows that there were the greatest differences in collections for scrap, tinklers, and blanks.

	Clips	**Beads**	**Blanks**	**Tubing**	**Tinklers**	**Scrap**	**Patches**	**Other**	**TOTAL**
Petersen (n=243)	0	10	48	2	19	111	48	5	243
% assemblage	0%	4%	20%	1%	8%	46%	20%	2%	100%
Wittry (n=92)	0	3	19	1	17	31	18	3	92
% assemblage	0%	3%	21%	1%	18%	34%	20%	3%	100%
UWO (n= 623)	0	22	78	10	107	290	100	16	623
% assemblage	0%	4%	13%	2%	17%	47%	16%	3%	100%
ST DEV (+/-)	*0.0%*	*0.4%*	*3.6%*	*0.3%*	*4.7%*	*5.9%*	*1.7%*	*0.5%*	--
Bell Site Total (n=958)	**0**	**35**	**145**	**13**	**143**	**432**	**166**	**24**	**958**
% Assemblage	**0.0%**	**3.6%**	**15.2%**	**1.4%**	**14.9%**	**45.1%**	**17.3%**	**2.5%**	**100%**

Based on the great quantity of copper-based metal artifacts in the combined Bell Site assemblage, inhabitants frequently manipulated trade kettles and other copper-based materials to produce finished objects including tinkling cones, rolled beads, and other objects of personal adornment, along with scrap and partially worked pieces. Patching was a common method of extending the use-life of kettles, and use of tubing and beads was minimal.

6.1.1.2 Doty Island attribute analysis results

The Village Portion of the Doty Island site was a c. 1720 – 1780 Ho-Chunk (Winnebago) occupation, while the Mahler portion was a c. 1680 – 1710 Meskwaki (Fox) habitation area (R. P. Mason and Mason 1993, 1997). During the investigation of chemical composition of glass beads from the Doty Island site, I found glass recipe differences corresponding to occupation periods of the Mahler and Village portions of the site. Although the site portions are directly adjacent to one another, only a few meters apart, these metal assemblages are considered separately because of their likely temporal and cultural differences (Table 6.6). After further consideration of the assemblages, I excluded 5 of metal artifacts from the final study (one from Mahler and four from the Village portion) because they were visually identified as non-copper-based metal or indeterminate after scratch tests, and include a twisted silver fragment, a probable lead lump, a piece that disintegrated during handling, and two pieces of likely later-historic trash. This left a total of 307 artifacts described using the copper-base metal typology.

Table 6.6: Doty Island assemblages compared

	Clips	**Beads**	**Blanks**	**Tubing**	**Tinklers**	**Scrap**	**Patches**	**Other**	**TOTAL**
Mahler Portion	0	15	13	2	12	12	2	4	60
% assemblage	0.0%	25.0%	21.7%	3.3%	20.0%	20.0%	3.3%	6.7%	100%
Village Portion	5	22	42	15	53	79	17	14	247
% assemblage	2.0%	8.9%	17.0%	6.1%	21.5%	32.0%	6.9%	5.7%	100%

The two Doty Island assemblages differ qualitatively and quantitatively. In the Mahler portion, rolled or hollow tubing is present, but two copper-base solid wire fragments make up the members of the "tubing" category. The tubes, tubing, and objects made from these category is more diverse in the Village portion and includes hollow tubing, wire, and spirals or coils from flat strips. Clips are also present in the Village portion but not the Mahler portion. The differences in glass bead chemistries noted in Chapter 5, and rolled metal artifact attributes, support the separation of the two spatially-adjacent Doty Island site components based on chronology and historically-documented ethnic affiliation (R.P. Mason and Mason 1993; 1997).

6.1.1.3 Fort St. Joseph site attribute analysis results

At Fort St. Joseph, excavations have not yet defined clear internal stratigraphy to delineate the relatively long occupation history of this site (c. 1691 to 1785), nor any site organization that might separate activity areas or cultural groups present, so all artifacts should be considered to be from a general historic-era occupation. Both the Fort St. Joseph site itself and the adjacent Lyne terrace (20 BE 23) were affiliated with a diverse group of local inhabitants including French, British, Miami and Potawatomi people along with visitors of these and other ethnic affiliations, as described in documentary records (Nassaney and Brandao 2009; Nassaney et al. 2012). Because of this diversity, Fort St. Joseph is considered a multi-ethnic community (Nassaney 2012). Copper-base metal objects from the Fort St. Joseph site were selected from feature and unit contexts available from the 2002, 2004, 2006, 2008, 2009, and 2010 excavation seasons. A total of 81 artifacts were included in the database, but two were excluded from the final count: one because it refits with another artifact, and another because it is not from a category of copper-base metal considered in this study (Table 6.7).

Table 6.7: Summary data table for the Fort St. Joseph metals

	Clips	Beads	Blanks	Tubing	Tinklers	Scrap	Patches	Other	TOTAL
FSJ	0	0	14	12	6	37	4	6	79
% assemblage	0.0%	0.0%	17.7%	15.2%	7.6%	46.8%	5.1%	7.6%	100%

Partially worked materials, mainly scrap and blanks, dominate the assemblage, indicating that while breaking-down copper-based metal trade items may have been an important activity, the production of finished forms was less common. Conversely, wearers of tinkling cones and metal beads may not have lost or discarded these adornments as frequently as at other sites. Eleven of the 12 artifacts in the tubing category are small wire fragments, not B-shaped tubing more common on sites without a sustained European presence. Based on these findings, the multi-ethnic community of Fort St. Joseph employed a distinctive technological style of metal reworking unlike other sites in the study sample, with the exception of Fort Michilimackinac.

6.1.1.4 Fort Michilimackinac attribute analysis results

More than half a century of excavation at Fort Michilimackinac has collected thousands of copper-base metal artifacts; however, most come from British occupation layers or the mixed-component “demolition” layer marking the transition from French to British control of the site in 1781 (Evans 2001; Reck 2004:321-332). By reviewing the Southeast Rowhouse House D fieldnotes and conducting searches for “French” and “metal” artifacts in the collection’s ARGUS database, I identified a total of 62 artifacts, from SE Rowhouse House D, the Rue de la Babillarde, and the parade ground, in levels associated with other French material (Table 6.8). The goal of the detailed contextual investigation was to determine if French and Métis individuals at the site employed distinctive metalworking and recycling practices. Since Natives and Europeans involved in the fur trade both made and wore tinkling cones at Fort

Michilimackinac (Morand 1994:54), I expected to identify some reworking practices similar to those documented at other sites in my sample. Two tinklers were examined from French or Métis contexts of SE Rowhouse House D (Evans 2001:22) but these artifacts did not differ in form or technological style from other tinkling cones in the study.

However, the metal reworking industry of the Fort Michilimackinac artifact sample is distinct from other sites in the study sample because it contains the highest proportion of "scrap" material. Based on the presence of three heated brass or copper nodules identified with scratch tests, recycling by blacksmiths may have been a common way to dispose of copper-based metal. Further evidence of high temperature metalworking, in the form of brass waste and forged slag, was documented near Southeast Rowhouse House D (Evans 2001:44). In contrast to other sites in my study sample, where scoring, clipping, and other non-pyrotechnic activities were common, blacksmiths at Fort Michilimackinac may have recycled scrap copper and brass by forging and smelting. The collection of scrap metal for smelting, rather than reworking into ornaments, therefore may explain the dominance of scrap in the Fort Michilimackinac assemblage.

Table 6.8: Summary data table for the Fort Michilimackinac metals

	Clips	**Beads**	**Blanks**	**Tubing**	**Tinklers**	**Scrap**	**Patches**	**Other**[1]	**TOTAL**
CM	0	1	5	0	6	45	1	4	62
% Assemblage	0.0%	1.6%	8.1%	0.0%	9.7%	72.6%	1.6%	6.5%	100%

6.1.1.5 Gros Cap site attribute analysis results

Although all Gros Cap artifacts in the study analyzed come from non-burial areas, the behavioral context of Gros Cap as both a cemetery and village site (Martin 1979; Nern and Cleland 1974; Quimby 1963) differs from most other sites in my study sample. Two collections from different archaeological investigations are combined because of similar recovery practices:

[1] Includes the three heated brass or copper nodules from French contexts

Michigan Technological University (MTU) conducted extensive shovel test-pits in disturbed and undisturbed areas (Martin 1979), while the Michigan Office of the State Archaeologist (MOSA) salvaged several disturbed features (Halsey 1986). The collections also may be combined because looters and local collectors repeatedly visited the site for many years prior to professional investigations (Nern and Cleland 1974:2), and therefore the spatial contexts of metal artifacts from Gros Cap may be more homogenized or compromised than other large assemblages in this study (see Ch. 2). Before combining, artifacts from both collections have been separated to highlight similarity and differences (Table 6.9).

Table 6.9: Summary data table for both Gros Cap metals collections

	Clips	**Beads**	**Blanks**	**Tubing**	**Tinklers**	**Scrap**	**Patches**	**Other**	**TOTAL**
MTU	0	2	6	0	26	15	4	1	54
% Assemblage	0%	3.7%	11.1%	0.0%	48.1%	27.8%	7.4%	1.9%	100%
MOSA	0	0	6	0	8	3	2	2	21
% Assemblage	0%	0.0%	28.6%	0.0%	38.1%	14.3%	9.5%	9.5%	100%
Gros Cap Total:	**0**	**2**	**12**	**0**	**34**	**18**	**6**	**3**	**75**
% Assemblage	0%	2.7%	16.0%	0.0%	45.3%	24.0%	8.0%	4.0%	**100%**

Since activities at Gros Cap included numerous mortuary events (Quimby 1963) and there was a high degree of site disturbance between habitation and mortuary areas, I expected to encounter a higher ratio of finished artifact forms to production waste as compared to sites where daily habitation activities produced the majority of the assemblage. Despite the fact that no associated grave goods were included in my study, there were more tinkling cones, beads, projectile points, and other finished artifacts in the Gros Cap site metals assemblage compared to other sites in the study sample. Other explanations for this pattern may be that the Gros Cap residents traded with nearby communities at St. Ignace to obtain finished objects, or residents simply dedicated more effort to recycling scrap into recognizable finished forms.

6.1.1.6 Marquette Mission site attribute analysis results

Several different programs of excavation at Marquette Mission over five decades (Branstner 1992; Fitting 1976a,b; O'Gorman 2007b) produced thousands of copper-based metal objects from surface collections, general levels, and feature and non-feature contexts from this historically-documented locale of French and Native American (predominantly Huron) interaction. Recent GIS analyses indicated that a French-style structure was constructed on top of an earlier Huron occupation (O'Gorman 2007b:95), so I developed a sampling strategy to select the most temporally secure copper-base metal artifacts from both of those contexts. I analyzed metal artifacts from feature contexts that included locally-made ceramics and that were either inside or just outside of a Huron-style longhouse, and metal artifacts directly associated with the French-style structure (Figure 6.4). This produced a sample of a total of 536 copper-based metal artifacts that could be located in the collections (Table 6.10).

Table 6.10: Summary data table for available Marquette Mission metal artifacts.

	Clips	**Beads[1]**	**Blanks**	**Tubing**	**Tinklers**	**Scrap**	**Patches**	**Other**	**TOTAL**
Located artifacts	2	9	78	67	161	195	6	18	536
% of sample	0.4%	1.7%	14.6%	12.5%	30.0%	36.2%	1.1%	3.5%	100%

Some rolled beads (or "copper mail"), copper "discs," and kettle parts identified in yearly excavation reports (Brantsner 1984, 1985, 1986, 1987) could not be located in the curated collections from the Marquette Mission site. This skews the proportions of types examined from each of the targeted features. For example, feature 201, described as a greasy sheet midden excavated during the 1986 season, contained copper mail, kettle lugs, and a copper disc (Branstner 1987: 26), but none of these artifacts affiliated with this feature could be located, though tinkling cones and metal scrap from the feature were present in the collection. As a result,

[1] Not all beads identified in excavation reports were available for analysis

quantitative discussions of the proportions of artifact types for the analyzed artifacts from this assemblage are less comparable to other sites; however, attribute analyses of tinkling cones and scraps (section 6.1.2) provide important qualitative and stylistic information about production practices and preferred finished forms of copper-base metal personal adornments at the site.

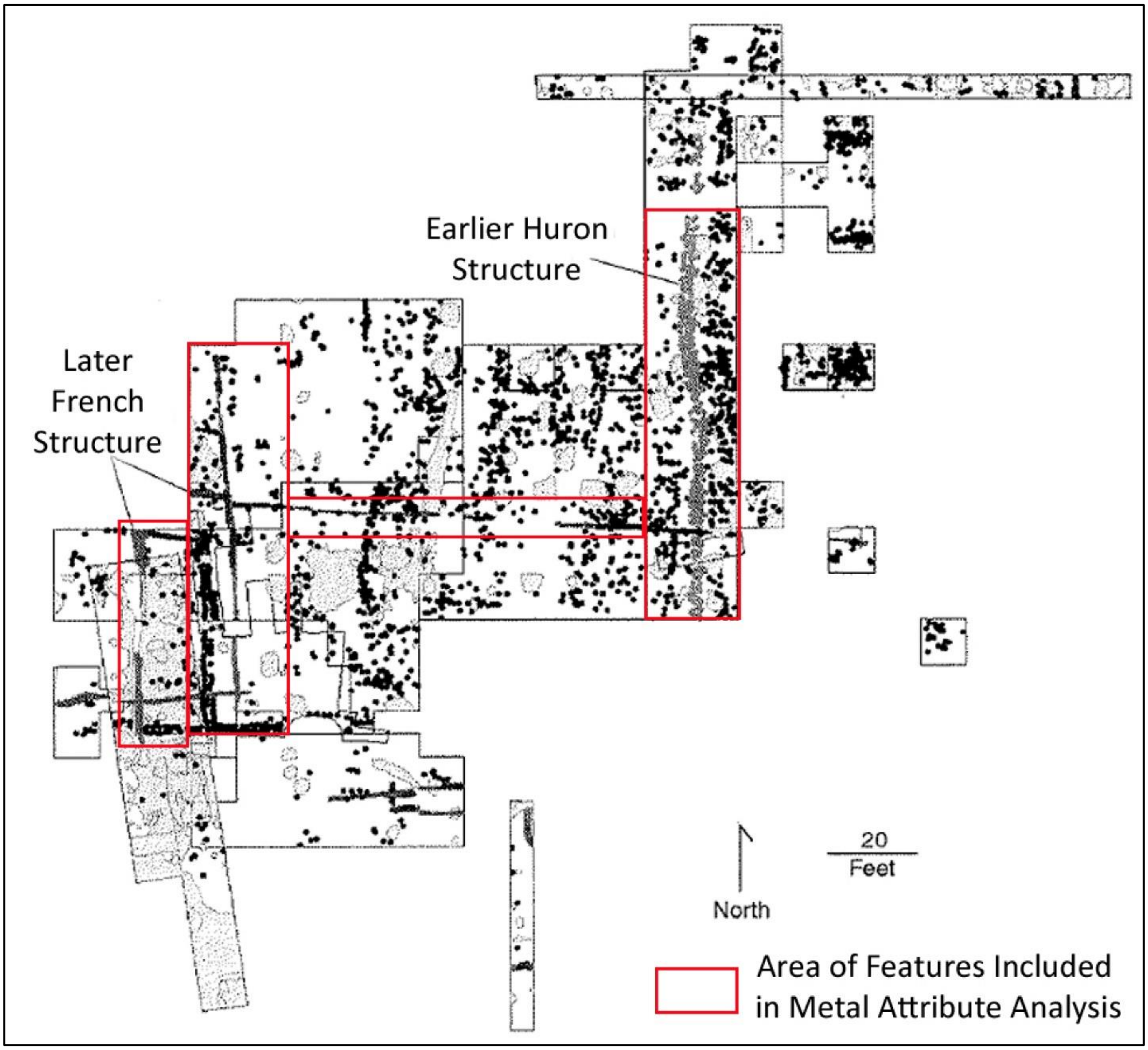


Figure 6.4: Complete site map of excavations at Marquette Mission, highlighting the locations of features associated with both the earlier Huron structure and the later French structure (adapted from O'Gorman 2007b:94).

To approximate the proportions of unavailable artifact types that were present in the features that I sampled, I tabulated the recorded value for each artifact type using the yearly excavation reports, which sort artifacts using categories adopted from Lyle Stone's typology created for Fort Michilimackinac (1974). For earlier features (27-79) from Fitting's excavations, I sorted the artifacts into the categories used later. When site reports were ambiguous about contexts of artifacts (e.g. 24 tinkling cones were recovered in 1984, but they are not listed by feature), I consulted an inventory prepared by Michigan State University (MSU) curatorial staff. In general, counts of tinkling cones and scrap corresponded well among the feature inventory, site reports, and available artifacts, though some discrepancies occur, with some features contributing more or less artifacts than were listed in inventories. However, Stone's typology conflates some categories used in Ehrhardt's typology as I applied it in this project; for example, rolled beads are counted along with tubes or rolled tubing, and bead and tinkling cone blanks are counted as scrap, so proportions are not comparable for all artifact types. I have taken these factors into account when considering the metal reworking strategy at the Marquette Mission site. Based on the published artifacts and the attribute analysis data collected, both tinkling cones and rolled metal beads, worn on leather straps or belts as "mail," were a significant part of the personal adornment strategy of the Huron and possibly later French occupants at this site.

Table 6.11: Tabulation of artifact types from Marquette Mission from sampled features; data from site reports and MSU inventory. Counts and % assemblage of analyzed artifacts added to the final row for appropriate typological categories.

Feature	Excavation Year	Copper Mail (segments)	Beads	Tinkling Cones	Kettle Patches	Kettle Lugs	Triangles & Diamonds	Discs	Rolled Brass Tubes/Wire	Scrap	Projectile Points	Other/Misc
27	1973									1		
34	1973			1								1
38	1973			1					1			1
48	1973			5			2			8		
79	1973			1						1		
108	1983	1		0						4		
109	1983			1								
114	1983			2						1		
121	1983	58		10						1		
125	1983			2			1			5		
136	1983			4			2	1		4		
144	1983			0								
146	1983			3					1	1		
153	1983			0								
154	1984			3	1	1				11	4	1
155	1984		1	11	1				1	9	3	
157	1984			8	1				2	7		
158	1984			9	2	1			2	16		
161	1984			2						4		
165	1984			18	1			1	2	20	4	
166	1984			4						4		
167	1984			4	2			1	1	17	2	
172	1984			1					2	11		
175	1984			1				1		0		
176	1984								1	3	1	
178	1985	1							1	1		
182	1985	4	2	3						7		
183	1985	2		1		1	1		3	3		
184	1985	1	2	11		1	3		1	5		
185	1985								1	1		

Table 6.11 (continued): Tabulation of artifact types from Marquette Mission from sampled features; data from site reports and MSU inventory. Counts and % assemblage of analyzed artifacts added to the final row for appropriate typological categories.

Feature	Excavation Year	Copper Mail (segments)	Beads	Tinkling Cones	Kettle Patches	Kettle Lugs	Triangles & Diamonds	Discs	Rolled Brass Tubes/Wire	Scrap	Projectile Points	Other/Misc
188	1985	2	1	1					2	3		
189	1985	1							1	13		
190	1985	3		2					1	7		
191	1985	1		2		1			3	2		
192	1985						1		2	1		1
195	1985	1		1					1	3		
201	1986	3		11		1		1		7		1
202	1986			2				1	2			1
203	1986			2	1	1		1	2	13	1	2
204	1986	1							1	2		
205	1986	1		2			1		3	13	1	
206	1986	2		3				1	1	4		
213	1986			1					1			
214	1986	12		2					9	5		
215	1986			8	1	2					2	2
216	1986	13		17				2	5	17	1	1
217	1986			1					2	4		2
222	1986			7				1		12	1	
226	1986	2		2						2		
229	1986	16		3					4	10	1	1
238	1986	1		3	1					7		
257	2001			1					1			
278	2001			1						1		
291	2001	10		3						2		2
303	2001			1						3		
TOTAL (n=739):		**136**	**6**	**182**	**11**	**9**	**11**	**11**	**60**	**276**	**21**	**16**
% assemblage		**18.4%**	**0.8%**	**24.6%**	**1.5%**	**1.2%**	**1.5%**	**1.5%**	**8.1%**	**37.3%**	**2.8%**	**2.2%**
Analyzed artifacts (n=536)			**3**	**131**					**40**	**196**	**7**	**3**
% assemblage			**0.5%**	**30.0%**					**7.5%**	**36.2%**	**1.3%**	**0.5%**

6.1.1.7 Rock Island attribute analysis results

The stratified and tightly dated components of the Rock Island site (Mason 1986; 1990; 1991) make it possible to examine change through time in the Green Bay and Door Peninsula area, but the complicated depositional contexts also required additional attention to provenience information for each artifact. I examined all available copper-base metal artifacts from the site, regardless of occupation period, then worked through the context information for each artifact to assign it to a component. To do this, with the help of a student worker, I converted the original site catalog cards to a full digital inventory spreadsheet used to identify associated artifacts present in the same context as each copper-base metal object. The student then cross-referenced each copper-base metal artifact with the site report (Mason 1986) and coded all copper-base metal artifacts with a cultural period (Pre- or Protohistoric & Period 1 – 4), recording confidence levels of the attribution based on associated temporally diagnostic artifacts and potential for stratigraphic mixing (Table 6.12).

In this way, it was possible to attribute many, but not all, of the copper-based metal artifacts to particular culturally-affiliated historic components (e.g. Potawatomi, Odawa, Huron-Petun) at a reasonable level of certainty. Curators labeled some artifacts according to assigned block numbers (e.g. Unit H, Block 35) while others bear the block coordinates (e.g W15 N10), so an extra step was required to link the coordinate system on the inventory cards to artifacts if only the block number was known. For instance, there was a single piece of "copper mail" recovered from Unit H, and the artifact bears the label "Unit H, Block 35." According to the inventory, only one fragment of copper mail comes from Unit H, from Block W15 N10, so I identify Block 35 as this Block W15 N10. Not all block numbers could be linked to particular coordinates, but a unit and stratigraphic level were often enough information to assign an artifact to a particular component. Some artifacts come from mixed strata, or levels that generally fall into the seventeenth and eighteenth centuries.

Table 6.12: Classification of certainty of cultural affiliation coding for Rock Island metals used in the Filemaker Pro database for metal artifacts

Certainty	**Cultural Affiliation coding example**	**Description**
High: Very certain the artifact is from this period	"Period 3"	Explicitly stated in the site report as a level containing artifacts from that time period.
Moderate: Artifacts from this context most likely come from this period	"Period 3 (*)"	While not explicitly stated, the level can be extrapolated to contain mostly artifacts from a specific period. This may also mean that while the Mason (1986) does not mention the object, the level contains diagnostic artifacts from that time period (usually Period 3).
Fair: Artifact may come from this period	"Period 3 (**)"	The level has been disturbed or the level is a mixed context that contains a variety of material (again, usually from Period 3).
Uncertain	"Unidentified"	Site report and inventory cards do not mention this level; the provenience may be nonexistent.

Of the 946 copper-base metal artifacts in the Rock Island sample, 487 (51%) were assigned to a specific temporal component with a high level of certainty, with another 303 (32%) artifacts assigned a period with a moderate level of certainty. The remaining 156 artifacts come from general historic levels, mixed stratigraphic contexts, or test pits and surface collections; although they are included in the final database they were not used in comparisons of the occupation periods or the inter-site and regional comparisons involving the Rock Island site as a whole because of the low certainty of the time period identified. I have summarized the artifact types with a "high" or "moderate" level of certainty attributed to each of the cultural periods (Table 6.13 and Figure 6.5). Evaluating the culturally-affiliated materials from each period reveals change and consistency through time, despite small sample sizes for early levels.

Table 6.13: Proportions of artifact categories, sorted by occupation period for Rock Island

	Clips	**Beads**	**Blanks**	**Tubing**	**Tinklers**	**Scrap**	**Patches**	**Other**	**TOTAL**
Protohistoric/Period 1 (to c. 1640)	0	0	5	3	6	3	2	2	21
% assemblage	0.0%	0.0%	23.8%	14.3%	28.6%	14.3%	9.5%	9.5%	100%
Period 2	0	0	0	0	1	3	0	1	5
% assemblage	0.0%	0.0%	0.0%	0.0%	20.0%	60.0%	0.0%	20.0%	100%
Period 3	3	16	147	35	163	219	39	30	652
% assemblage	0.5%	2.5%	22.5%	5.4%	25.0%	33.6%	6.0%	4.6%	100%
Period 4	0	2	18	5	29	38	5	15	112
% assemblage	0.0%	1.8%	16.1%	4.5%	25.9%	33.9%	4.5%	13.4%	100%

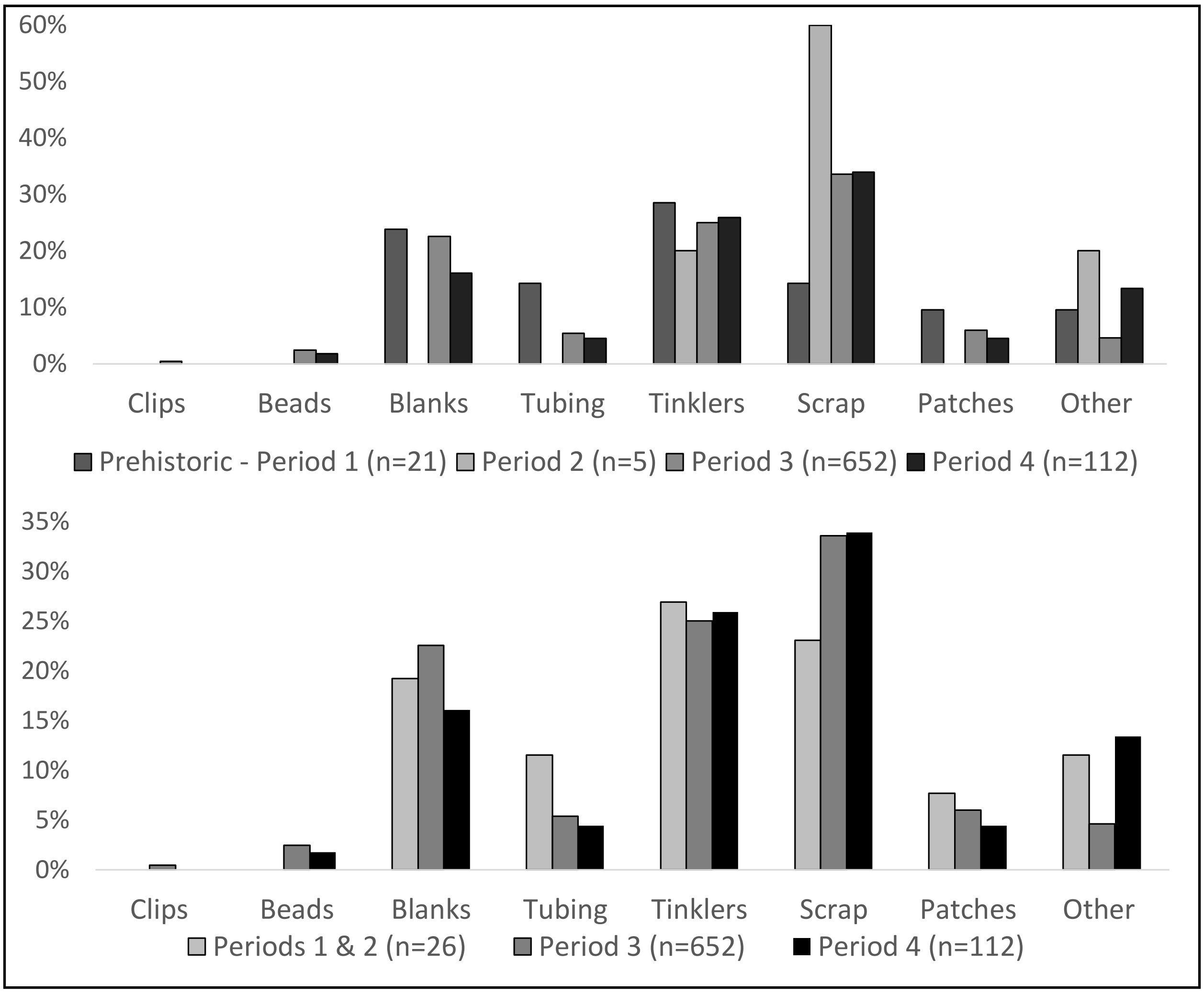


Figure 6.5: Comparison of general artifact categories for Rock Island components, top with Period 1 and 2 separated and bottom with Period 1 and 2 combined. Period 1 includes a few artifacts that may be intrusive from prehistoric or protohistoric occupations.

Since artifacts from Periods 1 and 2 were assigned dates only ten years apart, based on documentary evidence (Mason 1986), I combined these components in Figure 6.5 to clarify and simplify possible trends in the dataset and minimize the effects of a biased sampling from the very small sample size of Period 2 (n=6). Several patterns are consistent through time at the Rock Island site: tinkling cones, rather than beads or clips, are the preferred use of copper-based metal as personal adornment. Patching is not a prominent reworking activity and may have decreased slightly through time, and scrap dominates all but the earliest component. The higher proportion of tinkers to scrap in the combined Period 1 and 2 sample may reflect more limited resource availability and a greater necessity to turn available copper-based metal into adornments or patches rather than discarding as scrap.

6.1.1.8 Zimmerman attribute analysis

From the Zimmerman site, I examined a total of 130 copper-base metal artifacts from features and unit excavations that included seventeenth century materials and ceramics associated with protohistoric activities, such as Danner ware. All came from the portion of the site excavated and published by Rohrbaugh et al. (1999). These artifacts were the most recently excavated and were readily accessible at the Illinois State Museum, so I worked with this collection instead of materials from earlier investigations (J. A. Brown 1961; M. K. Brown 1975). I excluded five copper-base metal objects from the final count: three refit with other artifacts from that site and were re-classified as single artifacts, and two were probable later-historic trash, resulting in a final total sample of 125 artifacts (Table 6.14). I examined these materials working directly with Dr. Kathleen Ehrhardt in order to learn and better understand her established typological method and ensure my results would be comparable to other sites that Ehrhardt analyzed, including Iliniwek Village, which was roughly contemporary to Zimmerman.

Table 6.14: Summary data table for the Zimmerman site metals

	Clips	Beads	Blanks	Tubing	Tinklers	Scrap	Patches	Other	TOTAL
Zimmerman	7	18	29	26	9	35	0	1	125
% Assemblage	5.6%	14.4%	23.2%	20.8%	7.2%	28.0%	0.0%	0.8%	100%

The make-up of the copper-based metal assemblage from Zimmerman site is unique in my study sample, and I suggest that the attributed Illinois (Kaskaskia) ethnic affiliation of the occupants and their geographic location both contribute to this difference. The relatively high proportion of clips and beads and low proportion of tinkling cones as compared to other sites in the Upper Great Lakes study sample is similar to proportions of adornments present in the Illinois-affiliated Iliniwek Site assemblage (Ehrhardt 2005; 2013). Clips and small rolled metal beads require smaller blank sizes and less copper material than tinkling cones, so the adornment strategies in Illinois country also may reflect lower resource availability than at major trading centers such as Rock Island or the Fox River Valley. Therefore, a possible signifier of Illinois identity, adornment with small rolled metal beads and less frequently tinkling cones, may have been shaped by the availability of resources. Patching as a technological practice is also completely absent from both the Zimmerman and the Iliniwek copper-based metal assemblages, which may indicate an Illinois preference for converting worn-out kettles into adornments rather than extending their use life, as was so common at the Meskwaki-affiliated Bell Site.

6.1.1.9 Summary and discussion of regional and temporal interpretations for proportions of types of metal artifacts examined in the attribute analysis

I have presented the results of attribute analyses of copper base metal artifacts for ten discrete assemblages from eight archaeological sites in the study sample, and have accounted for patterning possibly related to sampling and excavation strategies in the discussion of each site, so that assemblages can now be compared to one another according to dates of occupation and area within the region. I divided the copper-base metal artifact assemblages into two main temporal groups. The earlier, mid-seventeenth to early eighteenth century group includes the Bell site, Doty Island Mahler, Gros Cap, Marquette Mission, Rock Island Period 3, and the Zimmerman site, as well as the published sample from Iliniwek Village (from Ehrhardt 2013). The inclusion of comparative data from the Iliniwek site highlights similarities and differences among these assemblages on a larger geographic scope. The later, early-to-mid eighteenth century group contains four large assemblages, from the Doty Island Village site, Fort St. Joseph, Fort Michilimackinac, and Rock Island period 4. Individual tables of proportions of types in each site assemblage have been combined to produce a summary table for all large assemblages (Table 6.15) and a summary chart of finished, unfinished, and patched artifacts (Figure 6.6).

Table 6.15: Summary table for copper-based metal assemblages >50 artifacts, in rough chronological order from earliest to latest

	Clips	**Beads**	**Blanks**	**Tubing**	**Tinklers**	**Scrap**	**Patches**	**Other**
Zimmerman (n=125)	5.6%	14.4%	23.2%	20.8%	7.2%	28.0%	0.0%	0.8%
Gros Cap: (n=75)	0%	2.7%	16.0%	0.0%	45.3%	24.0%	8.0%	4.0%
Marquette Mission (n=536)	0.4%	1.7%	14.6%	12.5%	30.0%	36.2%	1.1%	3.5%
Rock Island Period 3 (n=652)	0.5%	2.5%	22.5%	5.4%	25.0%	33.6%	6.0%	4.6%
Bell Site (n=958)	0.0%	3.6%	15.2%	1.4%	14.9%	45.1%	17.3%	2.5%
Doty Island Mahler (n=60)	0.0%	25.0%	21.7%	3.3%	20.0%	20.0%	3.3%	6.7%
Doty Island Village (n=247)	2.0%	8.9%	17.0%	6.1%	21.5%	32.0%	6.9%	5.7%
Fort St. Joseph (n=79)	0.0%	0.0%	17.7%	15.2%	7.6%	46.8%	5.1%	7.6%
Fort Michilimackinac (n=62)	0.0%	1.6%	8.1%	0.0%	9.7%	72.6%	1.6%	6.5%
Rock Island Period 4 (n=112)	0.0%	1.8%	16.1%	4.5%	25.9%	33.9%	4.5%	13.4%

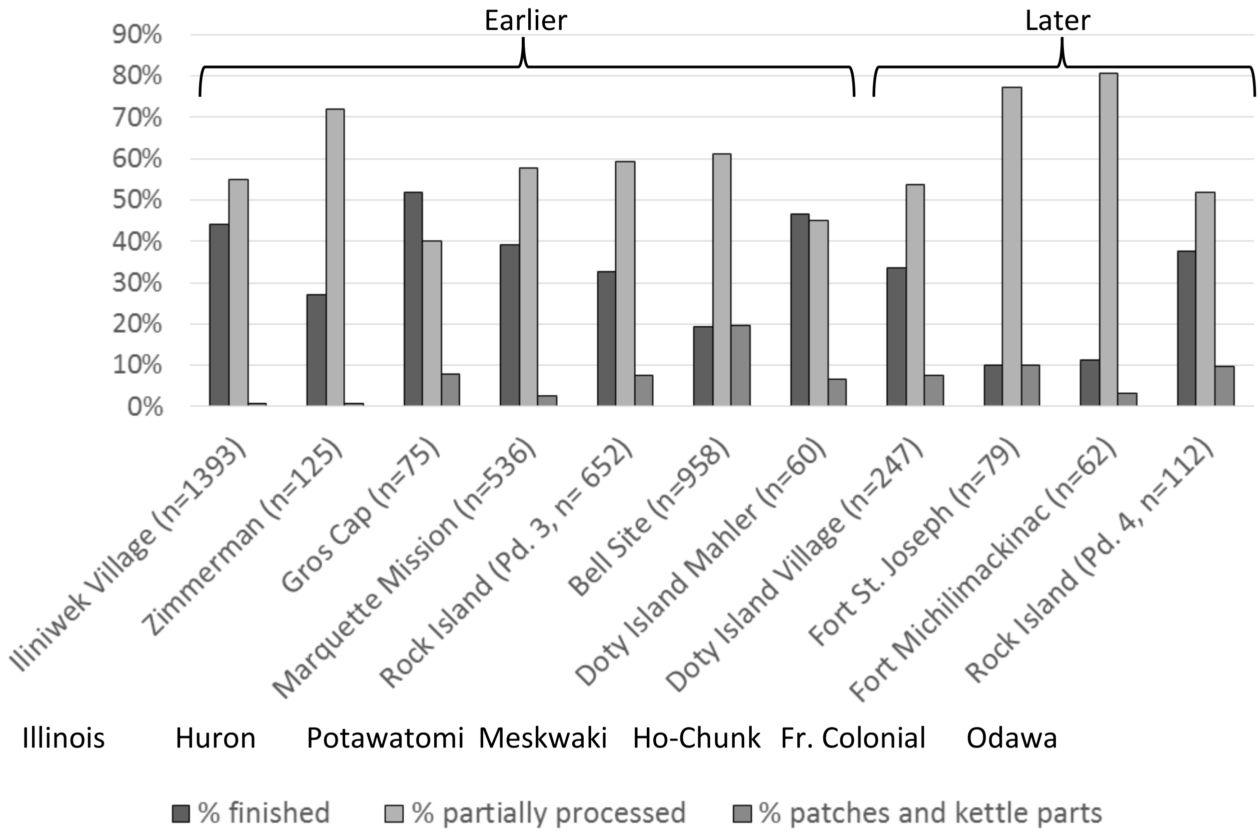


Figure 6.6: Relative proportions of finished, unfinished, and patched artifacts from assemblages >50 artifacts, including data from Iliniwek Village (Ehrhardt 2013:382-383). Labels of ethnicity below assemblages reflect predominant group present, according to published interpretations.

The regional scale of my research questions requires the comparison of these assemblages using the very broad categories of ethnic affiliations and temporal period of occupation. Furthermore, Figure 6.6 takes a "lumping" approach to the metal artifact typology, dividing assemblages only on the basis of finished, unfinished or partially processed, and patched pieces. Patched pieces represent a practice of secondary or tertiary reworking that does not fit well into either the finished or the unfinished categories as Ehrhardt defined them (2005). Proportions of patches or patched pieces in an assemblage provide a general indicator of both resource availability and general prevalence of mending kettles as a cultural practice. Patterns identified in each category correspond to both temporal and ethnic or cultural differences.

Mid-seventeenth to early eighteenth century group

The Iliniwek Village, Zimmerman, Gros Cap, and Marquette Mission sites are considered the oldest sites in the early group; occupations likely did not extend much into the 1700s at any of these sites, while the Bell, Doty Island Mahler, and Rock Island Period 3 occupations spanned the turn of the eighteenth century. Two of the early sites, Gros Cap and Doty Island Mahler, have greater proportions of finished artifacts than unfinished artifacts. For Gros Cap, I suggest that this may be a result of admixture of artifacts from disturbed mortuary contexts in the habitation areas, but this does not explain the greater proportion of finished objects at the Doty Island Mahler site. Since the latest sites, Fort Michilimackinac and Fort St. Joseph, have the highest proportions of unfinished to finished artifacts, and because they would have had regular supplies of trade items, decreased resource availability may be responsible for increased recycling of existing metal resources and therefore explain the presence of more finished objects at Gros Cap and Doty Island Mahler. Without further excavations in the Doty Island vicinity to rule out adjacent mortuary contexts, these explanations should be considered equifinal.

The presence and relative abundance of some key artifact types further highlights differences among earlier sites. Clips, the ubiquitous staple-like adornments so common at Iliniwek village, also appear frequently at Zimmerman, but less frequently at other sites, with a only few possible examples from Marquette Mission and Rock Island, though the latter may be more like rolled metal beads (see section 6.1.2.2). Likewise, copper mail or small rolled metal beads are a hallmark of Iliniwek Village, although they are difficult to quantify since some connected bead segments may be counted as individual artifacts. Small rolled beads appear on the Meskwaki sites but in lesser proportions: they make up 25% of the sample from Doty Island Mahler, and a dozen small metal were recovered from the Bell site (see section 6.1.1.1). Tinkling cones are ubiquitous, but differ greatly in their relative abundance; they make up a greater proportion of assemblages at Gros Cap and Rock Island (Period 3 and Period 4) than any other sites. The practice of patching is not documented at the Illinois sites, but it is extremely common at the Bell site, and to a lesser extent at Marquette Mission and Rock Island.

Very little patching or acquisition of previously patched kettles was documented at the two Illinois sites of Zimmerman and Iliniwek Village; these sites are the farthest from the trading centers of the Great Lakes, so copper-base metal may have been rarer and considered more valuable as raw material. Therefore, worn out or broken kettles may have been more likely to be recycled into objects of personal adornment rather than patched. Conversely, 17% of the Bell Site metal assemblage is made up of patches or patched pieces; this may be the result of continued use of kettles for utilitarian purposes past the point where they would be reworked into other objects elsewhere. One explanation for this may be that resource availability decreased suddenly as the Meskwaki came into conflict with the French during the early eighteenth century, necessitating patching to prolong the use-life of kettles. Adornment strategies at the Bell Site likewise may have been less reliant on copper-base metal beads and tinklers, leading to less reworking of metal for ornaments and a greater interest in patching metal containers.

In Research Question 1, I expected that historically documented ethnic groups would apply similar reworking methods to copper-based metal. If assemblages from a distinct ethnic group were compared to assemblages of similar age and geographic location but affiliated with a different group, temporally comparable assemblages on the same trade routes would differ in technological style from those around them, and this could be attributed at least in part to ethnic identity influencing crafting practices. The Bell site offered an opportunity to test this expectation: in fact, the Bell copper-based metal assemblage differs from comparable non-

Meskwaki assemblages in style and technological methods of reworking. Reworking practices at the Bell Site differ greatly from those applied at the Illinois-affiliated sites, and to lesser extent, practices elsewhere in the Upper Great Lakes. The expectation that reworking style is an expression of Meskwaki identity is supported by the predominance of patching at the Bell Site and the continued production of tinkling cones, indicating that during an era of displacement and conflict, the Meskwaki conserved resources through patching worn-out kettles but maintained a consistent technological style of producing personal adornments, which were likely to have been an important aspect of ethnic identity performance.

Early to mid-eighteenth century group

There are also some clear differences in relative proportions of metal artifact types among the later site assemblages, Fort St. Joseph, Fort Michilimackinac, Doty Island Village, Rock Island Period 4. Tinkling cones are present at the two French colonial or multiethnic communities at Fort St. Joseph and Michilimackinac, demonstrating that the use of these adornments was not restricted to Indigenous people. However, tinkling cones make up greater proportions of the assemblages at Rock Island Period 4 and Doty Island Village. Other rarer, specific types of finished objects, including projectile points, bracelets, and a cut brass cross (discussed in section 6.1.2) are present only at Rock Island, but perhaps these were only recognized because this was one of the largest assemblages examined and therefore represents the greatest variety of finished objects. Among later sites, patches and patched pieces are most common at Doty Island Village, but in general, patching is less common at the later sites. Clips are only present at Doty Island, though the artifacts identified as clips could also be classified as partially rolled or opened small metal beads (see section 6.1.2.5).

The sites associated with French colonial activity and Métis communities, Fort St. Joseph and Fort Michilimackinac, have the highest proportions of unfinished materials (mainly scrap and blanks) relative to finished artifacts, which are predominantly tinkling cones. Copper-base metal objects may have been in greater supply at these locales because of their sustained and well-documented connections with French and later British trade networks (Kent 2004; Nassaney and Brandao 2009), reducing a need for inhabitants to convert available scrap into finished objects. Fort St. Joseph and Fort Michilimackinac assemblages do differ in proportions within unfinished types: blanks are 17.7% and scrap is 46.8% of the total assemblage at Fort St. Joseph, but blanks are only 8.1% at Fort Michilimackinac, while scrap makes up 72.6%. Despite their shared connections to French trade, Michilimackinac is geographically closer and more accessible to direct suppliers of items; the interior location and possibly more hybridized or multi-ethnic identity of the Fort St. Joseph community might explain the greater proportion of blanks, which could have been, but were not, converted into ornaments. Evidence for blacksmithing at Fort Michilimackinac may likewise contribute to curation of scrap for smelting, but no such practice may have been taking place at Fort St. Joseph, so reworking activities there might have followed strategies more similar to those generally in use in local Native communities, like cutting blanks to make tinkling cones and beads.

In summary, the comparison of assemblages > 50 artifacts revealed patterns in proportions of general copper-based metal artifact types, and broader categories of finished, unfinished, and patched pieces. These patterns in the technological practices of recycling metals in the Upper Great Lakes region correspond to temporal, geographic, and cultural differences. The greatest contrast is apparent in differences between assemblages from Illinois country, Iliniwek Village and Zimmerman, and others in my study. The French colonial fortification sites likewise markedly differ from locales of predominantly Native American habitation. There are further patterns of difference evident in the technological style of particular finished and unfinished artifact categories, discussed next.

6.1.2 Personal adornments and other finished artifacts

In this section, I address each of the finished copper-based metal artifact categories present in the Upper Great Lakes region, identifying patterns in the styles of individual artifact types as they relate to geographic distribution, proximity to known trade routes or waterways, temporal periods, and attributed ethnic or cultural identity. To link the study area to broader patterns of interaction and migration in eastern North America, I compare rare or unusual artifacts to types described in other studies of Native reworking of European-made copper-base metals (especially Anselmi 2004; 2008; Bradley 1987; Ehrhardt 2005; 2013). The types and forms of finished artifacts illustrate how local communities integrated European trade items such as copper kettles into existing material practices and social systems (see Miller and Hamell 1986; Bradley 1987:132-139; 2005; Ehrhardt 2005; Anselmi 2008). Since I am examining variation in technological style within artifact types, rather than proportions of types in assemblages objects, all examined site assemblages, including those < 50 artifacts, are discussed in this section.

The assemblages examined meet Bradley's criteria for localized, community-oriented production of copper-base metal personal adornments: 1) unequivocal ornament-making production waste on sites; 2) the presence of traditional forms of objects like tinkling cones and trapezoidal pendants with antecedents in native copper, catlinite, and shell; and 3) local variation among sites attributed to different ethnic or tribal groups (1987:74-75). When these criteria are met, stylistic variations within reworked artifact types may reflect tribal identity. For example, a difference between circular or disc-shaped pendants on Onondaga Iroquois sites and projecting, perforated “tangs” on round pendants from Susquehannock sites may demonstrate local production of pendants by each community (Bradley 1987:75). To identify “local variation” among sites included in the attribute analysis of finished copper-base metal adornments, I focused details like the closure of tinkling cone seams, the shape and size of metal pendants, and the forms of metal projectile points. Assessing technological style variations within artifact types, such as tinkling cones or rolled metal beads, addresses Research Questions 1 and 2 by identifying ethnic and tribal difference through styles of reworking metal artifacts.

6.1.2.1 Tinkling Cones

Of the 3411 records in the copper-base metals database, 707 are tinkling cones, making them the most common finished artifact type and almost half of the total recorded finished artifacts (n=1464). Tinkling cones have a widespread distribution on archaeological sites related to the colonial encounters in North America (Bradley 1987: 73-75; Giordano 2005: 20-25; Morand 1994:52-54). Researchers have attempted to identify patterns in the lengths or metal thicknesses that correspond to time (e.g. Quimby 1966:76; Stone 1974: 133-134; Fitting 1976:207), with little success. A more recent study of tinkling cones production processes and standardization as part of “crafting culture” at Fort St. Joseph found considerable variation in styles and forms of tinkling cones within the entire site collection (n=356), which indicates that tinkling cone production was probably undertaken at a small and localized scale by many individuals in the community (Giordano 2005). Given the widespread, long-term use and relative ease of making of tinkling cones, patterns of variability documented in form and style likely result from individual or community crafting traditions of small-scale production. For tinkling cones, and all subsequent individual artifact types, I present summaries of qualitative and quantitative data separately, with artifacts sorted by site (Table 6.16 and Table 6.17).

Table 6.16: Summary quantitative data for tinkling cones, mean and standard deviation (+/-) presented for each attribute

Site name:	**N**	**Max length (mm)**		**Max width (mm)**		**length: width**		**edge angle (°)**		**Max metal thickness (mm)**	
		Mean	***(+/-)***	**Mean**	***(+/-)***	**Ratio**	***(+/-)***	**Mean**	***(+/-)***	**Mean**	***(+/-)***
Arrowsmith	7	19.2	*5.2*	6.9	*1.3*	2.8	*0.6*	85.3	*1.4*	.53	*0.2*
Bell	143	20.6	*7.6*	6.3	*3.5*	3.4	*0.1*	85.1	*2.6*	.44	*0.1*
Camp Shaginappi	2	24.5	*2.8*	10.8	*2.3*	2.3	*0.2*	82.7	*1.3*	.58	*0.1*
Doty Island Mahler	12	21.4	*8.1*	6.1	*1.9*	3.4	*0.9*	86.6	*2.2*	.39	*0.1*
Doty Island Village	53	21.6	*6.8*	7.8	*2.6*	2.8	*0.8*	85.5	*3.4*	.43	*0.1*
Elmwood Island	5	22.8	*6.3*	8.3	*4.9*	3.4	*1.7*	84.4	*3.2*	.60	*0.3*
Fort Michilimackinac	6	13.5	*4.6*	5.8	*1.5*	2.3	*0.3*	83.7	*0.8*	.45	*0.1*
Fort St. Joseph	6	19.2	*5.0*	6.9	*2.1*	2.9	*0.5*	85.7	*3.1*	.43	*0.0*
Gros Cap	34	22.4	*6.9*	6.5	*2.2*	3.6	*1.0*	86.1	*2.5*	.49	*0.2*
Marina	8	17.3	*3.5*	6.3	*1.3*	2.8	*0.5*	85.1	*1.3*	.64	*0.1*
Marquette Mission	161	23.2	*8.6*	6.3	*2.4*	4.0	*2.1*	86.2	*2.1*	.46	*0.1*
McCauley	14	22.3	*3.7*	7.1	*1.1*	3.2	*0.5*	85.8	*2.0*	.65	*0.1*
O'Neill	2	24.5	*3.9*	7.2	*1.0*	3.4	*0.1*	87.7	*2.3*	.66	*0.0*
Peshtigo Point	11	33.7	*12.9*	8.7	*3.1*	4.1	*1.5*	87.3	*1.9*	.35	*0.1*
Rock Island 1	6	19.4	*3.1*	6.9	*2.3*	3.2	*1.2*	84.4	*2.0*	.49	*0.1*
Rock Island 2	1	26.8	*n/a*	8.8	*n/a*	3.1	*n/a*	86.1	*n/a*	.44	*n/a*
Rock Island 3	163	21.0	*6.0*	7.3	*2.9*	3.1	*0.8*	85.1	*2.7*	.72	*3.2*
Rock Island 4	29	19.4	*4.9*	6.7	*1.4*	3.0	*0.8*	84.7	*1.3*	.51	*0.1*
Winston-Cadotte	9	26.3	*7.3*	7.6	*3.1*	3.7	*0.7*	87.5	*1.9*	.63	*0.2*
Zimmerman	9	24.4	*7.1*	10.2	*3.0*	2.4	*0.6*	84.4	*4.6*	.50	*0.1*

Mean length and width of cones, their length to width ratio, and thickness of metal do not appear to vary in any meaningful way based on the chronological, spatial, or cultural distribution of sites. I tested the proposition that tinkling cone length decreases over time from the mid-seventeenth to mid-eighteenth centuries (Fitting 1976:207) using a box and whisker plot of mean maximum lengths and standard deviations for tinkling cones from all sites, regardless of sample size (Figure 6.7). It is generally true that later sites do have slightly smaller mean lengths of cones than earlier sites, but there is a wide range of variation of individual cones, especially in the larger assemblages. Some anomalies in this pattern occur: for example, tinkling cones from Rock Island Periods 1 and 4 are both, on average, 19.4 mm long; this might be a result of long-standing craft production processes being conserved at this location, or simply an artifact of averaging the data from two diverse assemblages of different sample sizes. Based on these results, it is not possible to approximate the age of a site based on cone length alone.

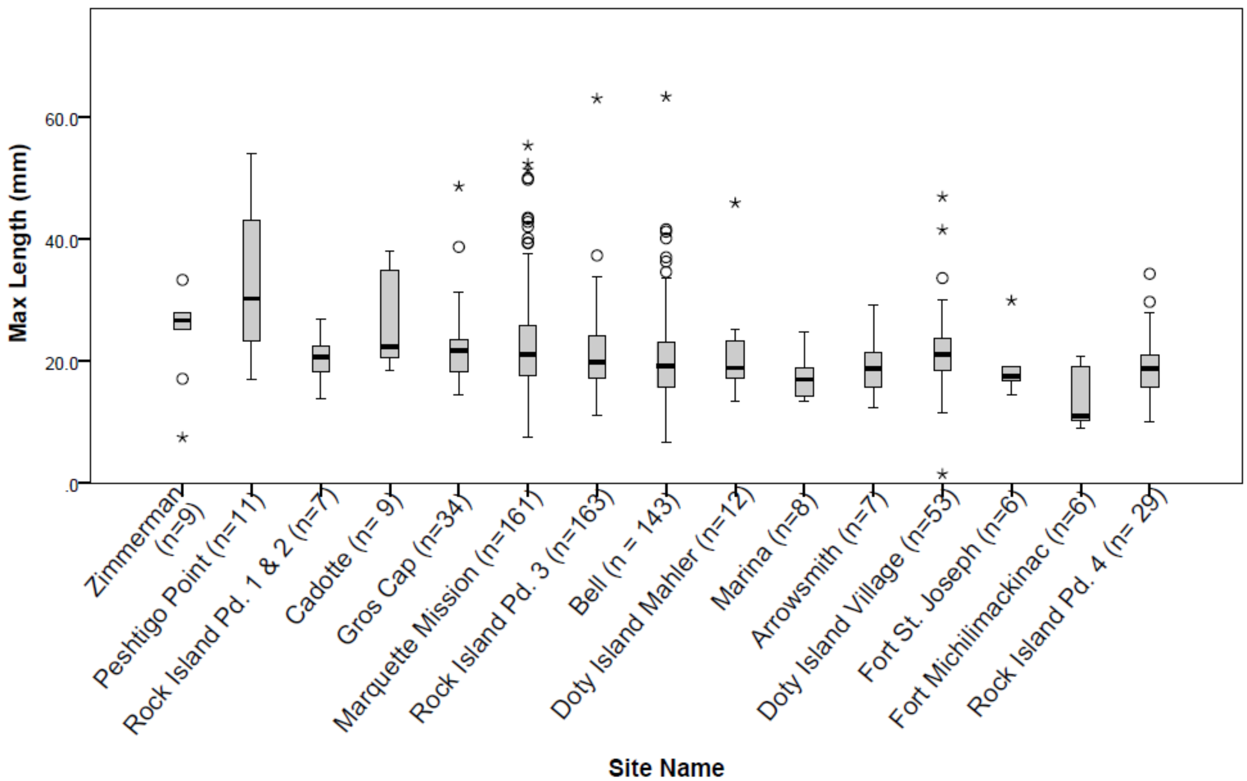


Figure 6.7: Box and whisker plots showing means, standard deviations, and outliers of mean maximum length for tinkling cones. Sites are sorted in rough chronological order, with earliest sites at left and latest sites at right.

Measuring the edge angle and length:width ratios for tinkling cones provides two related ways to quantify the shape of the artifacts; however, these measurements do not always correspond to one another, despite the fact that cone length is an attribute used in calculating both the simple length:width ratio and the edge angle measurements (Figure 6.8). The shape of tinkling cones, as assessed by length:width ratios and edge angles, was expected to vary according to the ethnicity or cultural affiliation of individual sites. However, there are no identifiable patterns in either attribute that correspond to ethnicity. As with length and other size attributes, localized variation among individual craftworkers and not any overarching community practices may be responsible for the tinkling cone shape differences observed for each site.

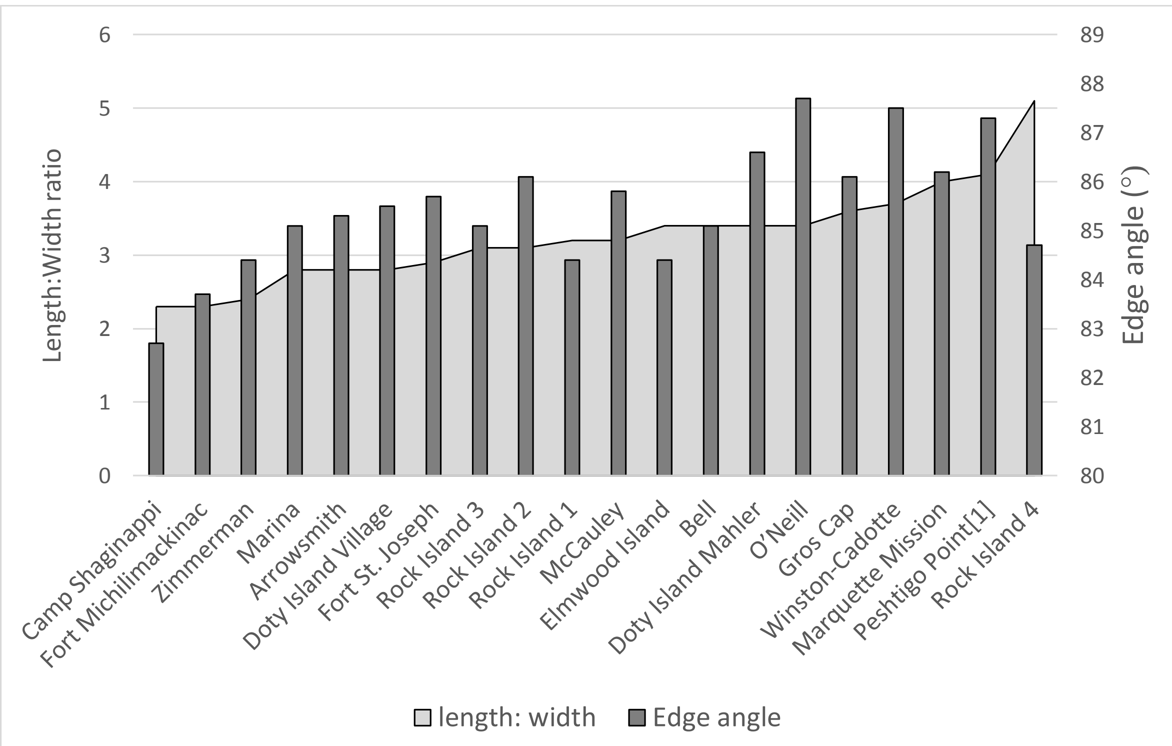


Figure 6.8: Comparison of length:width ratio to edge angle attributes, sorted by length:width ratio. Figure shows no spatial, temporal or social patterns in the shape of tinkling cones.

To assess qualitative aspects of tinkling cone production (Table 6.17), all tinklers were assigned an attribute code (Appendix E) based on technological and stylistic attributes including blank type, openness at the tip, and the closure of the seam, which was classified as open, abutting, or overlapping at the neck, midsection, and base of the artifact. The most common attribute code for each assemblage is recorded as a percentage of total artifacts, except in cases where tinkling cone attribute codes all differ from one another; these are listed as diverse.

Table 6.17: Qualitative data for tinkling cones by predominant attribute for each site. Percentages represent % of artifacts from that site for each attribute. The same abbreviations for each attribute will be used in all further tables in this chapter.

Site name:	N	Typology code(s)	Closure[1]	Blank Type[2]	Working Method[3]	Scratch Test	
						Red:	Yellow:
Arrowsmith	7	321: 43%	A/O: 100%	Tr: 86%	TM: 14%	N/A	N/A
Bell	143	319: 14%	O: 50%	Tr: 73%	Sc: 20%	50%	36%
Camp Shaginappi	2	328; 314	O: 100%	Sq/Irr	N/A	N/A	N/a
Doty Island Mahler	12	324: 25%	O: 58%	Tr: 75%	Sc: 17%	50%	33%
Doty Island Village	53	323: 30%	A/O: 81%	Tr: 85%	Be: 23%	58%	42%
Elmwood Island	5	319: 40%	O: 60%	Tr: 80%	Ha: 20%	N/A	N/A
Fort Michilimackinac	6	323: 33%	A: 50%	Tr: 100%	Sc: 67%	33%	66%
Fort St. Joseph	6	diverse	A/O: 100%	Tr: 83%	N/A	N/A	N/A
Gros Cap	34	323: 33%	A: 68%	Tr: 97%	Sc: 21%	62%	15%
Marina	8	323: 88%	A: 100%	Tr: 100%	Sc/TM: 25%	38%	50%
Marquette Mission	161	323: 23%	A/O: 84%	Tr: 98%	Sc: 32%	N/A	N/A
McCauley	14	323: 43%	A: 64%	Tr: 93%	Cl-S:14%	N/A	N/A
O’Neill	2	323:100%	A: 100%	Tr: 100%	Sc: 100%	N/A	N/A
Peshtigo Point	11	diverse	A/O: 81%	Tr: 55%	Be: 27%	N/A	N/A
Rock Island 1	6	323: 33%	A: 67%	Tr: 83%	F/Sc:33%	50%	50%
Rock Island 2	1	320	O: 100%	Tr: 100%	Sc: 100%	100%	0
Rock Island 3	163	323: 25%	A: 54%	Tr: 74%	Sc: 37%	56%	42%
Rock Island 4	29	323: 17%	A: 45%	Tr: 97%	Sc: 58%	24%	76%
Winston-Cadotte	9	320;323:44%	A/O: 100%	Tr: 100%	TM: 22%	N/A	N/A
Zimmerman	9	307: 22%	A/O: 88%	Tr: 77%	Be: 11%	N/A	N/A

The most common closure style for all tinklers measured was style 323, which is a trapezoidal blank that is rolled into a cone with abutting edges down the entire length of the seam, identified at the neck, midsection and base. Since specific types based on closure method split the tinklers

[1] Closure styles are coded as Abut (A), Overlap (O), or Abut/Overlap (A/O), the three most common seam-styles. These categories are assigned by assessing three sections of the cone: the neck, midsection, and base. If the neck is open, but the midsection and base abut, the cone is considered to have a generally “abutting” closure, and so forth. If the neck was open, midsection abutted, or base overlapped, (or any permutation of this) the type is classified as Abut/Open/Overlap, but this type did not predominate any assemblage and does not appear in the chart
[2] Tr= Trapezoidal; Sq = Square; Irr = 1 irregular blank. Dia = Diamond; Rec = Rectangle.
[3] TM= Tool-marked; Sc=scored; Be = bent; Ha = hammered; Cl = Clipped; F= folded

into finely differentiated categories that are not easily comparable in the table, I synthesized the results of studying closure styles in the summary table in two different ways; one gives the most common typological code, and the other a more general indication of closure types to try to illustrate the range of variation in the data set.

The three most common tinkling cone closure styles are coded as Abut, Overlap, or Abut/Overlap, and there seems to be some regional variation based on this attribute. Although as with other attributes each assemblage is very diverse, the Rock Island site seems to show a slight preference for abutting seams, while Bell site is dominated by overlapping seams, which seem to be slightly more common in the Lake Winnebago region (Figure 6.9).

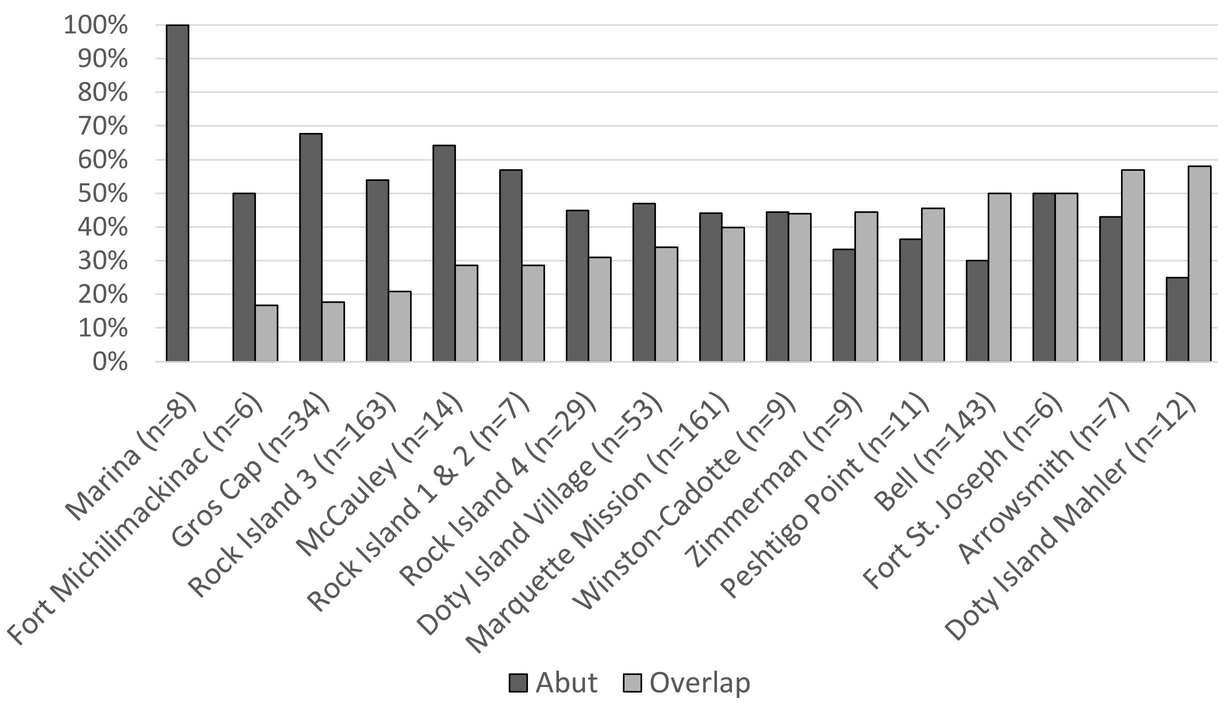


Figure 6.9: Closure style proportions, sorted from least to most overlapping seams. Northerly sites are present at left, while more southerly sites in the Lake Winnebago area are at the right.

I exclude O'Neill, Elmwood Island and Camp Shaginappi because there are <5 artifacts from each site, ethnic or tribal identity is uncertain, and the sites have unclear dates of occupation as compared to the other sites. Giordano observed slightly more overlapping seam objects (63%) in his study of closure styles at Fort St. Joseph (2005:64). To better visualize the regional pattern of seam-styles, I have mapped the spatial distribution of each closure style (Figure 6.10).

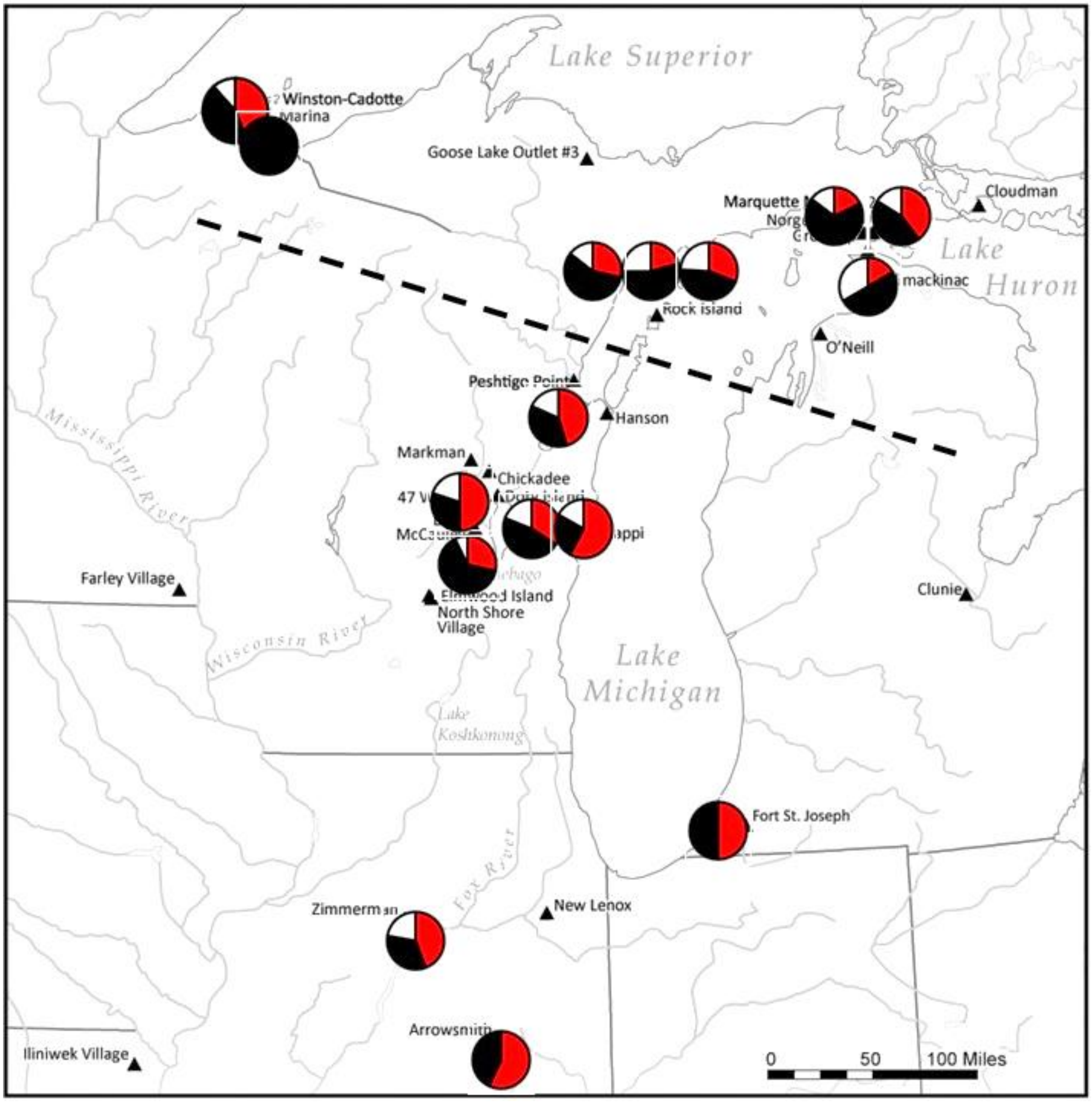


Figure 6.10: Regional map of sites with tinkling cones, illustrating proportions of closure style differences. Red = Overlap, Black = Abut, White = Other

There are no discernible differences predominant blank type or working methods summarized in the Table 6.17. Since by definition, most tinkling cones are trapezoidal pieces of metal rolled around a mandrel, it is unsurprising that trapezoids dominate this category, though other blank shapes are present, in varying quantities. There is no chronological or spatial pattern related to the prevalence of trapezoidal blanks in any of the assemblages. Only the most common metal-working method for each assemblage is tallied; this excluded the category of "rolling," since most cones, again by definition, appear rolled unless they have been flattened. Working methods (see Chapter 4 and Anselmi 2008: 110-129) are the most subjective attribute recorded during the metals analysis; their identification depends on the experience of the researcher, classification of various tiny dents, incisions, or burrs as indicative of particular technological practices, and consistency through a years-long data collection process. Inter-observer differences seems likely to affect recording of working methods, so comparisons with other studies that record these attributes (e.g. Anselmi 2004; Giordano 2005) must proceed with caution. For example, in his analysis of tinklers from Fort St. Joseph, Giordano reported that 98.5% of the assemblage of tinklers had been ground at the edges to remove uneven clips or burrs from the production process (2005:64). In my study, I identified only one ground artifact from Fort St. Joseph, a roughly circular scrap that had been ground across its surface. In general, edge-grinding was not readily visible on artifacts that I encountered throughout my study. I suggest that Giordano and I may have classified grinding differently; he may have identified all smooth edges as having been ground; I only recorded the presence of grinding when clear striations were present. I found that the corroded state of much of the copper-base metal that I analyzed would have obscured the evidence of grinding.

To investigate continuity between the predominantly Meskwaki-affiliated peoples living at the Bell Site, and their subsequent movement to the Arrowsmith site, I compared the style of tinkling cones identified at each site. Arrowsmith and Bell have similar proportions of overlapping to abutting seams on tinkling cones, with a majority of overlapping seamed objects. Likewise, edge angles are similar, at 85.3 degrees at Arrowsmith and 85.1 degrees at Bell, indicating that the general shape of cones from Arrowsmith and Bell are similar, though they differ slightly in length:width ratios of 2.8:1 at Arrowsmith and 3.4:1 at Bell. Trapezoidal blanks for tinkling cones are common, and they are also found in the partially reworked (blank) category. Although the sample size of the Arrowsmith tinkling cones is small (n=7), it is noteworthy that the edge angle, closure style, and mean maximum length and width are all similar to the Bell site. Type 321 a tinkling cone with an abutting seam at the midsection and base with open neck, appeared 43% of the time at Arrowsmith. There are ten artifacts of this specific type at the Bell site, but that assemblage is more diverse. At only 14% of the assemblage, type 319 is the most common type. Given the stylistic diversity of cones at Bell, it is possible that similarities between the two assemblages simply indicate that Arrowsmith's small sample fits within the range of diversity at the Bell site. This could be explained by a small contingent of Meskwaki individuals maintaining this practice at Arrowsmith or wearing materials brought with them but manufactured elsewhere, or simple coincidence in the technological style of cones recovered at both sites.

Throughout the Upper Great Lakes sites, scoring was the most common working method documented on tinkling cones, often along the seam edges and sometimes consistently on the inside of the cones. In comparison, the Zimmerman examples from the same area likewise have no evidence of scoring, and in her study of the Iliniwek site metalworking assemblage, Ehrhardt noted that scoring was present only on a single piece of metal from which blanks had possibly been removed (Ehrhardt 2005:132, Figure 6.9d). Conversely, Anselmi identified some scoring at most of her study sites in northeastern North America (2004:330), though it was not often the most common method in any assemblage. Scoring may be a production process generally practiced in the Upper Great Lakes region more frequently than in other areas, such as Illinois country, perhaps because shears or other European-made metal-working tools may not have been readily available as early or in fewer numbers as they were in northeastern North America. Based on this regional pattern, scoring also may be a technological practice that varies with regionally, possibly with ethnicity or cultural affiliation as well as trade-item availability.

The final qualitative attribute collected for copper-based metal artifacts is scratch testing. Results of scratch testing tinkling cones are consistent with previous findings that the proportion of brass in assemblages generally increases relative to copper, which decreases from the seventeenth to the eighteenth century in eastern North American sites (see Garrad 2014:359-367 for the most recent review of this trend). The pattern is present in Upper Great Lakes region, consistent at both French colonial outposts and Native American occupation sites (Figure 6.11). This may indicate that brass was simply more readily available or preferred by traders or their suppliers in later periods, rather than demonstrating any community or ethnic preference for brass over copper for manufacturing tinkling cones in later periods. My studies of scraps and blanks, discussed below, did not continue to exhibit the trend of brass increasing over time, which might support an actual preference of users trending to brass tinkling cones during the eighteenth century, rather than a resource-based explanation. Notably, the Doty Island assemblages do not fit the pattern of brass increasing at later sites; again, the pattern is not clear and could be a result of margins of error in differentiating brass and copper, or a lack of any chronological distinction between amounts of brass and copper available over time at this site.

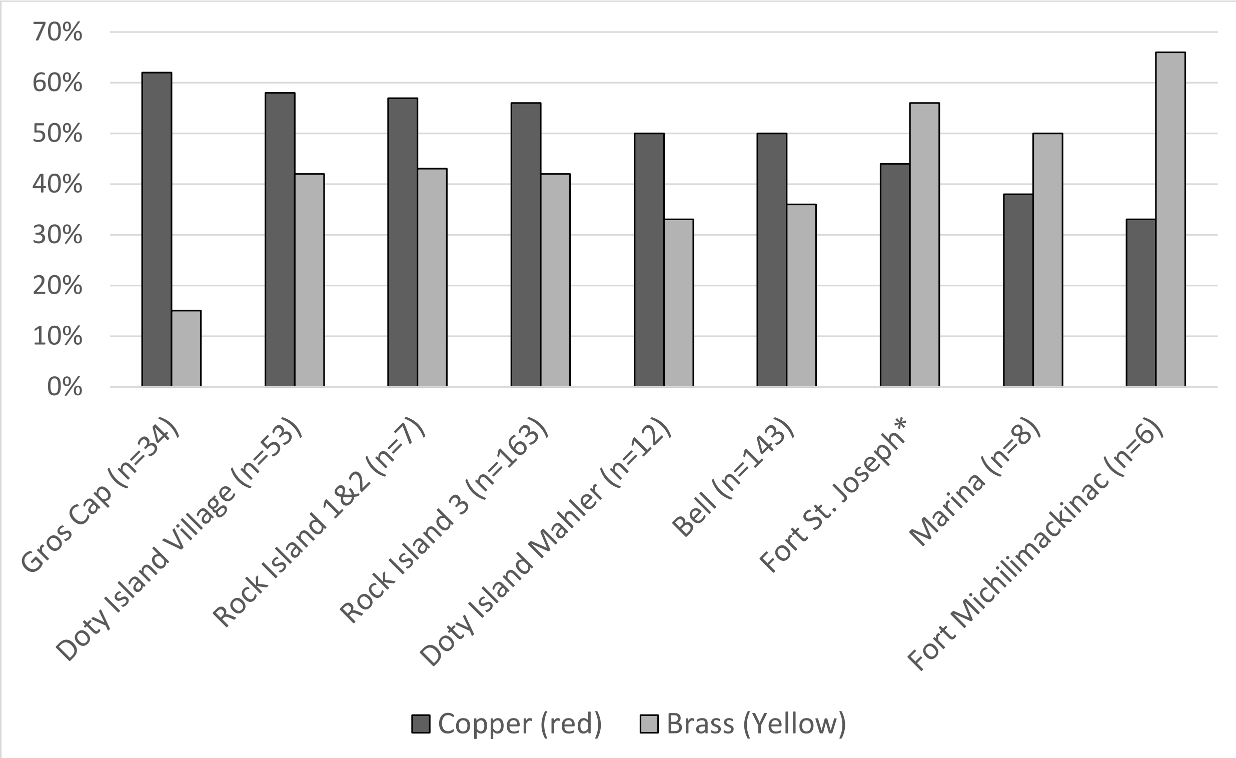


Figure 6.11: Data from scratch testing of tinkling cones, sorted from most to least copper present[1] and illustrating a temporal pattern from earliest sites (left) to later sites (right).

Beyond the qualitative and quantitative data summarized so far, certain artifacts or sites had unique traits that reveal more information about individual artisanal choices or usage contexts of tinkling cones. For example, a tinkling cone recovered from the Marquette Mission site has a black and a white glass trade bead crimped inside it, in what appears to be an intentional manner (Figure 6.12). The colors black and white, and red (the color of copper) are well-documented as ideologically significant in in Indigenous North American contexts (Hall 1997:18-19; Hamell 1992:456-458; Miller and Hamell 1986). The supernatural power of copper was one factor driving its movement through trade networks for thousands of years (Martin 1999: 199-204), and red ocher and copper, usually in the form of beads, are two ritual materials common in Archaic-period burials (Pleger 2000; Pleger and Stoltman 2009). Therefore, although

[1]Fort St. Joseph data(*) from Giordano's scratch testing of 356 tinklers from the Fort St. Joseph site, where he reports that 56% of tinklers were brassy, while 44% were coppery (2005:64).

I cannot suggest a particular meaning for the copper tinkling cone enclosing white and black glass beads, this artifact demonstrates the necessity of examining metal and glass beads in parallel research programs in order to better understand the social significance of personal adornments. Based primary archaeological contexts such as burials (e.g. Mason 1986:119-153), and pictorial and documentary evidence, tinklers and glass beads would have often been part of the same pieces of clothing or objects, (Loren 2009; Loren and Baram 2007), which necessitates some consideration of these categories in a unified manner.

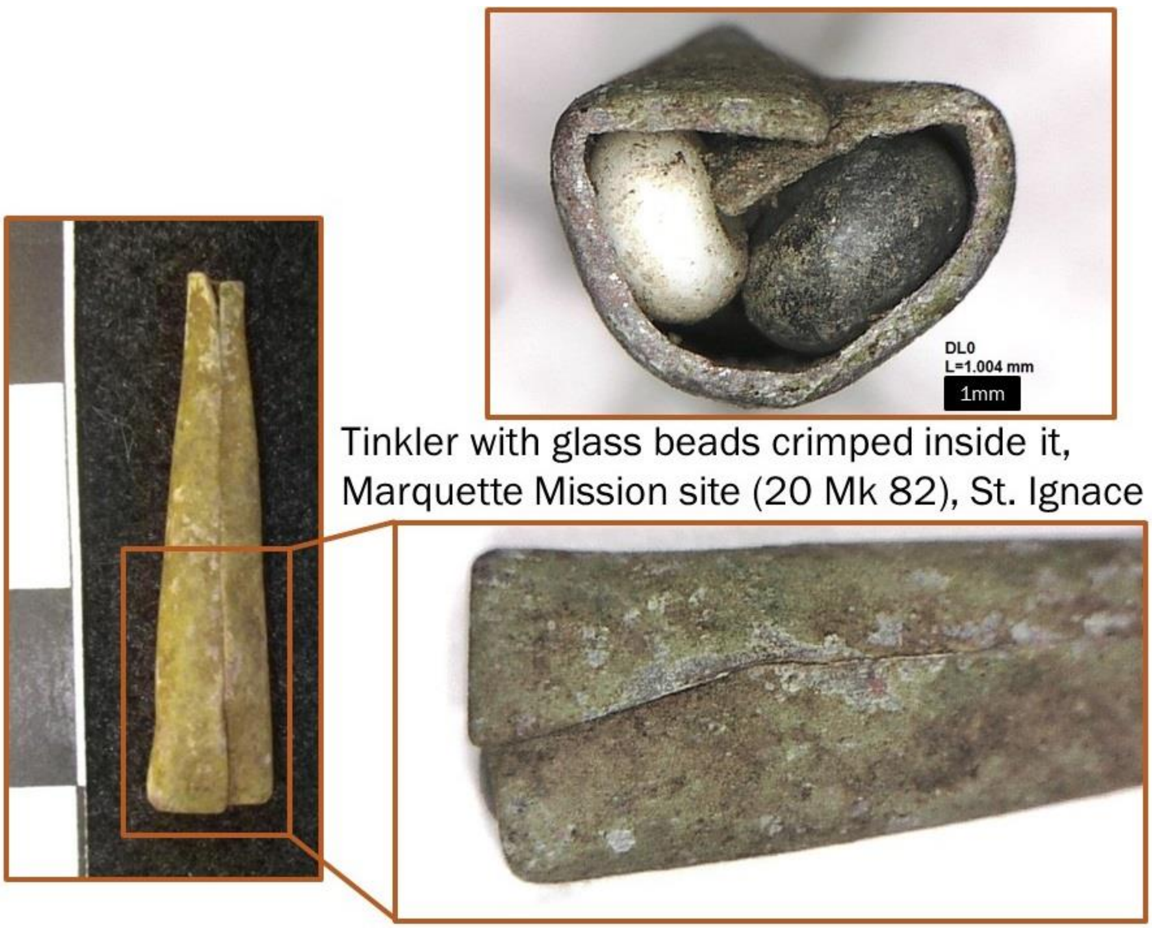


Figure 6.12: Tinkling cone with glass beads crimped inside it (HW-00354), from the Marquette Mission site

Many of the Rock Island tinkling cones offer more evidence for the manner in which tinkling cones were attached in these contexts. Although this attribute was not formally recorded, I noted the presence of hair, leather, or other organic material in at least 21 of the total of 225 Rock Island tinklers. One particular artifact (Figure 6.13) was found with a knotted leather strap with a small strip of brass wrapped around it, perhaps as an attachment point or a “clapper” that might affect the sound of the object as it came in contact with other tinklers in its use-context.

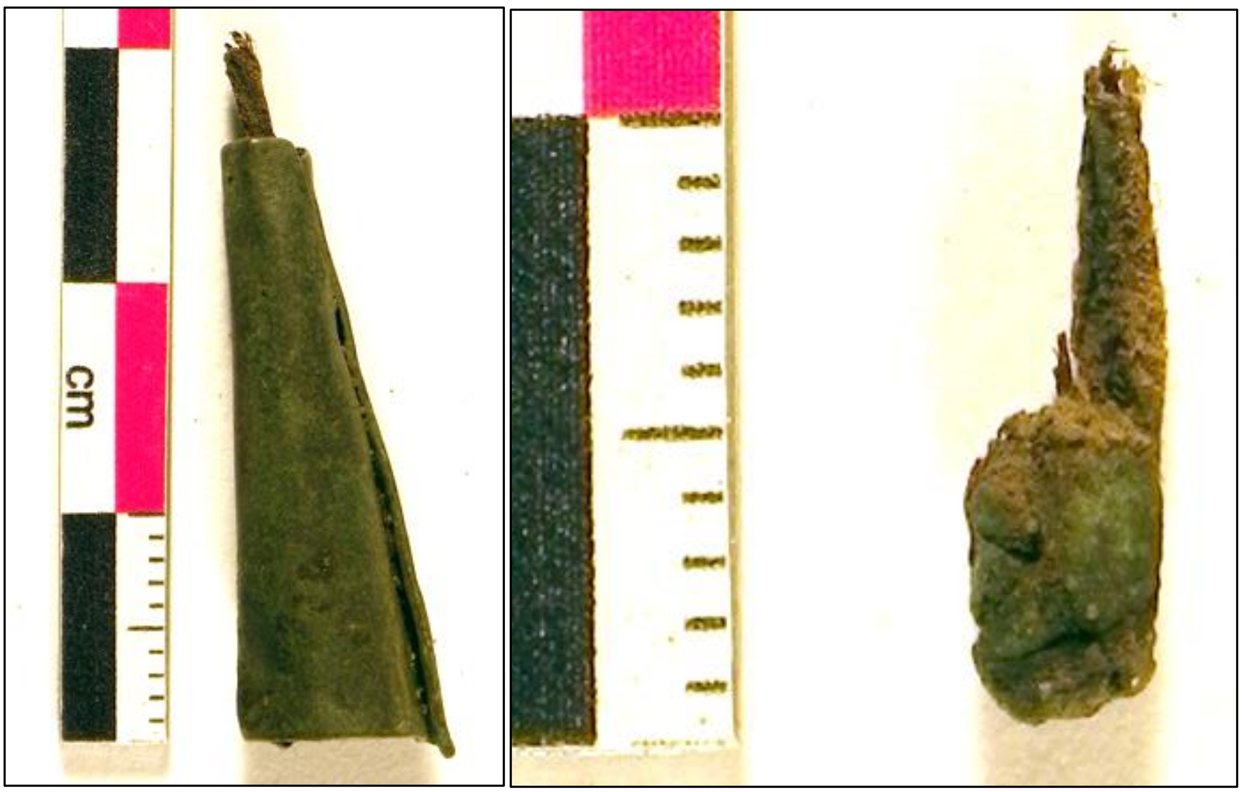


Figure 6.13: Tinkling cone (HW-02332) with fiber and preserved leather cord with metal strip wrapped around it, Rock Island Period 2. Scales in centimeters (left) and millimeters(right).

The surface of tinkling cones may also have been decorated in some cases. Several tinkling cones in the study sample were scored several times perpendicular to the circumference of the cone, parallel to the long axis of the blank (Figure 6.14). Unlike most scoring on tinkling cones, which appears to be functional because of its position parallel to cut edges and sometimes on only the inside surfaces of the cone, decorative scoring is present across the midsections or on the outer surface of the cone. Since some metal objects from the Marquette Mission collection were cleaned using electrolysis, which removes the corrosion layer, more scoring and other working methods were visible on the cleaned Marquette Mission objects than would have been identifiable if the objects had remained in their corroded state.

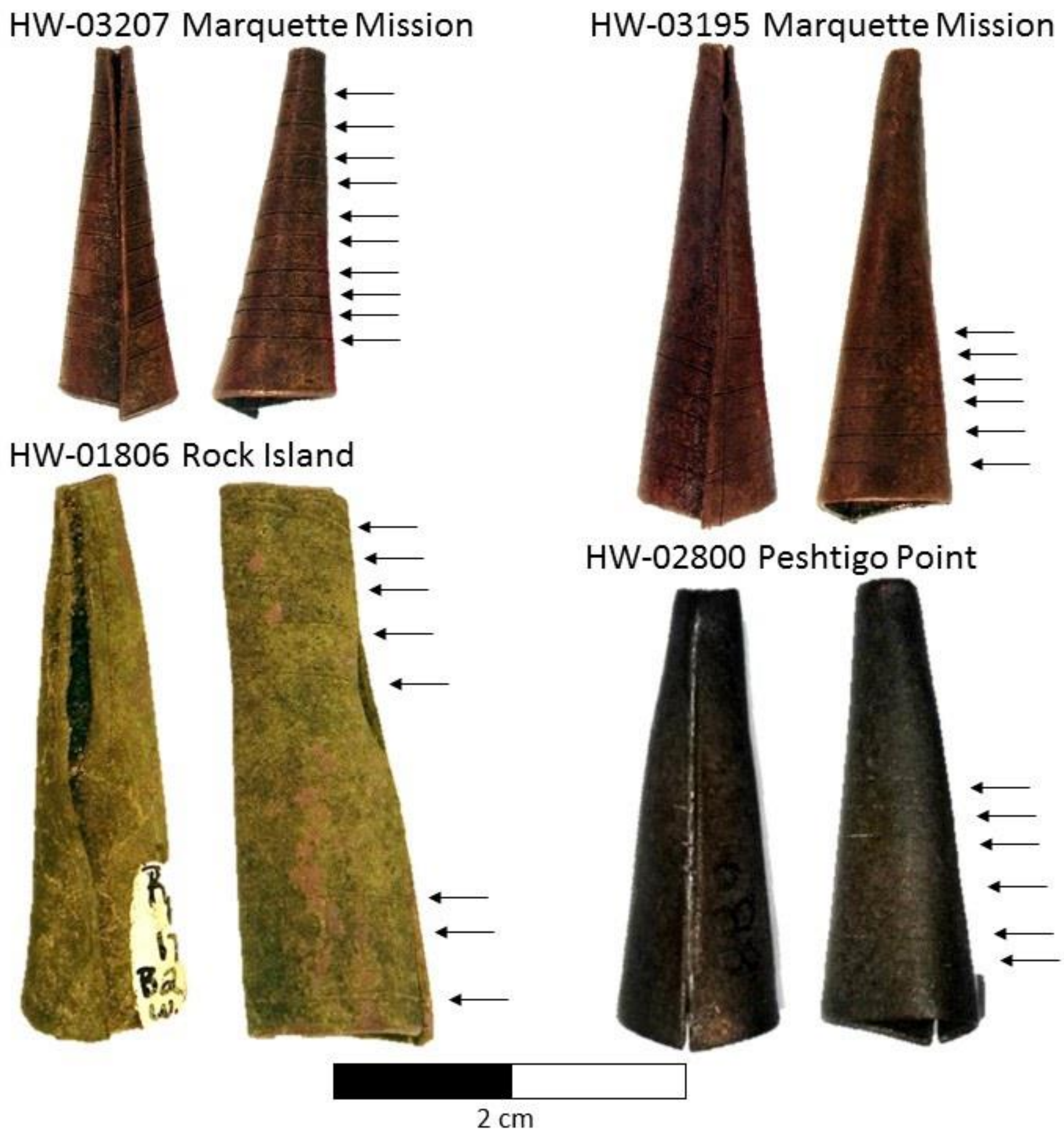


Figure 6.14: Scored tinkling cones, arrows indicating parallel scored lines

Five artifacts from Marquette Mission displayed the decorative scoring pattern: HW-03159, HW-03195, HW-03207, HW-03236, and HW-03245. The last three of that list come from the same context, Feature 157. Similar parallel scoring was identified on another artifact (HW-01806) from the Rock Island Period 3 component, which is roughly contemporary to the Marquette Mission site occupation (c. 1670 – 1701). There is also a faintly-visible set of parallel scored lines on one tinkler from the Ron Strojny collections at Peshtigo Point (HW-02800). It is unclear if this scoring method is a particular artisan's signature style, the identifier of a community or ethnic group, or perhaps just a coincidence.

An artifact form that may be unique to the Bell site is the tinkling cone recycled from a kettle patch. Although there were 15 total artifacts in the tinkling cone study with perforations (5 from Rock Island, 3 from Doty Island, 1 from Marquette Mission, and 6 from Bell), only one had both a perforation and an extant rivet. The object was partially rolled (or un-rolled), with two rivets and one perforation, which would form an "L" pattern if the blank were unrolled. This may indicate that the piece was either part of a standard rectangular patch, or that it was a portion of kettle-body that had been patched in this way. Such recycling is not surprising at the Bell site, given that the assemblage had the highest proportion of patches or patched pieces of any of the sites in the study sample.

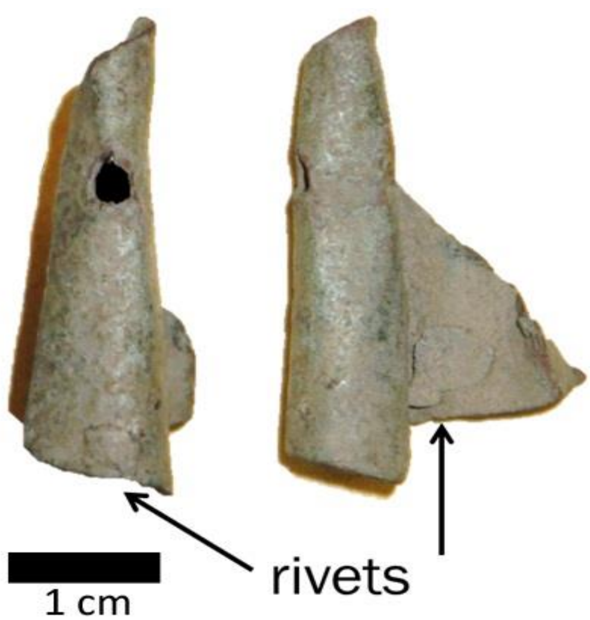


Figure 6.15: Tinkling cone (HW-00120) recycled from a patch or patched kettle body piece from the Bell Site

These unique objects provide glimpses into individual variation in adornment style and use-contexts, but they are not readily comparable in any quantitative way in a regional analysis. Rather, decorative scoring and the use of hair or other organic decorations and a possible clapper reflect stylistic or possibly aesthetic choices on the part of craftspeople, as well as reliance on recycling available resources (in the case of the riveted tinkling cone). Although the particular meaning of the beads crimped within the tinkling cone is unknown, this artifact represents the broader symbolic nature of tinkling cones as personal adornments in the Upper Great Lakes.

6.1.2.2 Rolled metal beads

Rolled metal beads, and objects made from them, such as “copper mail,” are represented by 152 database records, two of which are artifacts made of multiple beads. Beads are discussed quantitatively (Table 6.18) and qualitatively (Table 6.19); however, numerical comparisons to other artifacts in the copper-base metal assemblage are difficult because beads may be strung together, and it is questionable whether they count as one single artifact (i.e., a “necklace fragment”) or should be considered separate artifacts. Copper mail is a term applied to small rolled beads when they are found attached to leather or textiles, rolled around the material or arranged in a pattern on the surface (see Cleland 1971:28-29 for the original description of this artifact category at the Lasanen site). This is an especially problematic category, because the methods of counting these artifacts differ: some archaeologists count mail “segments” while others record individual beads. In this section, I address both “copper mail,” and larger rolled beads, sometimes known as “tubular beads” or “hair tubes.”

To begin sorting the metric attribute data for rolled beads, I made a histogram of bead lengths and identified the range of variation in the size and shape of rolled beads (Figure 6.16) and plotted the length of all individual rolled beads (Figure 6.17).

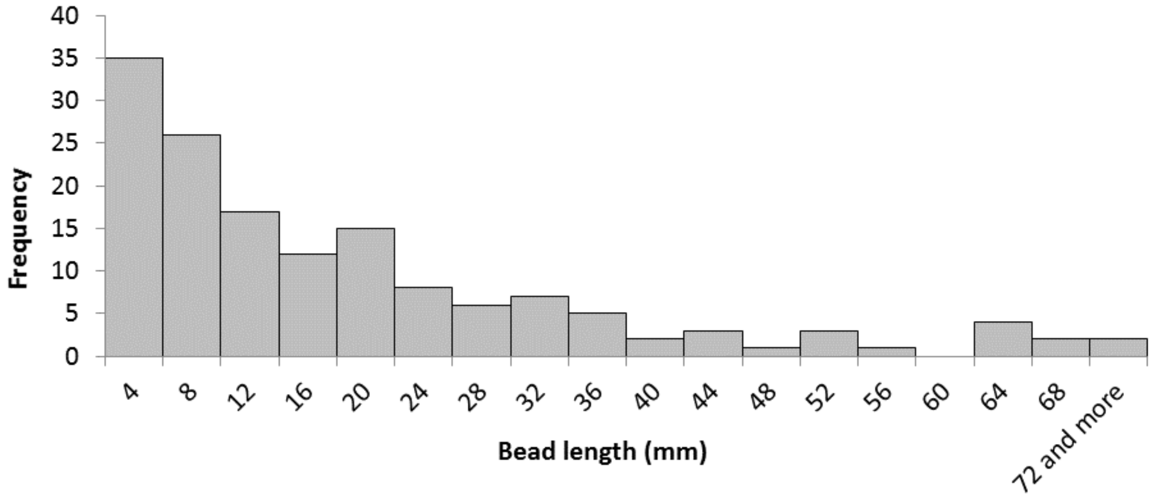


Figure 6.16: Histogram of rolled bead maximum lengths (n=150)

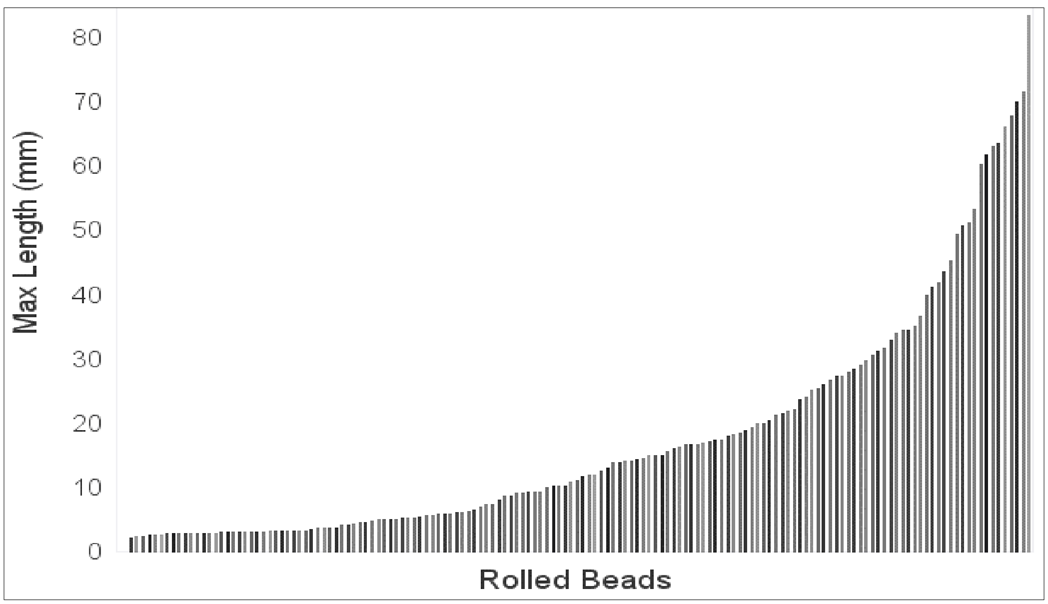


Figure 6.17: Maximum lengths of individual rolled beads (n=150) plotted sequentially

There are no natural breaks in the data, but since calculating a single mean bead length for each assemblage would homogenize the artifact types, I artificially divided the beads into two groups based on length. The two categories of beads with the greatest frequency are < 8 mm in length, and "copper mail" generally includes beads of this size or smaller. Therefore, I divided all objects classified as "beads" into two size categories, a "small rolled metal bead" <8 mm long and a “tubular bead” category for the larger objects, which range widely in size and do not form natural breaks in their length. There is also a continual range of variation between “tubular beads” and tinkling cones. In general, tinklers are tapered cone-shapes and narrow at one end, but some tubular beads do have a slight narrowing at one end, so I used blank shape to differentiate between the two types: rectangular blanks are considered beads, and trapezoidal blanks are considered tinkling cones.

Table 6.18: Summary quantitative data for rolled beads, mean and standard deviation (+/-) presented for each attribute

Beads < 8 mm long									
Site name:	**N**	**Max length (mm)**		**Max width (mm)**		**length: width**		**Max metal thickness (mm)**	
		Mean	***(+/-)***	**Mean**	***(+/-)***	**Ratio**	***(+/-)***	**Mean**	***(+/-)***
Bell	2	7.4	*0.1*	5.1	*2.3*	1.8	*0.8*	.28	*0.0*
Clunie	4	5.5	*0.9*	2.7	*0.5*	1.9	*0.3*	.41	*0.2*
Doty Island Mahler	13	3.4	*1.0*	2.1	*0.5*	1.7	*0.3*	.39	*0.1*
Doty Island Village	17	3.8	*1.0*	2.7	*0.7*	1.5	*0.5*	.46	*0.1*
Ft. Michilimackinac	1	6.5	*n/a*	2.7	*n/a*	1.5	*n/a*	n/a	*n/a*
47 WN 853	7	5.2	*0.3*	3.8	*0.3*	1.4	*0.2*	.33	*0.0*
Zimmerman	17	3.5	*1.2*	2.6	*0.5*	1.4	*0.5*	.41	*0.1*
Beads > 8 mm long									
Bell	33	27.1	*15.8*	8.4	*3.8*	3.8	*2.5*	.69	*1.0*
Camp Shaginappi	1	27.4	*n/a*	7.1	*n/a*	3.9	*n/a*	.54	*n/a*
Cloudman	4	25.5	*11.4*	6.7	*1.0*	4.0	*1.8*	.8	*0.5*
Clunie	5	17.4	*8.8*	5.1	*1.7*	3.4	*1.0*	.48	*0.1*
Doty Island Mahler	2	21.4	*9.8*	5.3	*1.3*	3.7	*0.9*	.55	*0.2*
Doty Island Village	5	20.0	*7.3*	8.5	*3.3*	2.6	*1.1*	.36	*0.1*
Elmwood Island	1	22.2	*n/a*	8.5	*n/a*	2.6	*n/a*	.33	*n/a*
Farley Village	1	9.3	*n/a*	3.9	*n/a*	2.3	*n/a*	N/A	*n/a*
Gros Cap	1	27.3	*n/a*	5.5	*n/a*	4.9	*n/a*	1.2	*n/a*
Marquette Mission	9	27.3	*17.0*	6.5	*3.0*	5.4	*3.4*	.51	*0.3*
McCauley	2	25.1	*10.1*	6.8	*0.1*	3.7	*1.4*	.49	*0.0*
Peshtigo Point	3	20.0	*7.4*	4.3	*0.6*	4.8	*1.7*	.25	*0.1*
Rock Island[1]	21	30.5	*23.6*	9.7	*2.9*	3.2	*2.3*	.48	*0.2*
Winston-Cadotte	1	70.1	*n/a*	6.6	*n/a*	10.6	*n/a*	.44	*n/a*

[1] This includes beads from Period 4 (n=2), Period 3: (n=14), and mixed historic contexts: (n=5).

Small rolled beads from each site tended to be stylistically more similar to one another than to beads from other sites. For example, all of the small rolled beads from Doty Island Village were of type 50, ovoid with overlapping seams, and they were sized within +/- 1 mm in length and .5 mm in width (Figure 6.18). Type 50 was also the most common small rolled bead or mail type for all sites. The larger beads (> 8 mm) were more diverse and include more irregularly shaped beads; for example, the Bell site tubular bead assemblage included several with irregularly closed edges, crumpled and bent beads, and other modifications to this style. Tubular beads come from more sites than small rolled beads, so use of mail or small rolled beads may be a more localized or specialized adornment practice, while larger rolled bead use may be more widespread in the Upper Great Lakes region at this time.

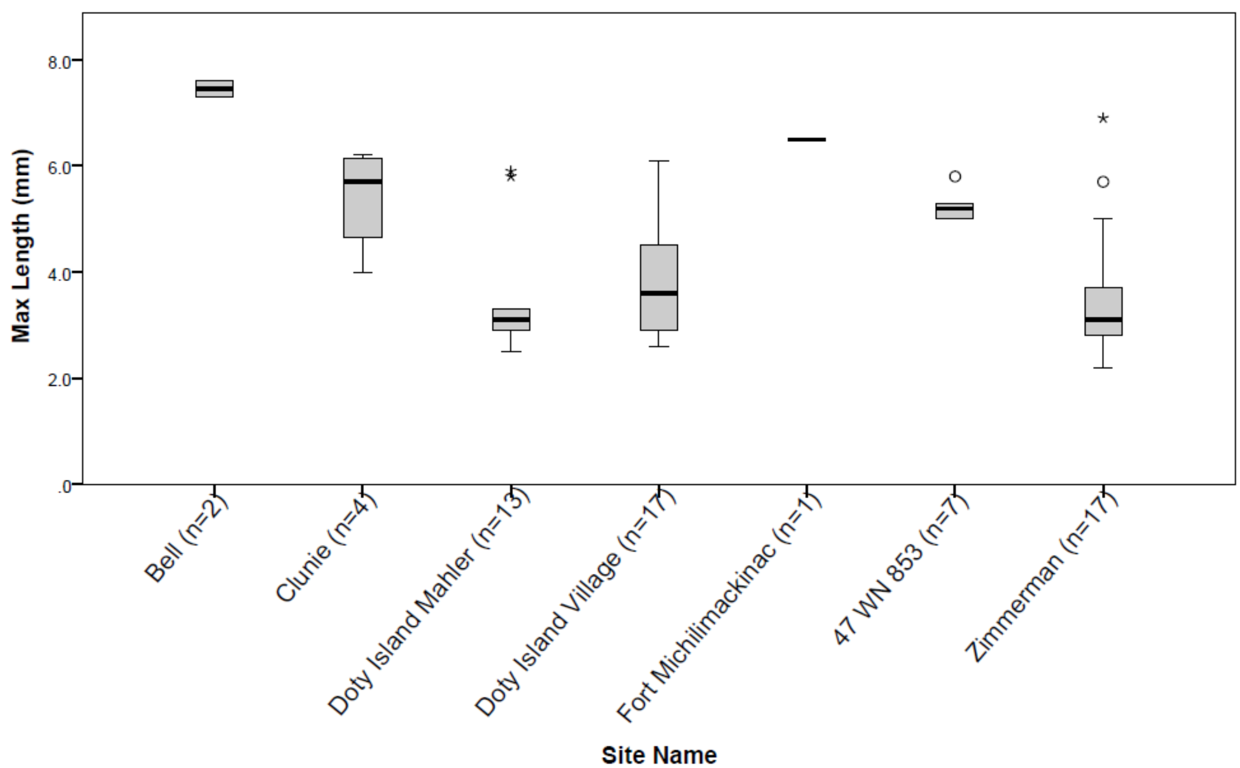


Figure 6.18: Box and whisker plots plots showing means, standard deviations, and outliers of mean maximum length for rolled metal beads <8mm long. Figure demonstrates similarity of objects from same site to one another.

Table 6.19 Qualitative data for rolled metal beads by predominant attribute for each site. Percentages represent % of artifacts from that site for each attribute

Beads < 8 mm long							
Site name:	**N**	**Typology code(s)**	**Closure**	**Blank Type**	**Working Method**	**Scratch Test**	
						Red:	**Yellow:**
Bell	2	54, 50	O: 100%	Irr:100%	Fold: 50%	50%	N/A
Clunie	4	58: 100%	n/a	Irr: 100%	Be: 25%	N/A	N/A
Doty Island Mahler	13	50: 100%	O: 100%	Rec: 100%	N/A	N/A	N/A
Doty Island Village	17	50: 47%	O: 65%	Rec: 94%	N/A	N/A	N/A
Ft. Michilimackinac	1	50: 100%	O:100%	Rec: 100%	N/A	N/A	N/A
47 WN 853	7	50: 100%	O:100%	Rec: 100%	N/A	100%	N/A
Zimmerman	17	50: 82%	O: 100%	Rec: 94%	Clip: 6%	N/A	N/A
Beads > 8 mm long							
Bell	33	50: 25%	O: 51%	Irr: 46%	Fold: 39%	45%	15%
Camp Shaginappi	1	51	N/A	Rec	N/A	N/A	N/A
Cloudman	4	54: 100%	O:100%	Rec: 100%	Ham: 25%	N/A	N/A
Clunie	5	54: 60%	O:80%	Rec: 80%	Be/Ham 20%	100%	N/A
Doty Island Mahler	2	54: 100%	O:100%	Rec/Ir:50%	TM: 50%	N/A	50%
Doty Island Village	5	diverse	O:80%	Rec: 60%	Be:60%	40%	40%
Elmwood Island	1	50	O:100%	Rec	Bent	N/A	N/A
Farley Village	1	59	O:100%	Rec	N/A	N/A	N/A
Gros Cap	1	66	O:100%	Rec	Bent	0	100%
Marquette Mission	9	63,66: 22%	O:55%	Rec: 66%	Be: 33%	N/A	N/A
McCauley	2	50:100%	O:100%	Irr/Sq	Cr: 50%	N/A	N/A
Peshtigo Point	3	62:66%	O:100%	Rec: 100%	N/A	N/A	N/A
Rock Island[1]	21	50:38%	O:81%	Rec: 95%	Be: 42%	19%	71%
Winston-Cadotte	1	70	N/A	Rec	TM	N/A	N/A

Several groups of small rolled beads or copper mail are not cataloged in the metals database as individual objects, and they are discussed qualitatively only because of the difficulty of measuring each of the beads, which were often attached to fragile organic fibers that could not be moved. These beads or groups of beads were identified from Bell, Rock Island, Gros Cap, Marquette Mission, and the Hanson site. Like the small beads assessed quantitatively above, based on observations of general appearance, closure styles, and size, the small rolled bead groups from each site appear stylistically similar to one another.

[1] This includes beads from Period 4 (n=2), Period 3: (n=14), and mixed historic contexts: (n=5).

At the Bell site, two lots of small rolled metal beads (Figure 6.19, n=15) were identified during flotation of unit fill from 10 cm levels in two consecutive levels (20 and 21, 200 – 210 cm below surface) from the same 1x1 meter unit, N27-28 E120-121. This is the only unit where rolled metal beads were recovered at the site during controlled excavations, so the beads may be a result of localized deposition of a single object or fragment of an object originally decorated with the beads. No other adornment objects such as glass beads or tinkling cones are reported from the same flotation sample. Individual measurements of each bead were not taken, but they were all photographed at the same scale and lighting conditions. They all fall into the 050 ovoid, overlapping seam category. The beads range between 2.5 and 3 mm in length, and two have fiberous organic material preserved inside of them.

Figure 6.19: Bell Site small rolled metal beads

Figure 6.20: "Copper mail" segment with small rolled beads of approximately the same size and shape attached to a leather strip. From a general level of a unit at the Marquette Mission site

Several pieces of unprovenienced "mail" were present in the Marquette Mission collection, and I photographed them but did not add them to my database, since their contexts were unknown and likely outside of the sampling strategy (Figure 6.20). According to the full feature inventory, a total of 211 individual segments of copper "mail" or small rolled individual beads were recovered from the site, but I examined only 11 total metal beads, predominantly rolled tubular beads unlike "mail." Based on the yearly excavation reports (Branstner 1983; 1984; 1985; 1986), use of elaborately-designed copper mail ornaments was an important personal adornment strategy at the Marquette Mission site.

Further evidence of the importance of rolled-bead ornaments in the St. Ignace area comes from the Gros Cap site. A long history of exploration and looting by treasure-hunters and local collectors at Gros Cap has produced some artifacts of types not recovered during controlled excavations, including a well-preserved collar or belt made of several hundred rolled metal beads (Figure 6.21). Based on gaps in the beadwork and leather along the edges, this object is the same one photographed in documented in the Greenlees family collection by Nern and Cleland, Figure 12A (1974:21), though by 1978, the C-shaped band had been torn or bent at the middle (at left in Figure 6.21). I made efforts to contact the descendants of the Greenlees family during this project, but the whereabouts of this important object are now unknown.

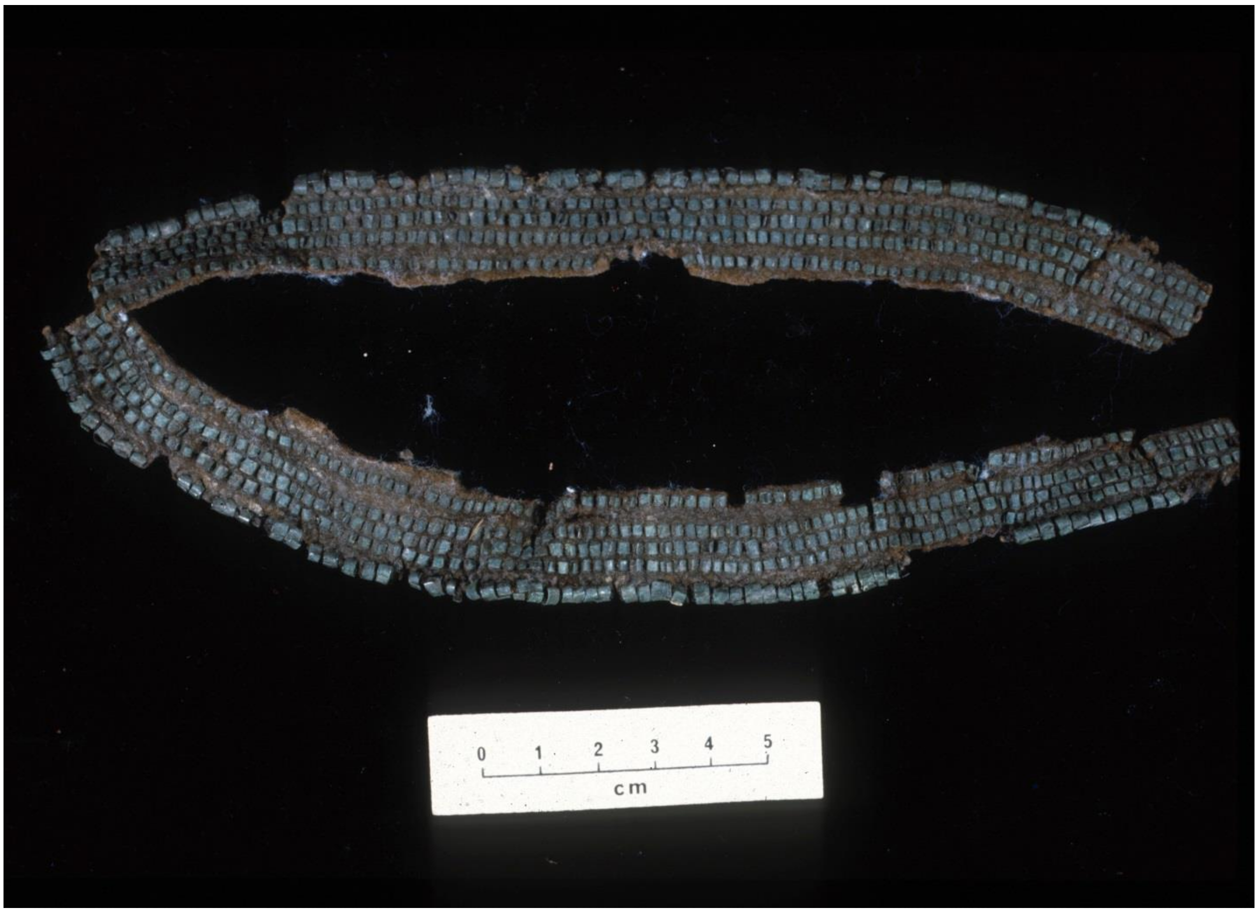


Figure 6.21: A nearly-complete belt or necklace made of hundreds of rolled copper beads from the Greenlees collection, documented by Susan Martin during the 1978 investigation of the site. Image courtesy of Susan and Patrick Martin.

However, test excavations by Michigan Technological University did recover a fragment of copper mail consisting of at least 37 rolled metal beads (Figure 6.22). The beads are connected on a matting of interwoven, possibly braided plant fibers, which were too fragile to permit removing the artifact from its tinfoil packaging for further examination. Individual loose beads were photographed; they conformed to the type 50 overlapping ovoid bead category and appear similar in size and shape to the examined mail fragment from the nearby Marquette Mission site.

Figure 6.22: Clockwise from upper left: braided organic fibers, "mail" fragment in tinfoil, profile and plan of a single loose rolled metal bead "mail" fragment from the Gros Cap site.

A string of at least 325 tiny rolled brass beads was recovered in the Hanson site assemblage of slumped materials. Based on their very small size ranging from 1.5 to 2 mm in diameter, these beads were originally identified as glass beads of Kidd and Kidd's IIa24 or IIa26 bead types, and were thought to be fused together by exposure to heat (Overstreet 1993:178-

180). This led to some confusion, since glass beads of Type IIa24 and IIa26 beads only appear in Wisconsin in the well-documented Rock Island assemblage during the Odawa occupation of 1760-1770, approximately 100 years too late for the rest of the Hanson assemblage. Using pXRF as an initial tool, the beads were determined to be metallic, specifically brass (copper and zinc alloy), and their "fused" appearance is a result of metallic corrosion, not heat treatment.

Figure 6.23: Hanson site small rolled beads. Scale in mm

These beads are the only evidence of potential reworking of European metal in the Hanson site assemblage, provided that the beads were fashioned from kettle metal or wire. SEM-EDS compositional analysis of the Hanson site beads was conducted on fragments of beads that had broken off of their string, and the string was also visually documented using the SEM, which

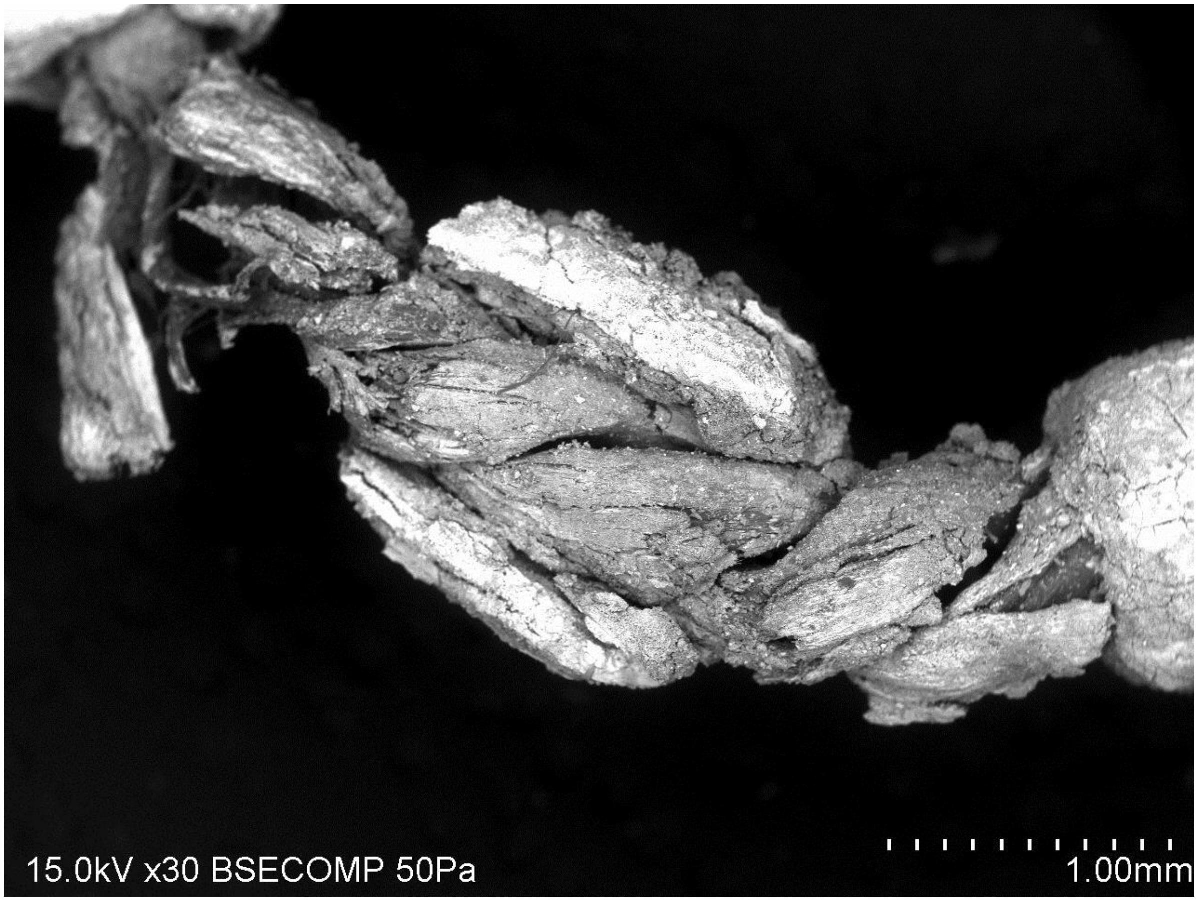


Figure 6.24 A broken metal bead from the Hanson site adhering to the twisted bast fiber. The white areas indicate uncorroded metal surface area suitable for sampling using SEM-EDS.

made it possible to determine the string was made of bast fiber (Bettina Arnold, personal communication, 2011). The analysis of more-recently broken bead fragments from the slump area of the site facilitated the sampling of relatively uncorroded metal (Figure 6.24), which were a copper-zinc alloy (brass), with inclusions of lead particles heterogeneously interspersed, a clear indicator of European manufacture of the base metal. Although Native production of ornamental objects from European metal objects was common in this era, no other reworked artifacts or partially worked scraps were recovered from the Hanson site mortuary assemblage. The Lasanen burial site at St. Ignace, perhaps the most comparable mortuary assemblage to Hanson, likewise produced no partially worked or unfinished artifacts (Cleland 1971:27-29). It is also possible that the small rolled beads recovered at the Hanson site were produced in a European workshop; however, the style of rolling seems consistent with other tiny rolled beads and mail fragments present in other historic assemblages at Native American habitation sites in my study sample.

Two possible "mail" fragments of rolled copper beads were recovered at the Rock Island site; they were logged as single records in the metals database HW-02309 and HW-02308. Both come from Period 3 of the site's historic-era occupation. HW-2308 consists of eight small rolled metal beads approximately 3mm long by 2mm wide woven onto a band or belt made out of organic material. The beads are all of type 050, with a slightly ovoid profile (Figure 6.25). HW-02309 is actually three distinct objects, two beads and a clip, which were nested together. They were photographed as a single object but became disentangled during handling and were subsequently photographed separately (Figure 6.26). Despite feature flotation and the recovery of many small glass beads, there were no small rolled beads recovered as individual objects, though a single clip that may be a pried open metal bead (HW-2143) also comes from the site.

Figure 6.25: Rock Island Period 3 woven fragment with small rolled metal beads (HW-2308)

Figure 6.26: Nested small rolled beads and clip. Three views of nested artifacts (left) and plan and profile views of the individual artifacts once they were separated (right).

The sites where small rolled beads were present do not share an ethnic or cultural attribution, a concentrated geographic region, or a close temporal range. Instances of small rolled beads extend from the Clunie site in eastern Michigan (made of native copper and possibly even associated with the Late Woodland component there) through the Doty Island Village eighteenth century Ho-Chunk (Winnebago) site, and a small rolled bead from Fort Michilimackinac. With the exception of the St. Ignace area, small rolled beads seem relatively rare on Upper Great Lakes sites, making up <1% of most assemblages. Rolled beads may be most popular among Illinois peoples, since the beads that Ehrhardt documented from the Iliniwek site (n =243) seem to be predominantly of the small, rolled kind. In the Upper Great Lakes region, only the Marquette Mission site comes close to this quantity of beads, with 136 rolled beads or mail fragments reported from feature contexts selected for analysis. Rolled metal beads worn in the form of “mail” may be a “fashion” that peaked select areas during mid-late seventeenth century, but without better control of samples from sites in the Upper Great Lakes, their usefulness as a temporal or cultural marker is limited.

There were a total of 89 tubular beads or large beads (>8mm) recovered from sites in the study sample (Table 6.18 and Table 6.19). The larger rolled metal bead is a diverse category because any non-trapezoidal blank that was rolled to form an aperture was considered a rolled bead. Some of these fit Ehrhardt’s “tubular bead” category, which she described as beads are at least 3x as long as their width (personal communication 2013). As with the small rolled metal beads, there are no clear ethnic, regional, or temporal patterns observed in the styles of larger tubular beads. However, some locales exhibited unique forms of tubular beads. The Bell site tubular beads were often bent or crumpled, and the predominant blank type was an irregular form, rather than clearly cut or sheared square or rectangular blanks. A long, slightly bowed-edge rectangle form of rolled bead, usually found flattened, appeared only at the Rock Island site, and it was given its own typological category (Type 72: bead, flattened, rectangular blank with both long edges folded in to the center with seam at center). Some members of this category were perforated at one end and may better be considered a pendant form. One bead from Marquette Mission (HW-02891) was a similar form and shape, but the edges met irregularly.

The comparison of small rolled beads and larger, tubular beads from the Upper Great Lakes has demonstrated that people of this region used a diverse adornment strategies that varied among sites, with unique expressions of the general form of “metal bead” found in some communities. Sites dated to the mid-late seventeenth century yielded more beads than later sites in the study sample, and the use of small rolled beads is especially prevalent at Marquette Mission, Gros Cap, Zimmerman, and Iliniwek Village, all occupied during the 1670s. Irregularly formed and rolled tubular beads predominate in the Bell assemblage, while tubular beads from Marquette Mission are more regular and tend toward rectangular blanks. The two French colonial outposts do not contribute examples of small rolled beads, and only a single, heavily corroded tubular bead (or possibly a corrosion encrusted tin tube) was found at Michilimackinac. Rolled metal beads used singly, as “hair tubes,” conversely do not have any temporal patterning and come from Native American habitation sites of the seventeenth and eighteenth century. The abundance of both small rolled beads and tubes at the Doty Island Village site indicates that some groups continued to use this form of adornment into the eighteenth century, at least in the Lake Winnebago region. However, rolled beads were not as common in this area as in the seventeenth century Illinois territory or at the contemporary sites of St. Ignace; based on this geographic distribution, people of these areas had a preference for copper “mail” adornments.

Figure 6.27: Flattened tubular beads (Type 72). Top: unperforated form (HW-01651); middle: perforated form (HW-02443); bottom: irregular seam form (HW-02981).

6.1.2.3 Metal pendants

In the study sample, a total of 18 metal artifacts were classified as pendants, or geometrically-shaped flat metal pieces with straight or smooth edges, perforated once near a corner or edge (Table 6.20 and Table 6.21). Triangular or trapezoidal metal pendants from historic contexts may mimic the shape of other adornments fashioned from shell, bone, and stone present in earlier contests (e.g. Meyer and Young 2004), and similar trapezoidal forms are also documented in refired glass (see Chapter 5 and Brown 1972). Pendant shape is stylistic choice unrelated to any technological processes of pendant production, and so it provides an opportunity to address Research Question 2, that spatial or temporal variations in reworked metal artifacts relate to regional or cultural distributions of Indigenous peoples around the Upper Great Lakes. No pendants were identified at Doty Island Village, Fort St. Joseph, or Fort Michilimackinac, supporting an inference that metal pendants might be an adornment primarily used at Native habitation sites, and most popular during the seventeenth and early eighteenth century.

When pendants are present, shapes differ within and among assemblages. One trapezoidal pendant, a possible trapezoidal pendant with jagged edges, and a diamond shaped pendant (a square blank perforated at one corner) were found at the Bell site. All three are slightly rolled along one edge, although the edges differ. A similar "diamond shaped" pendant comes from Marquette Mission; diamond shaped "pendants" may actually be simply perforated blanks, but there is no clear way to distinguish these items without clearer information about their use context. Ovate or rounded pendants, often broken at the perforation come from Elmwood Island, Farley Village, and the Cadotte Site. The Farley Village example is heavy for its size and may actually be made of lead; lead is also suspected for at least one of the Cadotte site objects, while the Elmwood Island piece is copper-base metal cut into an ovate form.

Table 6.20: Summary quantitative data for metal pendants, mean and standard deviation (+/-) presented for each attribute

Site name:	N	Shape	Max length (mm)		Max width (mm)		length: width		Max metal thickness (mm)	
			Mean	*(+/-)*	Mean	*(+/-)*	Ratio	*(+/-)*	Mean	*(+/-)*
Bell	2	Tra	18.3	*0.5*	16.2	*2.8*	1.2	*0.2*	.39	*0.1*
	1	Dia	13.6	*n/a*	13.4	*n/a*	1.0	*n/a*	.38	*n/a*
Cloudman	1	Irr	44.7	*n/a*	10.7	*n/a*	4.1	*n/a*	2.4	*n/a*
Doty Island Mahler	1	Tra	29.5	*n/a*	9.0	*n/a*	3.3	*n/a*	.22	*n/a*
Elmwood Island	1	Ov/R	22.3	*n/a*	12.5	*n/a*	1.8	*n/a*	.52	*n/a*
Farley Village	1	Ov/R	20.3	*n/a*	19.8	*n/a*	1.0	*n/a*	1.2	*n/a*
Marquette Mission	1	Dia	26.7	*n/a*	33.4	*n/a*	1.3	*n/a*	.32	*n/a*
McCauley	1	Squ	22.3	*n/a*	22.2	*n/a*	1.0	*n/a*	.49	*n/a*
Rock Island Period 3[1]	1	Rec	60.7	*n/a*	12.3	*n/a*	4.9	*n/a*	.47	*n/a*
	1	Tri	22.9	*n/a*	16.7	*n/a*	1.4	*n/a*	.48	*n/a*
	2	Tra	18.2	*1.5*	13.4	*0.5*	1.4	*0.2*	.43	*0.0*
Rock Island Period 4	3	Tra	20.4	*10.1*	14.2	*4.6*	1.5	*0.7*	.44	*0.1*
Winston-Cadotte	2	Ov/R	20.1	*2.8*	19.9	*2.4*	1.9	*0.0*	.72	*0.2*

Table 6.21: Qualitative data for metal pendants by predominant attribute for each site. Percentages represent % of artifacts from that site for each attribute.

Site	N=	Shape	Typology code(s)	Working Method	Scratch Test	
					Red	Yellow
Bell	2	Tra	521	Ro: 100%, Cl:50%; Sc: 50%	0%	100%
	1	Dia	522	Ro, Sc (100%)	100%	0%
Cloudman	1	Irr	N/A	Ham	N/A	N/A
Doty Island Mahler	1	Tra	521	Sc, Fol	N/A	100%
Elmwood Island	1	Ov/R	514	Be, Cl	N/A	N/A
Farley Village	1	Ov/R	514	N/A	N/A	N/A
Marquette Mission	1	Dia	522	Sc	N/A	N/A
McCauley	1	Squ	520	Cl, Ro	N/A	N/A
Rock Island Period 3[1]	1	Rec	529	Be	N/A	N/A
	1	Tri	502	N/A	N/A	100%
	2	Tra	521	Gr: 50 %; Sc: 50%	N/A	100%
Rock Island Period 4	3	Tra	521	Gr: 33%	33%	33%
Winston-Cadotte	2	Ov/R	514	Cl: 100%; Sc: 100%	N/A	N/A

[1] Includes one object from mixed contexts, from either period 3 or 4.

From the Iliniwek Site, Ehrhardt reported five triangular copper-base metal pendants that been hammered and colored with red ocher on their surfaces in (2005:123-126). She noted that these pendants were very similar to two artifacts from Rock Island Period 3, which were included in my study sample as HW-01702 and HW-01703. These Rock Island artifacts were the only two triangular pendants that I identified in the course of my study, but similar trapezoidal forms were identified from Bell and also from Rock Island. The distinction between trapezoidal and triangular forms might have some social significance: trapezoidal forms are present at sites associated with the Meskwaki, as well as Rock Island, while triangular forms are present at Illinois sites and at Rock Island, a known meeting place where diverse peoples converged for trade (Mason 1986: 17-20). The diversity of pendant forms recovered there mirrors variation in the Rock Island ceramic assemblage, which includes examples of a Danner or La Salle Filleted type similar to those found at Zimmerman, in Illinois (Mason 1986:175-176), and a possible example of the Bell Type I (Butte des Morts ware) ceramic type associated with Meskwaki sites (Mason 1986:171). Therefore, stylistic variation in metal pendants shapes may reflect inter-cultural exchange at Rock Island.

Rock Island also has a unique pendant form, the elongated bowed rectangle (Figure 6.28), a shape also present in flattened bead forms. Artifacts of this shape could be produced either by rolling and hammering flat a bowed rectangular blank (described as a form of rolled bead), or to create a pendant, cutting out the shape from a flat blank and perforating one end. The shape is unlike any other pendants documented from contemporary contexts in the Upper Great Lakes region. A somewhat similar artifact in my study sample comes from the Cloudman site on Drummond Island, Michigan. Based on its hammered surface appearance, the artifact (HW-00343) may be made of native copper (Figure 6.39) Although it is not perforated, there is a

Figure 6.28: Bowed rectangle shaped pendant from Rock Island (HW-02090)

folded flap or flange on one short end, and there is a seam of hammered copper running roughly down the middle of one long face of the object, in a manner similar to the perforated and folded "bead" from Rock Island discussed above. Despite the lack of perforation, a cord could have been run around the folded flap the object from Cloudman, and it classified as a possible pendant. The Cloudman site produced several copper-base metal artifacts suspected to be native copper, based on working methods and forms, and these objects come from the same contexts as glass trade beads, protohistoric ceramic types, and two gunflints of locally-available chert. Artifact HW-00343 comes from the same unit as a feature identified as a Late Late Woodland/ Protohistoric context (Feature 18), on the basic of ceramic styles present there (Branstner 1995: 34). The artifact is described as a Late-Woodland era "butter knife" (see Branstner 1995:97), but it may represent a protohistoric example of a bowed-rectangle-shaped objects that might have functioned an adornment, like the Rock Island pendant of similar form.

Figure 6.29: Copper object (HW-00343) from the Cloudman site

6.1.2.4 Bracelets

Metal bracelets are infrequent finds in the Upper Great Lakes assemblages, and I examined 18 possible bracelets or bracelet portions from four sites: Bell, Marquette Mission, Rock Island, and the O'Neill site. Bracelets are C-shaped and can be fashioned from three metal raw material forms: solid wire, tubes or tubing (B-shaped, e-shaped, or O-shaped), and strips cut from flat sheet metals. To better compare artifacts crafted through similar production processes, bracelets, I sorted bracelets first by the form of the raw material used to make the bracelet (Table 6.22 and Table 6.23). Length and width measurements reflect the actual size of the bracelet, not the material itself, and thickness refers to the maximum thickness of the wire or tubing, not the individual sheet of metal, except for strip-style bracelets, for which width records the width of the metal blank and thickness records the metal sheet thickness. The most common recorded working method is bending, which produces the C-shaped form with sharp angles at the apexes. All C-shaped bracelets are also classified as rolled, as they exhibit a curvature that would come from rolling around a human wrist or arm or a suitably-sized mandrel.

Table 6.22: Summary quantitative data table for metal pendants, mean and standard deviation (+/-) presented for each attribute

Site	**N=**	**Wire, tube, strip**	**Max length (mm)**		**Max width (mm)**		**Max thickness (mm)**	
			Mean	***(+/-)***	**Mean**	***(+/-)***	**Mean**	***(+/-)***
Bell	1	B-tube	64.3	*n/a*	40.1	*n/a*	2.8	*n/a*
	1	O-tube	44.6	*n/a*	27.1	*n/a*	3.5	*n/a*
	3	wire	68.4	*11.4*	41.9	*4.6*	3.5	*0.9*
Marquette Mission	1	B-tube	53.2	*n/a*	48.1	*n/a*	4.4	*n/a*
O'Neill	1	strip	69.6	*n/a*	23.85	*n/a*	.92	*n/a*
Rock Island Periods 2, 3 and 4	2	B-tube	48.6	*3.6*	36.9	*4.3*	3.2	*0.3*
	1	e-tube	44.8	*n/a*	35.0	*n/a*	4.9	*n/a*
	3	O-tube	43.6	*2.7*	33.0	*5.1*	.35	*0.1*
	4	wire	46.7	*12.5*	33.3	*3.2*	1.6	*0.3*
	1	strip	39.4	*n/a*	7.04	*n/a*	.45	*n/a*

Table 6.23: Qualitative data for bracelets by predominant attribute for each site. Percentages represent % of artifacts from that site for each attribute.

Site	**N**	**Wire, tube, strip**	**Typology code(s)**	**Working Method**	**Scratch Test**	
					Red	**Yellow**
Bell	1	B-tube	226	Bent	0%	100%
	1	O-tube	210	Bent	N/A	N/A
	3	wire	212	Be: 100% Ham: 33%	N/A	N/A
Marquette Mission	1	B-tube	208	Bent	N/A	N/A
O'Neill	1	strip	516	Be, Cl, Sc	N/A	100%
Rock Island Periods 2, 3 and 4	2	B-tube	226	Bent: 50%	100%	0%
	1	e-tube	209	Bent	0%	100%
	3	O-tube	210	Bent: 66%	0%	100%
	4	wire	212	Bent: 25%	0%	100%
	1	strip	211	Sc/Rol	N/A	100%

Based on the recorded attributes, there are no clear temporal or spatial patterns in bracelet style; they come from some of the largest assemblages in the study sample and may have been generally rare forms of adornments. Nine bracelets come from Period 3 Rock Island, a solid wire bracelet that is most likely from Period 2 (HW-02323) and a B-shaped tubing bracelet is from Period 4 (HW-02329). Aside from the form of the material used (wire, tubing, and strip), there are no clear stylistic differences among the Rock Island bracelets, despite the fact that they come from several different temporal components. The Bell site C-shaped bracelets also differ in form of material and are consistent in shape, but on average they are longer and wider than bracelets from other sites. B-shaped tubing used for the Marquette Mission bracelet is slightly larger "gauge" or wider than the tubing found at the Bell site. The C-shaped bracelet fragment that Ehrhardt describes from the Iliniwek site is also made of B-shaped tubing (2005:127-128). There are not enough bracelets represented in this study to make an interpretation about cultural or regional associations of particular C-shaped bracelet types.

Figure 6.30: Examples of tubing shapes from Rock Island bracelets, not to scale

Figure 6.31: Examples of c-shaped bracelets, all examples from the Rock Island site

Figure 6.32: Cuff-style bracelet (HW-00350) from O'Neill

The O’Neill site, a predominantly Late Woodland-era site with a probable historic seventeenth century component, produced a small assemblage of 14 trade items (Lovis 1973), including a unique “cuff” style bracelet Figure 6.32: Cuff-style bracelet (HW-00350) from O'Neill(Figure 6.32). Existing scratches reveal the yellowish metal is clearly brass, not copper. One edge of the bracelet is notched or cut into a fringe, perpendicular to the edge of the bracelet, and the object appears flattened, which may have happened post-deposition. This bracelet type is unique in the Upper Great Lakes study sample, but similar “cuff bracelets” from are documented from Wendat, Petun, Neutral, Fort Ancient, Micmac, and Delaware affiliated sites in eastern North American (Anselmi 2004:195-197). Based on this formal similarity, the cuff bracelet at the O’Neill site in northern Michigan may have been deposited by displaced newcomers to the area in the seventeenth century, or by an individual in the community with a direct trade connection to eastern North American groups. Conversely, the O’Neill site inhabitants could have obtained this item through down-the-line trade, or the bracelet may represent a far northwestern limit of the distribution of cuff-style bracelet manufacture not otherwise documented in Michigan.

6.1.2.5 Coils, Spirals and Rings

Coils, spirals, and rings are a diverse set of artifact types that appear infrequently in the Upper Great Lakes dataset, with no discernable patterns in their stylistic distribution in this region. Fourteen coils/spirals and 8 rings were found at only a few geographically disparate sites: O'Neill, Fort St. Joseph, Marquette Mission, Doty Island, and Rock Island (Table 6.24 and Table 6.25). Like bracelets, finished forms may be made from solid wire, tubing, or strips of sheet metal. Ehrhardt defines rings (for wearing on fingers) as single rolls of strips, wire, or tubing; coils as bedspring-like rolls of hollow tubing; and spirals as coils made of flat strips (2005:115-117, 126-130; 2013:Figure 16-3). These may be finished objects used as personal adornments or partially worked and discarded materials. The origin of tubing (also known as "B-wire" or "butt-convoluted wire") is unknown: it may have arrived in North America as a trade item already formed into its B-, O-, or e-shapes (Bray 1978:31), but Indigenous production of these forms by rolling thin flat blanks cannot be ruled out (Ehrhardt 2005:134-135; 168-169).

Table 6.24: Quantitative Summary table for Coils, Spirals, and Rings, mean and standard deviation (+/-) presented for each attribute

RINGS								
Site	**N=**	**Wire, tube, strip**	**Max length (mm)**		**Max width (mm)**		**Max thick-ness (mm)**	
			Mean	***(+/-)***	**Mean**	***(+/-)***	**Mean**	***(+/-)***
Rock Island Period 1	1	strip	16.1	*n/a*	7.9	*n/a*	.43	*n/a*
Rock Island Period 3	1	strip	17.1	*n/a*	3.9	*n/a*	.48	*n/a*
	1	strip	15.5	*n/a*	5.3	*n/a*	.47	*n/a*
Fort St. Joseph	1	wire	13.3	*n/a*	7.7	*n/a*	.44	*n/a*
Marquette Mission	1	wire	21.7	*n/a*	N/A	*n/a*	1.16	*n/a*
	2	B-tube	17.7	*2.9*	11.6	*3.7*	N/A	*n/a*
	1	strip	12.5	*n/a*	4.3	*n/a*	.38	*n/a*
COILS								
Rock Island Periods 3 & 4	2	O-tube	19.5	*7.8*	13.6	*4.3*	1.2	*0.1*
Rock Island Period 3	1	B-tube	13.9	*n/a*	0.9	*n/a*	2.1	*n/a*
Marquette Mission	1	B-tube	24.3	*n/a*	21.8	*n/a*	3.0	*n/a*

Table 6.24 (continued): Quantitative Summary table for Coils, Spirals, and Rings

SPIRALS			Max length (mm)		Max width (mm)		Max thick-ness (mm)	
			Mean	***(+/-)***	**Mean**	**Mean**	***(+/-)***	**Mean**
Rock Island Protohistoric?	1	strip	14.5	*n/a*	7.9	*n/a*	.62	*n/a*
Rock Island Periods 3 & 4	3	strip	16.0	*0.3*	5.1	*3.3*	.45	*0.1*
O'Neill	1	strip	14.9	*n/a*	14.3	*n/a*	.89	*n/a*
Doty Island Village	3	strip	9.8	*1.8*	4.7	*1.9*	.82	*0.4*
Doty Island Mahler	1	strip	41.3	*n/a*	5.7	*n/a*	.54	*n/a*
Fort St. Joseph	1	strip	21.5	*n/a*	3.7	*n/a*	.27	*n/a*

Table 6.25: Qualitative summary table for rings, coils, and spirals by predominant attribute for each site. Percentages represent % of artifacts from that site for each attribute

RINGS						
Site	**N**	**Wire, tube, strip**	**Typology code(s)**	**working method**	**Scratch Test**	
					Red:	**Yellow:**
Rock Island Period 1	1	strip	216	Be, Sc	0%	100%
Rock Island Period 3	1	strip	216	Be	100%	0%
	1	strip	216	Sc	100%	0%
Fort St. Joseph	1	wire	218	N/A	N/A	N/A
Marquette Mission	1	wire	218	Be	N/A	N/A
	2	B-tube	214	Be:50%	N/A	N/A
	1	strip	216	Be, Sc	N/A	N/A
COILS						
Rock Island Periods 3 & 4	2	O-tube	223	N/A	0%	100%
Rock Island Period 3	1	B-tube	221	N/A	100%	0%
Marquette Mission	1	B-tube	221	Be, F, TM	100%	0%
SPIRALS						
Rock Island Protohistoric (?)	1	strip	220	N/A	100%	0%
Rock Island Periods 3 and 4	3	strip	220	Sc: 33%	33%	66%
O'Neill	1	Strip	220	Cl/S, Sc	N/A	N/A
Doty Island Village	3	Strip	220	B: 33%; F: 33%	66%	0%
Doty Island Mahler	1	Strip	220	N/A	N/A	N/A
Fort St. Joseph	1	Strip	220	Cl/S	N/A	N/A

Measurements of rings and spirals from metal strips document maximum diameter of the artifact, not the length of the blank itself. Width for these objects was measured across the short axis of the blank. Width of objects made of tubing or wire reflects the width of the finished object, while thickness records the thickness of the tubing, not of the individual sheet of metal.

Like bracelets, coils, spirals, and rings are all considered to be rolled objects, so rolling is not listed in the table as a working method. Rings and coils made of tubing are apparently quite rare in the Upper Great Lakes region; they were only recovered from the Rock Island and Marquette Mission sites, though this could be a result of sampling, since these are two of the most complete site assemblages in the study sample. The single "ring" made of solid wire in the Fort St. Joseph sample is very thin (.44 mm thick), much thinner than wire used for rings at other sites, and comparable to the thickness of earring wires observed in other collections.

Spirals are found at more sites than rings and coils, but the shapes of the spirals are diverse. The "spiral earring" from the O'Neill site (Figure 6.33) does not conform to the blank shape or dimensions of other spiral beads made from metal strips. It may be a piece of curved production waste resulting from the production of tinkling cones, copper discs, or other more familiar forms. The spiral bead from Doty Island's Mahler portion is most similar to those that Ehrhardt describes from Iliniwek site (2005:165-166), but the object has a silvery patina, and the scratch test was inconclusive. The "spiral" from Fort St. Joseph (Figure 6.33) is a rectangular blank coiled once around a mandrel, but it is formally dissimilar to most other reported "spiral beads," and it may be simply a discarded blank or partially worked object.

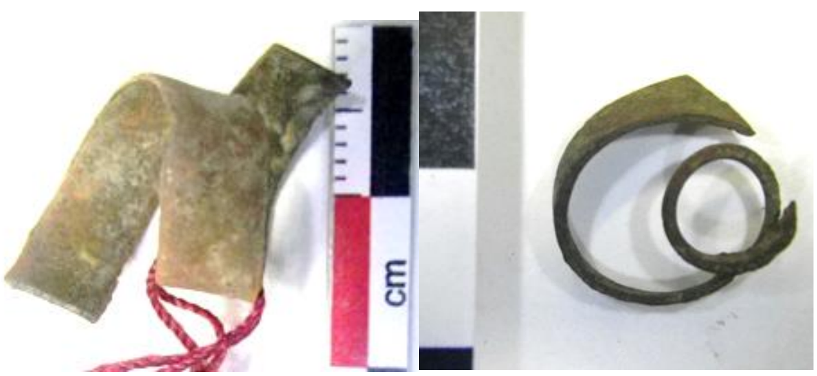


Figure 6.33: Non-standard, possible spirals from Fort St. Joseph (left) and O'Neill (right). Scales in centimeters.

There is evidence for the long-term continuity of the spiral form at the Rock Island site. A spiral bead (HW-02333, Figure 6.34) recovered from a context containing only unidentifiable grit tempered ceramics (Unit F, Square 2, Stratum B2; see Mason 1990) was consistent in form and shape with other spiral beads made of smelted copper from protohistoric contexts in Illinois (see Ehrhardt 2013), but pXRF and LA-ICP-MS analyses determined that the Rock Island site object was made of native copper. Similar spiral forms made of smelted copper were recovered from later, clearly historic contexts attributed to Periods 3 and 4 of occupation at the site (Figure 6.34). Although working methods differ, with possible hammering on the protohistoric/late prehistoric spiral and clear evidence of scoring along the long narrow edge of the later examples, the dimensions and ultimate finished appearance of these artifacts are comparable and demonstrate long-term continuity of the spiral form at Rock Island.

In the Upper Great Lakes, spirals appear to be a widespread form produced using a variety of manufacturing techniques and used or worn by many different cultural groups. It is not possible to determine the origin of the spiral form, but given its expression in native copper in Oneota-affiliated contexts on Rock Island, it may be a late prehistoric form that gained popularity as the availability of copper-base metal increased when trade with Europeans became more common. Coiled elongated strip spirals also occur in early historic Iroquoian contexts (Anselmi 2004: 281; Bradley and Childs 1991), as well as at the Grimsby site in Ontario, Madisonville in Ohio, and the Iliniwek Village site (see Ehrhardt 2002:231; 2005). The broad distribution of the spiral form highlights the interconnected nature of trade among Indigenous peoples in eastern North America and the Midwest both prior to and during the colonial era.

Figure 6.34: Spirals from Rock Island. Top: Spirals from late prehistoric contexts with Oneota ceramics, leftmost positively identified as native copper (HW-02333); rightmost object (HW-02330) not tested. Bottom: Spirals from 17th century contexts found in association with other trade items (HW-01571 and HW-02440). Scoring visible on object at bottom right.

6.1.2.6 Projectile Points

This section describes flat, pointed metal objects formally similar to lithic or bone projectile points used in pre-contact times (Figure 6.36). Flat projectile points differ from triangular blanks or pendants (if perforated) because of their central perforation or presence of a stem, which would facilitate hafting. Rolled, closed tip projectile points shaped like tinkling cones also have been identified (Anselmi 2004:229-248; Ehrhardt 2005: 120), but without clear contextual information such as direct association in a mortuary or faunal context, or preservation of mandrels or arrow shaft fragments preserved inside the metal, it is not possible to separate rolled, closed-tip projectile points from tinkling cones with a slightly crimped or closed apexes.

I identified three completely closed-tip cones in the Upper Great Lakes sample set, and I classified these as type 353, a tinkling cone or projectile point, trapezoidal blank, tip closed, neck, midsection, and base overlap. These objects were included in metric data for tinkling cones presented in section 6.1.2.1. Two out of three objects in this category contained wood fragments, supporting the idea that they may have been used as projectile points. Furthermore, several more rolled cones had tips that were crimped closed, but this could have secured a tinkling cone onto a leather strip, or to fasten hairs or a “tassel” inside the cone. These closed-tipped cones were classified as types 322 (n=1), 327 (n=7), 329 (n=1), and 330 (n=1). Since there is ambiguity between cone-shaped rolled projectile points and tinkling cones, I kept all conical points with closed tips in the tinkling cone category based on their formal similarity. Therefore, this projectile point section deals only with flat, two-dimensional artifacts

Figure 6.35: Type 353 projectile point or tinkling cone (HW-03214, bottom) from the Marquette Mission site, with wood or other organic material preserved inside (top).

A total of 40 flat probable projectile points were examined, and more than half (56%) come from the Rock Island site, with others from Marquette Mission, Gros Cap, McCauley, Marina, and Winston-Cadotte (Table 6.26 and Table 6.27).

Table 6.26: Summary quantitative data for projectile points, mean and standard deviation (+/-) presented for each attribute

Site	N	Stem, Perf., or Serrated	Max length (mm)		Max width (mm)		length: width		Max thick-ness (mm)	
			Mean	***(+/-)***	**Mean**	***(+/-)***	**Ratio**	***(+/-)***	**Mean**	***(+/-)***
Gros Cap	2	Perf	28.8	*1.4*	18.2	*1.1*	1.6	*0.0*	.9	*0.2*
Marina	5	Stem	32.1	*8.8*	13.0	*2.0*	2.5	*0.6*	.9	*0.3*
Marquette Mission	7	Perf.	25.8	*3.5*	15.0	*3.6*	1.8	*0.5*	.6	*0.2*
McCauley	1	Stem	39.5	*n/a*	15.0	*n/a*	2.3	*n/a*	.6	*na*
Rock Island Period 3	2	Serr.	41.5	*10.0*	12.0	*0.5*	3.5	*1.0*	.5	*0.0*
	5	Perf	30.0	*7.6*	17.3	*2.4*	1.8	*0.5*	1.0	*0.4*
	6	Stem	34.8	*15.3*	18.7	*5.6*	1.9	*0.5*	.8	*0.4*
Rock Island Period 4	1	Serr.	22.2	*n/a*	9.3	*n/a*	2.4	*n/a*	.5	*n/a*
	4	Stem	29.3	*6.2*	15.7	*1.3*	1.9	*0.5*	1.0	*0.2*
Rock Island (general)	1	Perf	17.1	*n/a*	14.0	*n/a*	1.2	*n/a*	.7	*n/a*
	2	Stem	31.2	*4.4*	14.8	*0.3*	2.1	*0.3*	.8	*0.0*
Cadotte	2	Stem	30.3	*0.6*	16.8	*4.4*	1.9	*0.5*	.8	*0.0*

Table 6.27: Qualitative summary table for projectile points by predominant attribute for each site. Percentages represent % of artifacts from that site for each attribute

Site	N	Stem, Perf., or Serrated	Typo logy code(s)	Blank types	working method(s)	Scratch Test	
						Red	**Yellow**
Gros Cap	2	Perf	518	Tri: 50% Dia:50%	Sc:100%;	50%	0%
Marina	5	Stem	510	Tri: 100%	Sc: 80%; Gr:60%	0%	80%
Marquette Mission	7	Perf.	518	Tri: 100%	Sc: 57%	N/A	N/A
McCauley	1	Stem	510	Tri: 100%	Clip: 100%	N/A	N/A
Rock Island Period 3	2	Serr.	526	Rec: 100%	Sc: 100%	50%	50%
	5	Perf	518	Tri: 83%	Sc: 60%	60%	40%
	6	Stem	510: 83%	Tri: 60% Dia: 40%	Sc: 66%	44%	66%
Rock Island Period 4	1	Serr.	526	Rec: 100%	Sc, Cl, Be	100%	0%
	4	Stem	510	Tri: 100%	Sc: 50%	0%	50%
Rock Island (general)	1	Perf	518	Tri:	N/A	0%	100%
	2	Stem	510	Tri: 100%	Sc: 100%	50%	50%
Cadotte	2	Stem	510	Tri: 50% Dia 50%	Cl, Sc: 50%	N/A	N/A

Points from the same site localities tend to be stylistically similar, both in their size attributes and method of hafting. There are two possibilities for hafting metal points: use of a perforation near the center of the point, through which cordage could be passed, or the form with a stem or tang, similar to the attachment method for lithic points. Scoring is the most common working method documented among all points, but edge grinding also appears on several of the points, especially the larger stemmed varieties. Triangular or diamond-shaped perforated points appear less frequently than stemmed points, and no stemmed and perforated types were documented, with the exception of a unique, double-perforated form, from Rock Island.

Figure 6.36: Representative styles of metal projectile points, left to right: two basally notched examples from Madeline Island, a conserved copper triangular point with perforation and scoring from Marquette Mission, a unique stemmed and double-perforated point from Rock Island, and a stemmed, ground-edge brass stemmed point from Madeline Island.

A basally notched, stemmed form appears only on Madeline Island, and was recovered from both the Marina and the Cadotte sites. There is a fragmentary point from Rock Island that may also be basally notched, but the tip of the point has been deliberately cut off. No stemmed points were identified at Marquette Mission or Gros Cap, possibly indicating that stemmed metal points are a more localized style in the Upper Great Lakes region while perforated triangular or diamond shapes are more widespread. Like the coils, spirals, and rings, copper or brass projectile points are absent from the Lake Winnebago region and/or Meskwaki-affiliated sites, including the 100% sample of the large Bell site metals assemblage as well as French colonial/Métis locales.

The Rock Island assemblage is most diverse, with stemmed, diamond-shaped, perforated triangular forms, and a unique serrated form or miniature harpoon-like points, (Type 526, Figure 6.37, n=3), possibly fishing arrows. These artifacts are similar in form but smaller than bone and antler harpoons from historic and prehistoric Rock Island (Mason 1986: 182) and contemporary sites (Cleland 1971; Martin 1979); the closest published example of a metal “harpoon” of this type is also larger and comes from Fort Michilimackinac (Stone 1974:278). Two serrated forms from Rock Island are more rounded and saw-like, and one of these has been further reworked.

Figure 6.37:Rock Island serrated artifacts: Left: Possible fishing arrow points or miniature harpoons; Right: saw-like point fragments or production waste with scoring, and possibly a triangular point blank removed. Pieces do not refit.

6.1.2.7 Miscellaneous other possible adornments or finished objects

This section presents qualitative discussion about other recognizably finished objects that do not fit into the categories described above. The most striking difference between the present study and findings from the Illinois region is the scarcity of small, “staple-like” clips in the

Upper Great Lakes. Beads have a rounded or ovoid cross-section, and clips are distinguished by a flat midsection resulting from attachment style: clips are used with the legs poked through leather or cloth and bent to attach it, not strung like beads or copper mail (Ehrhardt 2005:117-119). At Iliniwek Village clips, were the second most-common finished object recovered at that site, after beads (Ehrhardt 2005:117-119). I identified only 17 possible clips, some of them fragmentary, in my study sample. At the Illinois-affiliated Zimmerman site, clips (n=7) make up 5% of the total assemblage (n=125), and tinkling cones (n=8) are as common as clips; however, at the Iliniwek site, clips (n=173) appear more frequently than tinklers (n=41), illustrating both similarities and differences in the adornment strategies at these two Illinois sites (Ehrhardt 2013:382). Of all clips in my study sample, those with the most similar shape and form to the Iliniwek site clips come from the Zimmerman site (Figure 6.38). Other locales of possible clip use include Southwest, Plains, and Midwest regions (Ehrhardt 2005:117-119), but based on the present data, clips seem to be a distinctive Illinois-area adornment strategy, possibly one that grew out of an economic need to produce adornments from small or fragmentary scrap pieces less suitable for use as other kinds of beads or tinkling cones.

Figure 6.38: Left: HW-00582 a clip, or possibly rolled metal bead from the Doty Island Village site. Described as a clip, type 001, in the metals database. Right: HW-02862 a clearer example of a clip, from the Zimmerman site, type 007. Scales in millimeters

Aside from Zimmerman, the clips from the Upper Great Lakes sample came from Doty Island Village (n=5), Rock Island (n=3), and one each from Lake Winneconne Park, Marquette Mission, and North Shore Village. Of the clips recovered, the most common type was type 008, which I describe as: “clip, both legs bent up, neither bent in; midsection bent or rippled, (not completely rolled) - bent or pried open?”. Objects of this type may be opened or detached rolled metal beads, and there is a continuous range of variation between clips and beads. Some possible clips from Doty Island have a flat midsection but rounded “legs” more like an ovoid bead, and the only clip from Lake Winneconne Park comes from an assemblage that includes seven small rolled beads of the same size and proportions; the “clip” may simply be a slightly unrolled or pried open bead. Based on these findings, the adornment strategy of clips seems generally restricted to the Illinois region and was not widely used in the Upper Great Lakes.

Aside from clips, there are several other unique finished artifacts that warrant individual discussion. Based on their forms and coating with red pigment, two artifacts from the Rock Island site are associated with symbolic activities. One object is a rectangular piece of metal with regular perforations around the edges, which would ordinarily be classified as a patch. However, the edges were bent and folded to form a cup-shape or container, and there is scoring present just below some perforations, as if in an attempt to remove the perforated metal and perhaps make the container more secure. The inside of the “cup” has traces of a bright red, powdery substance that could be red ocher or vermillion; it does not have the same color or texture as an iron-oxide or rusty corrosion product. Vermillion was identified in the Odawa burial component of the Rock Island site, which demonstrates both the presence of this pigment at the site and possible ideological significance.

Figure 6.39: HW-01813, patch possibly reused as a pigment container

Another unique object with possible red pigment is HW-1704, a cross-shaped pendant cut from brass which, based on context and associated artifacts, probably comes from the Period 3 occupation (c. 1670 to 1730). There are clear scoring marks near the perforation, and the slightly irregular shape suggests that this was not a form manufactured for the trade. A very similar cross of the same size, proportions, and with the same rounded attachment point was recovered from Burial 2, which could have been deposited no earlier than 1756 (Mason 1986:152). The similarity between the cut-brass object and the later trade silver cross form could be coincidental, or this form could be a long-standing cross-style emulated first in brass before silver items could be obtained later, probably through trade with British rather than French sources. The brass cross is speckled with reddish pigment on both sides; like the “cup.” Since the cross is a traditional Christian symbol while ochre has long-standing ritual significance among Native America peoples (Roper 1991; Pleger 2000), this artifact may be an example of ideological syncretism represented in the archaeological record of Rock Island.

Figure 6.40: Obverse and reverse views of object HW-01704, possibly dusted with ocher or vermillion. Coring visible at the top reverse side, indicating local manufacture.

Another possible adornment object (Figure 6.41), from the Gros Cap site, is described as artifact as “silver-plated brass,” (Martin and Martin 1979:158, Figure 10c), and in appearance it is yellowish-silver with blackened patches, but scratch testing was not permissible for this collection. The piece has three perforations: one in the middle of a rounded edge and two at the corners of a clearly snapped or broken edge; the latter might have been used to connect the piece to the other half of the bracelet, while the perforation at the finished edge might have held a tie or fastener. Because of the serrated edge, I placed the object into typological category 526, point serrated, blunt or pointed tip (saw like), but it may actually be more similar to the cuff bracelet from the O’Neill site, but broken and possibly repaired.

Figure 6.41: Saw-like artifact (HW-02456) from Gros Cap, possible bracelet fragment

A final unique object (Figure 6.42) is a piece of copper-base metal possibly reused as a scraper or knife, from the Fort St. Joseph Site. One long edge of the piece is rolled and flattened or backed in a manner that indicates it may have been part of the rim of a kettle body, with the iron ring or rim-band removed. If used as a scraper, one part of the kettle body would be used for scraping, with another portion trimmed away to make a handle. The possible "blade" edge varied in thickness, and was very thin in places as if hammered or possibly sharpened, but exhibted no grinding marks. There were clipping or shearing marks near where the body was cut to make the "handle," or possibly simply to remove a rectangular blank for other uses.

Figure 6.42: Copper-based metal object possibly reused as a scraper (HW-02657)

6.1.2.8 Summary and discussion of regional and temporal interpretations for finished metal artifact types examined in the attribute analysis

The investigation of stylistic variation within finished metal artifact types revealed patterns of technological style difference that I interpret as indicative of localized production strategies, interaction or population mobility, and ethnic or cultural affiliations. Variation within types within very large assemblages like Bell, Rock Island, and Marquette Mission, which I primarily attribute to localized, perhaps household-level crafting activity, demonstrates that metal reworking was a widespread practice in most communities. Diversity within adornment types, such as the intra-site variations in length, width, closure style, and other attributes of tinkling cones may represent individual craftworking styles, as well as trade and exchange of tinklers or objects decorated with tinkling cones, loss from garments worn by visitors or captives, or other factors. Bracelets made of tubing or wire also only come from the largest assemblages, highlighting the greater diversity of types present in these collections, which may be an outcome of better archaeological recovery. Projectile point types highlight possible regional differences in style, with stemmed points present at Madeline Island, perforated triangular points at St. Ignace, and a wide range of point styles at Rock Island, a trading center and known meeting place situated geographically in between the other two sites. The lack of copper and brass projectile points from Meskwaki sites may reflect a preference for other weaponry such as firearms or lithic points. The working method of scoring appears to be localized in the Upper Great Lakes region. Scoring was not documented on Illinois sites and is also not common in Eastern North America, perhaps because of greater availability of shears or other metalworking tools there.

No copper-base metal artifact types are temporally diagnostic within the Upper Great Lakes study sample, and the assertion that tinkling cones decrease in size over time (Fitting 1976:207) was not supported. The use of brass instead of copper for tinkling cones grows over time across the region, but this preference is not shared in scrap and blanks, perhaps highlighting a general preference for brass cones later in time, or a shift in local production preferences; this pattern could also be a result of varying preferences across the region. However, the use of rolled beads or copper-mail and clips was most prevalent on sites occupied predominantly prior to AD 1700, especially those in the Illinois area and near St. Ignace.

Some artifact types provide insight about cultural or ethnic differences in adornment preferences of each community. Such differences, rather than period of occupation, might explain the prevalence of clips and beads at St. Ignace and in the Illinois area because Meskwaki-affiliated sites and French-colonial fortifications lack copper-mail and beads, as well as copper-based metal pendants and projectile points. Stylistic variation in metal projectile points from Madeline Island, St. Ignace, and Rock Island also may reflect preferences for particular hafting methods within each community. It is not possible to separate the influence of ethnic identity and resource distribution in some cases, because limited availability of metal at interior sites such as Zimmerman and Iliniwek Village also may have influenced the greater popularity of producing small rolled beads rather than larger adornments like tinkling cones. Small rolled beads from each site are generally similar to one another in size, shape, and closure styles, which I interpret as evidence of localized production. The use of perforated and patched metal to produce tinkling cones at the Bell Site may reflect a Meskwaki cultural preference for recycling copper and brass using patching, more prevalent at Bell than any other site. Tinkling cone closures vary regionally, with northern sites showing a greater preference for abutting seams, with more overlapping seamed cones present in southerly sites and in the Lake Winnebago area, also possibly a result of general cultural differences across the region. The spiral form, found in native copper in protohistoric contexts as well as in copper from later historic levels at Rock Island, has a broad distribution across eastern North America and may be an example of an object type with long-term and widespread cultural significance or continuity.

The examination of the finished artifact types also provided evidence for intercultural interaction and exchange. Distinctive decorative scoring on a few tinkling cones from Marquette Mission, Peshtigo Point, and Rock Island may indicate interaction or trade among these sites. The O'Neill site cuff-bracelet, made in a style usually seen in eastern North America at Iroquoian sites, could represent migration, down-the-line or direct exchange, or even imitation, but all of these circumstances relate to the interactions among Native groups in the seventeenth century. Likewise, in the Rock Island assemblage, the diversity within types of metal projectile points, pendants, and tinkling cones parallels the diversity of the ceramic assemblage at that site, and attests to the importance of this location as a trading locale. At Rock Island, hybrid and possibly syncretic forms such as the red-pigment container and cut-brass cross represent further intercultural interaction between European visitors and local residents. The power of color symbolism applied to hybrid objects is further evidenced in the copper tinkling cone crimped to enclose black and white beads, from the Marquette Mission site. The study of the technological style of finished artifacts is complemented by studying unfinished artifact categories, allowing a more complete understanding of the *chaîne opératoire* for ornaments and other finished forms.

6.1.3 Unfinished artifact categories

There are four general categories of unfinished or discarded copper-based metal objects: blanks, which are geometric forms that could be used to produce finished forms such as tinkling cones, beads, and projectile points; scrap or material not identifiable as finished or partially-worked forms; patches, patched kettle body fragments, and kettle parts; and tubing and wire fragments of the kinds used to produce bracelets, coils, spirals, and rings. To facilitate comparisons among the most complete and representative metal assemblages, sections below address unfinished artifact types from metal assemblages >50 total artifacts.

6.1.3.1 Blanks

Any object with a regular geometric shape but not recognizable as a finished form was considered a "blank" (n=581, Table 6.28 and Table 6.29). Differences in blank shape, size, and working methods are the most informative attributes gathered from blanks because these data reflect the technological processes used to produce various finished artifact forms relative to available material. For example, a site with a high proportion of trapezoidal blanks would be expected to also yield higher proportions of tinkling cones, rather than beads, projectile points, or other finished objects formed from non-trapezoidal blanks. The amount and size of copper base metal material available could also influence the types present in the finished artifact assemblage, and locales with limited copper availability would be expected to produce smaller finished forms and leave behind smaller pieces of partially worked blanks and scrap.

Table 6.28: Quantitative summary table for blanks from assemblages > 50 total artifacts. % = percent of total site assemblage comprised of blanks. Mean and standard deviation (+/-) presented for each attribute

Site name:	**N**	**%**	**Max length (mm)**		**Max width (mm)**		**length: width**		**Max metal thickness (mm)**	
			Mean	***(+/-)***	**Mean**	***(+/-)***	**Mean**	***(+/-)***	**Mean**	***(+/-)***
Bell	145	15%	26.6	*16.4*	14.7	*7.8*	2.3	*2.9*	.55	*0.4*
Doty Island Mahler	13	22%	22.8	*9.6*	11.2	*5.1*	2.5	*1.9*	.42	*0.1*
Gros Cap	12	16%	22.9	*9.3*	11.9	*3.8*	2.2	*1.5*	.49	*0.1*
Marquette Mission	78	15%	26.4	*19.8*	23.5	*6.6*	2.5	*2.0*	.53	*0.2*
Rock Island Period 3	147	23%	31.2	*25.6*	14.3	*9.4*	2.5	*2.0*	.50	*0.2*
Zimmerman	29	23%	16.4	*6.1*	8.6	*3.4*	2.5	*2.0*	.58	*0.9*
Doty Island Village	42	17%	25.6	*20.7*	11.4	*7.3*	2.7	*2.7*	.46	*0.3*
Rock Island Period 4	18	16%	26.4	*9.4*	14.1	*8.9*	2.7	*2.3*	.54	*0.3*
Fort St. Joseph	14	17%	34.3	*31.4*	16.2	*12.7*	2.6	*1.9*	.43	*0.1*
Fort Michilimackinac	5	8%	23.9	*11.4*	11.1	*2.2*	2.2	*1.1*	.45	*0.1*

Table 6.29: Qualitative data for blanks from sites > 50 metal artifacts, by predominant attribute for each site. Percentages represent % of artifacts from that site for each attribute

Site name:	**N**	**%**	**Typology code(s)**	**blank type[1]**		**working method(s)**	**Scratch Test**	
				Rec	**Tra**		**Red**	**Yellow:**
Bell	145	15%	127:10%; 100: 9%	48%	28%	Be: 39%; Sc: 37%	57%	30%
Doty Island Mahler	13	22%	100; 139; 143 (16% each)	38%	23%	Be: 50%	8%	83%
Gros Cap	12	16%	103: 25%	42%	50%	Ro: 42%	57%	43%
Marquette Mission	78	15%	137:19%; 127:16%	47%	23%	Sc: 51%	N/A	N/A
Rock Island Period 3	147	23%	100: 14%; 143:14%	51%	33%	Sc: 63%	24%	72%
Zimmerman	29	23%	100; 112; 150 (10 % each)	72%	17%	Ro: 31%	N/A	N/A
Doty Island Village	42	17%	143: 14%	48%	31%	Be: 45% Sc: 33%	24%	50%
Rock Island Period 4	18	16%	104: 17%	55%	17%	Sc: 72%	28%	72%
Fort St. Joseph	14	17%	143: 21%	14%	35%	Be: 85%	N/A	N/A
Fort Michilimackinac	5	8%	122: 40%	100%	0%	Be/Ro/Sc: 40%	40%	60%

[1] Rectangular and trapezoidal blanks were the two most common blank shapes for all sites in the study sample, except at Fort St. Joseph, where there are an equal number of parallelogram, rectangular, and triangular blanks (n=2 each; 14%); most common shape is trapezoidal (n=5, 35%). In the blanks category, assemblages that do not total 100% also included triangular, parallelogram, ovoid, or geometrically-shaped irregular blanks

Blanks from Zimmerman are smaller than those from all of the other sites, but the length to width ratio, which reflects blank shape, remained similar to other sites in the sample. This indicates that similar but smaller forms of finished artifacts, such as small rolled beads, might have been preferred at Zimmerman. The mean length and width of the Zimmerman blanks recorded was 16.4 mm long by 8.6 mm wide, closer in size to the small Iliniwek Site blanks (n=119), which averaged 11.1 mm long and 3.6 mm wide (Ehrhardt 2002: 266), than to others in the Upper Great Lakes study sample (Figure 6.43). Based on these findings, I suggest that the emphasis on smaller-size adornment styles in the copper-base metal reworking industry in the interior, farther away from Great Lakes trade routes may have been influenced by limited availability of copper-base metal trade items prior to the 1700s. The small size in general of blanks, beads, clips, and other artifacts from Zimmerman and Iliniwek Village sites, affiliated with Illinois peoples of the seventeenth century, may reflect their common ethnicity or shared participation socially-mitigated exchange networks.

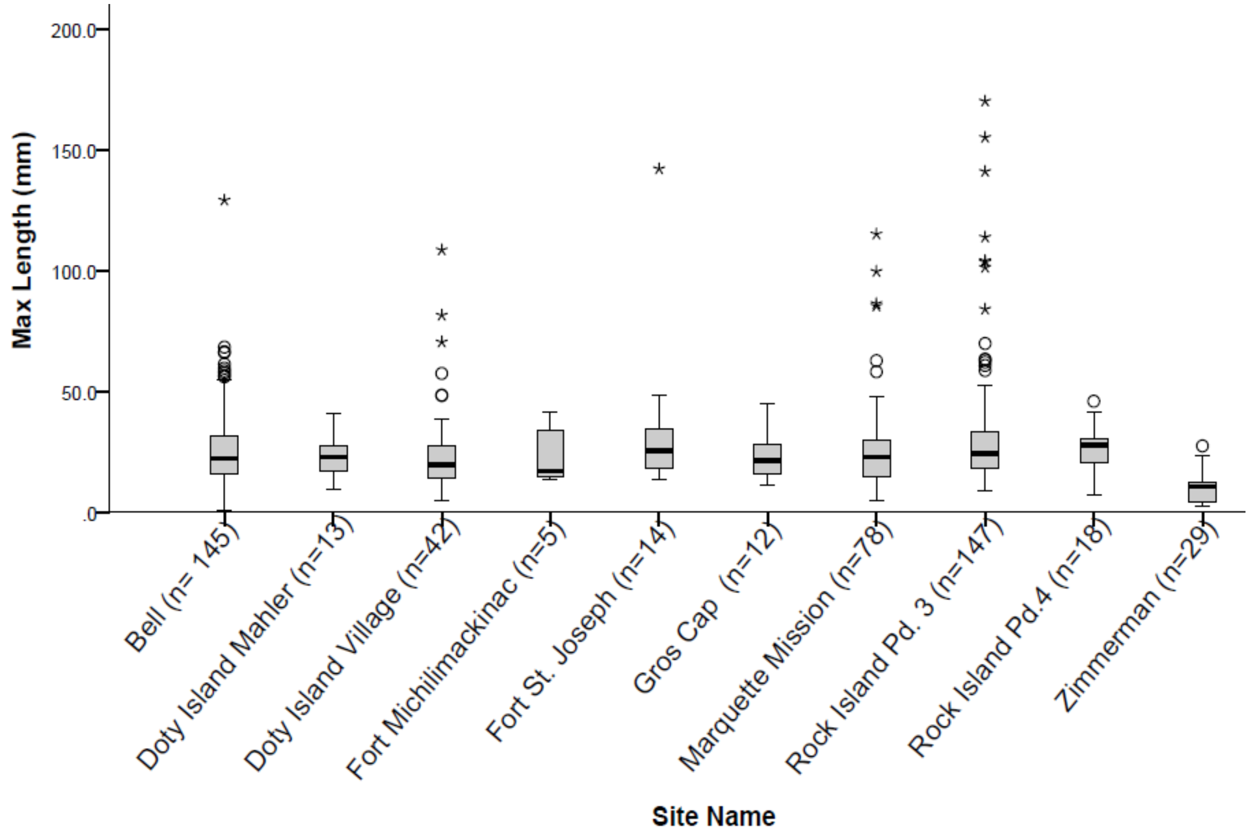


Figure 6.43: Box and whisker plot of means and standard deviation of blank sizes from sites with metal assemblages > 50 artifacts, showing smaller size of the Zimmerman site blanks in relation to sites in the Upper Great Lakes region.

The shape of blanks produced at sites was also investigated to determine if blank shape prevalence corresponds to finished artifact forms. Rectangular blanks are most common at all sites except at the Gros Cap site and Fort St. Joseph, where trapezoidal blanks are most common (Figure 6.44). Zimmerman and Michilimackinac have the greatest proportion of rectangular blanks. Neither individual locales through time nor contemporary sites within the same geographic areas exhibit close similarities in the proportions of rectangular to trapezoidal blanks, indicating that shared community preferences or geographic proximity may not have influenced blank production choices.

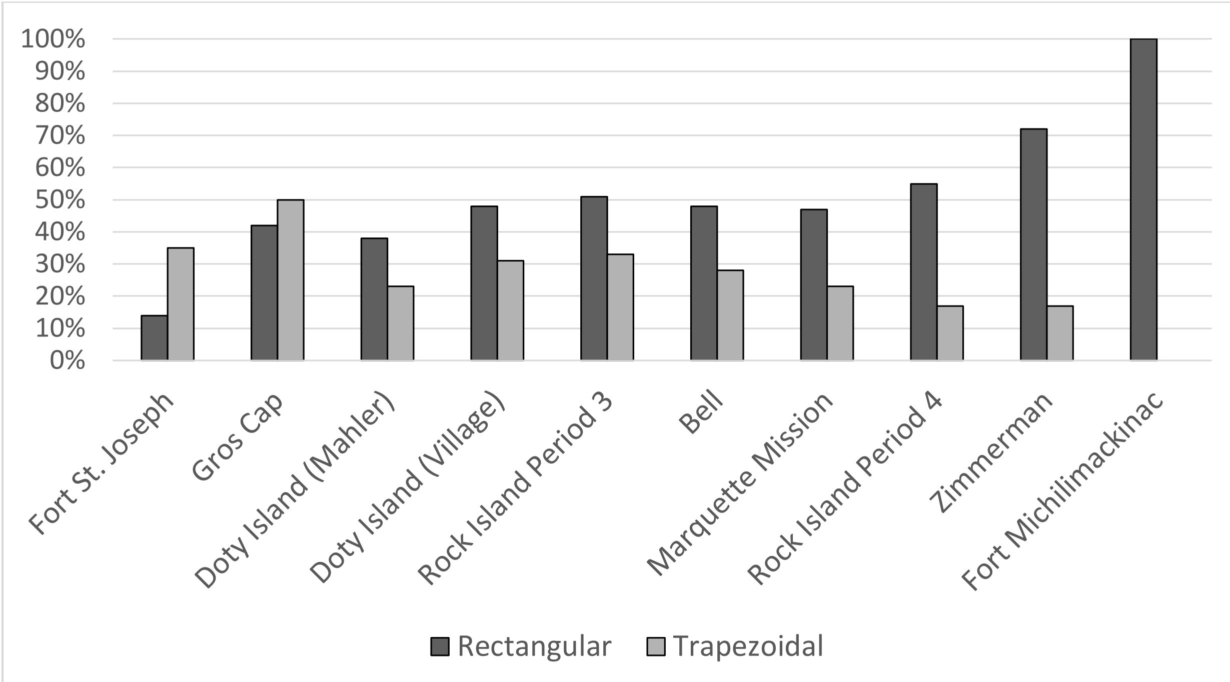


Figure 6.44:Comparison of rectangular and trapezoidal blank proportions, sorted by ratio of rectangular:trapezoidal blanks, illustrating no temporal, spatial, or ethnic patterns present.

To investigate the relationship between blank shape and finished artifacts, I compared ratios of tinkling cones: beads and triangular: rectangular blanks (Table 6.30). Since trapezoidal blanks are used to make tinkling cones and rectangles are needed for rolled beads, sites with more trapezoidal blanks, such as Fort St. Joseph and Gros Cap, were expected to yield more tinkling cones, and sites with more rectangular blanks, Zimmerman and Michilimackinac, were expected to have rolled beads as the preferred adornment strategy. Expectations were supported in some but not all cases: there were 2.5 times as many trapezoidal blanks as rectangular blanks in the Fort St. Joseph, and only tinkling cones were recovered there. At Gros Cap, trapezoidal blanks dominated the assemblage and had the greatest proportion of finished tinkling cones to beads. At Zimmerman, rectangles outnumber trapezoidal blanks by about 4:1, and likewise, rolled beads are twice as common as tinkling cones. However this pattern does not hold up well or as strongly for Doty Island Village, Rock Island Periods 3 or 4, the Bell site, or Fort

Michilimackinac. The expectation of finding more rolled beads than tinkling cones at Marquette Mission also was not supported based on the available artifact sample. Based on data from all sites, it was not possible to determine if proportions of blank shapes represent a preference for tinkling cones or rolled beads by groups of people at these sites. One cause of this relative lack of clear patterning is that trapezoidal blanks could have been produced several at a time by cutting them in series from larger rectangular or parallelogram-shaped pieces (Figure 6.45).

Table 6.30: Comparison of blank shapes to finished artifacts, sorted by sites with the greatest proportion of trapezoidal:rectangular blanks

		Blanks			**Finished Artifacts**		
Site name:	**N**	**Rec. Blanks**	**Tra. Blanks**	**Ratio Tra:Rec**	**Beads**	**Tinkling Cones**	**Ratio Tink:Bead**
Fort St. Joseph	14	14%	35%	2.5	0%	8%	N/A
Gros Cap	12	42%	50%	1.2	3%	45%	15.0
Doty Island (Mahler)	13	38%	23%	0.6	25%	20%	0.8
Doty Island (Village)	42	48%	31%	0.6	9%	21%	2.3
Rock Island Period 3	147	51%	33%	0.6	2%	25%	12.5
Bell	145	48%	28%	0.6	4%	15%	3.8
Marquette Mission	78	47%	23%	0.5	2%	30%	15.0
Rock Island Period 4	18	55%	17%	0.3	2%	26%	13.0
Zimmerman	29	72%	17%	0.2	14%	7%	0.5
Fort Michilimackinac	5	100%	0%	0.0	2%	10%	5.0

A parallelogram-shaped blank with a repeating triangular scoring pattern (Figure 6.45) came from the Marquette Mission site, from a feature (219) not included in the sampling strategy, but unscored blanks of similar size and shape to this large piece were recovered from features that I did include. These could be a step in the production process for either perforated triangular projectile points or tinkling cones. The size of the blanks is consistent with the lengths of both points and tinklers from the site. The scores on both sides of the large blank are in the same pattern, possibly indicating that the craftsperson was attempting to score through from both sides to detach the blanks, or that one side was rejected and scoring was restarted on the other side. Scoring, bending, and rolling were the most commonly documented working methods applied to blanks in the study sample, which is unsurprising since all of these methods also appear regularly on objects fashioned from blanks and rolling is a defining characteristic of both tinkling cones and rolled beads.

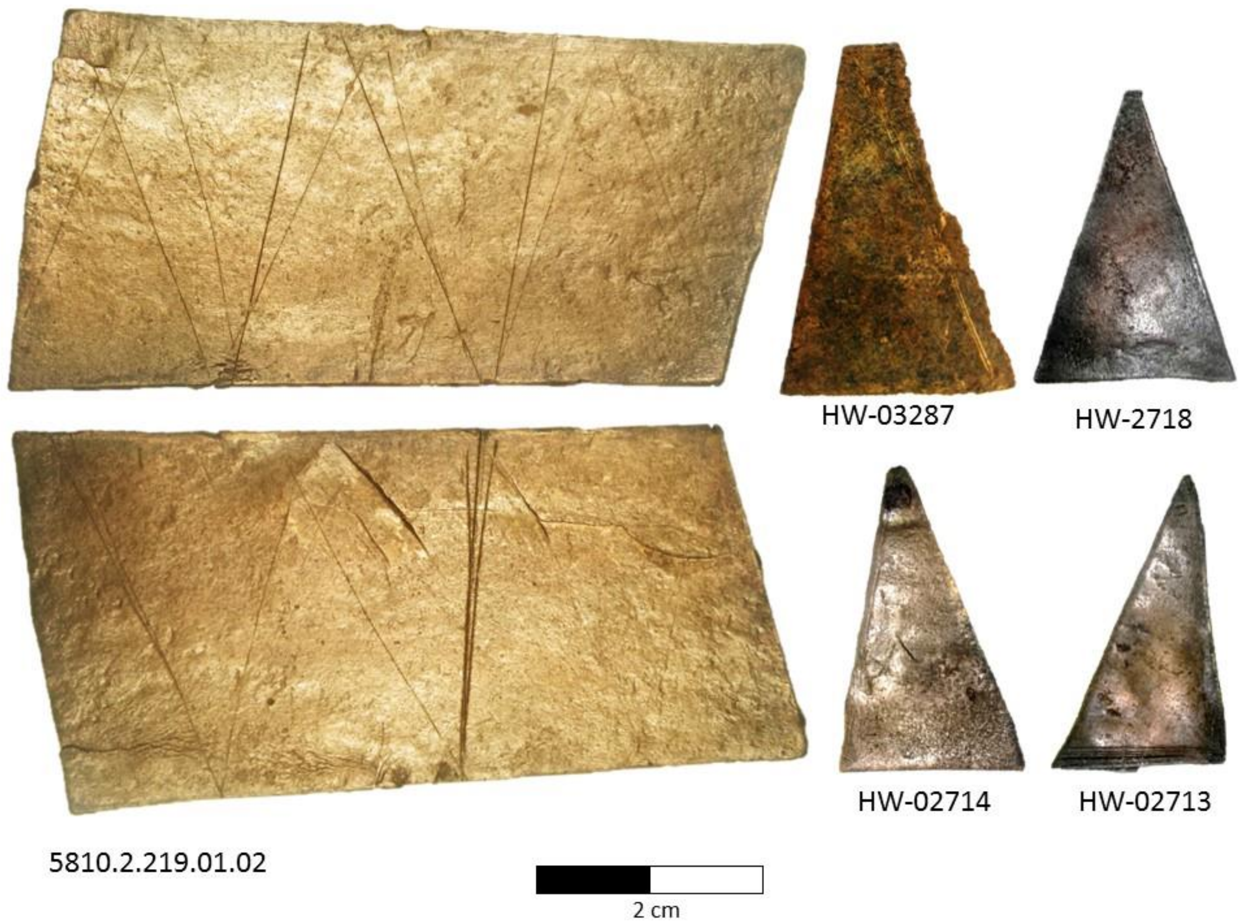


Figure 6.45: Obverse and reverse of a scored large parallelogram-shaped blank, with four similarly-shaped triangular or trapezoidal blanks, all from Marquette Mission, showing scoring and chaîne opératoire *for tinkling cone and projectile point production*

Blanks recorded in the study sample could be either fragmentary or complete, but it was difficult to differentiate between fragmentary blanks and general scrap. However, for instances of a blank of a regular shape, usually trapezoidal, that had been broken or modified in some way, I assigned the artifact to Type 143: blank, trapezoidal, broken (Figure 6.46). Artifacts were assigned to this category only if they clearly exhibited working methods such as bending, rolling, or other jagged edges that might result from breakage during manufacture, such as during the process of rolling them into tinkling cones. Scoring is visible along the broken edge of artifact HW-00633, demonstrating a possible attempt to reuse the blank, presumably after breakage.

Figure 6.46: Broken blanks from the Bell, Doty Island, and Rock Island sites, obverse and reverse views. Scoring, bending, rolling, and other working methods are visible.

Attribute data collected from scratch tests does not follow the temporal pattern of brass increasing in frequency over time documented in tinkling cones (Figure 6.47); earlier sites do not have a higher proportion of copper to brass blanks than later sites. At Doty Island and Rock Island, more brassy yellowish metal blanks were reported from the earlier components (Rock Island Period 3 and Doty Island Mahler) than later components (Rock Island Period 4 and Doty Village). Personal choice in the metal used for tinkling cones may be one explanation for the pattern seen in that dataset but not identified in the blanks, but availability of raw material may also have influenced the type of copper-based metal used.

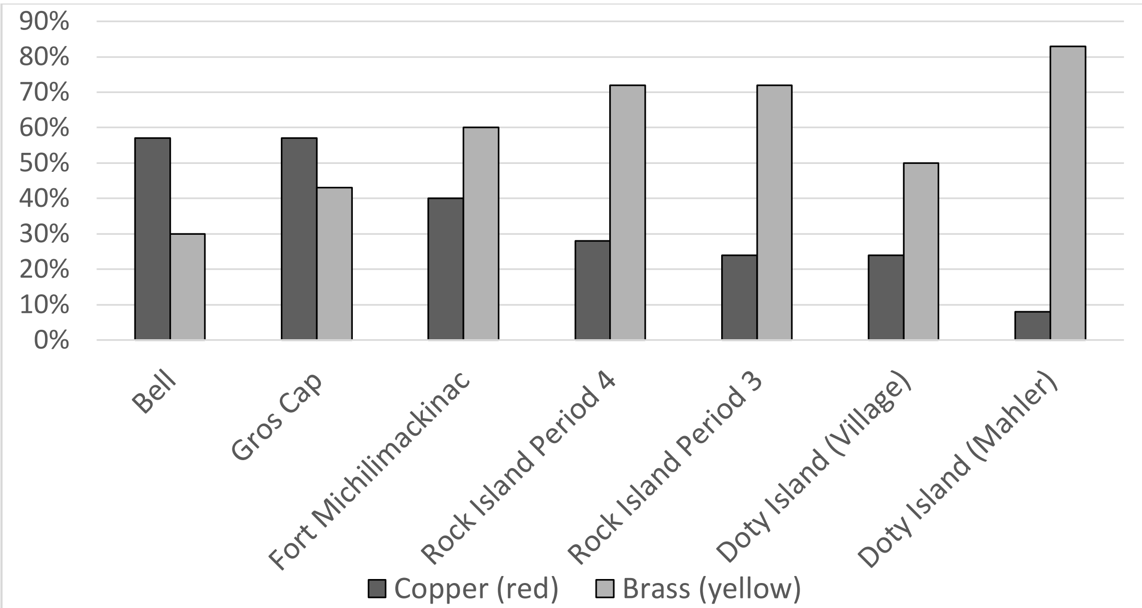


Figure 6.47 Data from scratch testing of blanks, sorted from most to least copper present and illustrating that the brass does not increase in proportions of blanks over time.

6.1.3.2 Scrap

I documented a total of 1,285 pieces of scrap, by far the largest category of copper-base metal artifacts (Table 6.31 and Table 6.32). Pieces designated as scrap were often heavily worked in multiple ways, the most common of which were bending, scoring, folding, clipping or shearing, crumpling, and rolling. Any pieces that were perforated, but had no straight sides or other evidence of use in patching, such as rivets, were included in the scrap category rather than in patches and patched pieces. Some scrap pieces do have straight cut or scored edges, or they resemble geometric shapes of blanks, such as trapezoids or rectangles, but these “blank shapes” are not specifically tabulated because they make up only a small portion of the whole scrap assemblage. In relation to the research questions, the most meaningful categories for scrap, like for blanks, are the size of the artifacts, working methods applied, and the scratch test data.

Table 6.31: Summary quantitative data for scrap from assemblages > 50 total artifacts, mean and standard deviation (+/-) presented for each attribute

Site name:	**N**	**Max length (mm)**		**Max width (mm)**		**length: width**		**Metal thick-ness (mm)**	
		Mean	***(+/-)***	**Mean**	***(+/-)***	**Mean**	***(+/-)***	**Mean**	***(+/-)***
Bell	432	27.7	*17.9*	16.3	*11.1*	2.2	*4.0*	.47	*0.4*
Doty Island (Mahler)	12	24.6	*15.9*	14.5	*8.8*	1.8	*0.5*	.41	*0.2*
Gros Cap	18	26.5	*11.6*	14.2	*7.0*	2.0	*1.1*	.63	*0.4*
Marquette Mission	194	30.5	*19.9*	16.7	*11.5*	2.1	*1.5*	.56	*0.3*
Rock Island Period 3	219	32.6	*19.1*	16.3	*9.6*	2.4	*1.8*	.45	*0.2*
Zimmerman	35	12.7	*11.8*	7.8	*6.8*	2.0	*1.7*	.53	*0.2*
Doty Island (Village)	79	23.8	*11.0*	14.7	*7.2*	1.8	*1.2*	.46	*0.2*
Rock Island Period 4	38	36.7	*20.1*	17.1	*11.1*	2.5	*1.2*	.49	*0.2*
Fort St. Joseph	37	32.8	*18.5*	18.9	*12.5*	2.0	*1.0*	.60	*0.3*
Fort Michilimackinac	45	25.9	*19.0*	23.8	*8.6*	2.0	*1.3*	.70	*0.4*

Table 6.32: Qualitative summary table for scrap,

Site name:	**N**	**Typology code(s)**	**Working Method(s)**	**Scratch Test**	
				Red:	**Yellow:**
Bell	432	402: 26%	Be: 50%	48%	40%
Doty Island Mahler	12	411: 33%	Be: 58%; Fo: 41%	8%	58%
Gros Cap	18	402: 33%	Be: 61%	33%	38%
Marquette Mission	194	406: 19%; 415: 18%	Sc: 34% Be: 34%	N/A	N/A
Rock Island Period 3	219	415: 22% 411: 17%	Sc: 40%; Be: 39%	35%	63%
Zimmerman	35	402: 35%	Be: 29%	N/A	N/A
Doty Island Village	79	402: 28%	Be: 56%	52%	44%
Rock Island Period 4	38	415: 30%	Sc: 57%	51%	49%
Fort St. Joseph	37	402: 22% 405: 19%	Be: 43%	N/A	N/A
Fort Michilimackinac	45	406: 24% 402: 22%	Be: 24%; Sc: 17%	56%	27%

Findings from scrap, like blanks, illustrate the relatively small size of the Zimmerman site objects as compared to the rest of the sites in the study. The mean length and width of the Zimmerman site scrap pieces are the smallest in the study sample (Figure 6.48), which again could result from several linked factors, including: availability of raw material at this interior location, adornment strategies such as rolled beads and mail that the usefulness of small scraps, and the stylistic choices of craftspeople in this community and the Illinois region. Also like the blanks, the Zimmerman length:width ratio is comparable to other sites in the sample, and no distinct spatial or temporal patterning is identified in the thickness of the metal. Other than the small size of the scraps from the Zimmerman sample, there are no temporal or spatial patterns in the size attributes of scrap from other sites.

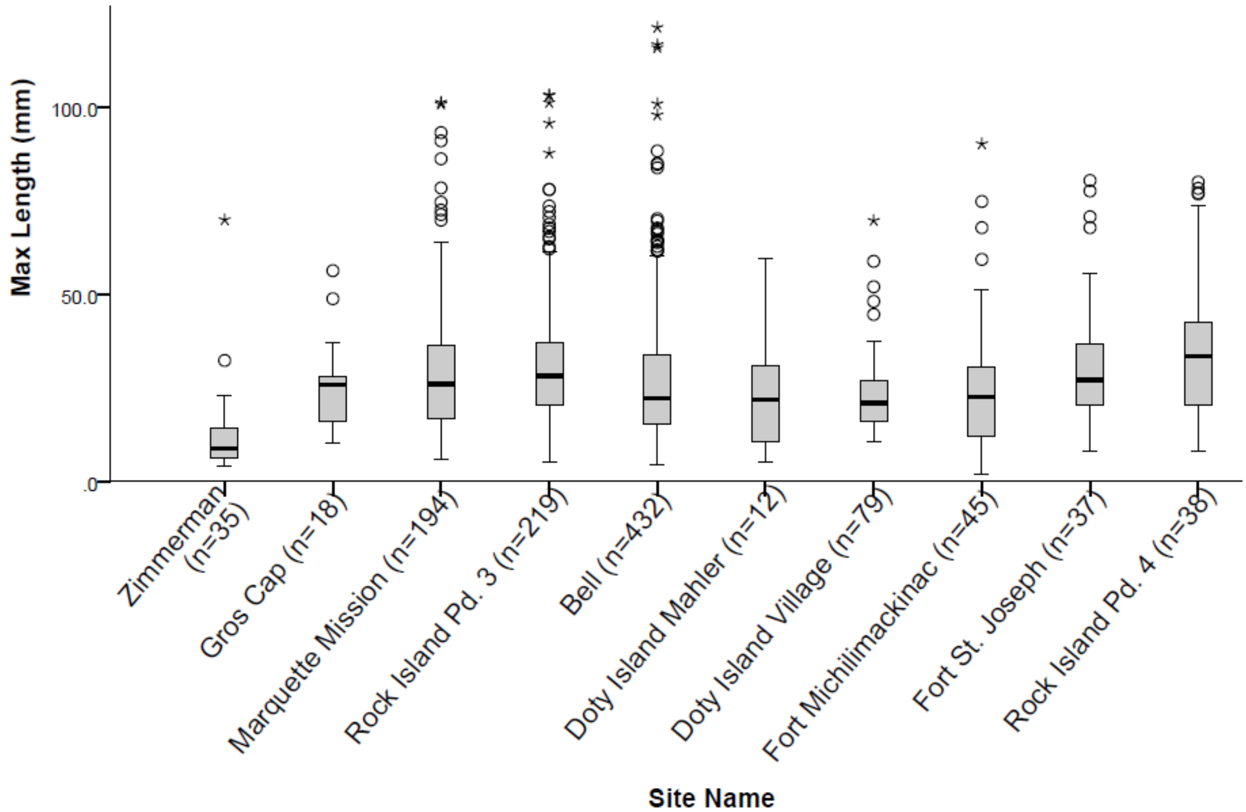


Figure 6.48: Box and whisker plots of scrap, showing that Zimmerman site scrap is smaller than Upper Great Lakes sites. Sites are in rough chronological order from earliest (left) to latest (right), illustrating no overall temporal pattern in size of scrap.

Scrap, in general, provides evidence that reworking of copper-based trade items was taking place on a site, but patterning of scrap types did not relate to proportions of blanks or finished artifacts, or the temporal, spatial, or ethnic distribution of sites. The most common category of scrap is Type 402, scrap, irregularly shaped. This is a “catch-all” category for copper-based metal pieces with irregular forms and jagged or un-cut edges. The second-most common category is 415, scrap, geometric irregular, which includes pieces that had been worked to produce straight sides but that did not fit regular shape categories such as “roughly rectangular” (type 406) or “roughly trapezoidal” (type 405). Types 405 and 406 are common at Marquette Mission and the French colonial sites. Scraps that are roughly rectangular or trapezoidal in shape may be discarded, unfinished blanks or shaped this way coincidentally in the process of breaking down kettles into workable pieces. At Doty Island (Mahler) and Rock Island Period 3, the type 411, scrap, irregularly shaped with one straight edge, is a common form. As with blanks, the presence of scrap demonstrates that reworking was taking place at these sites.

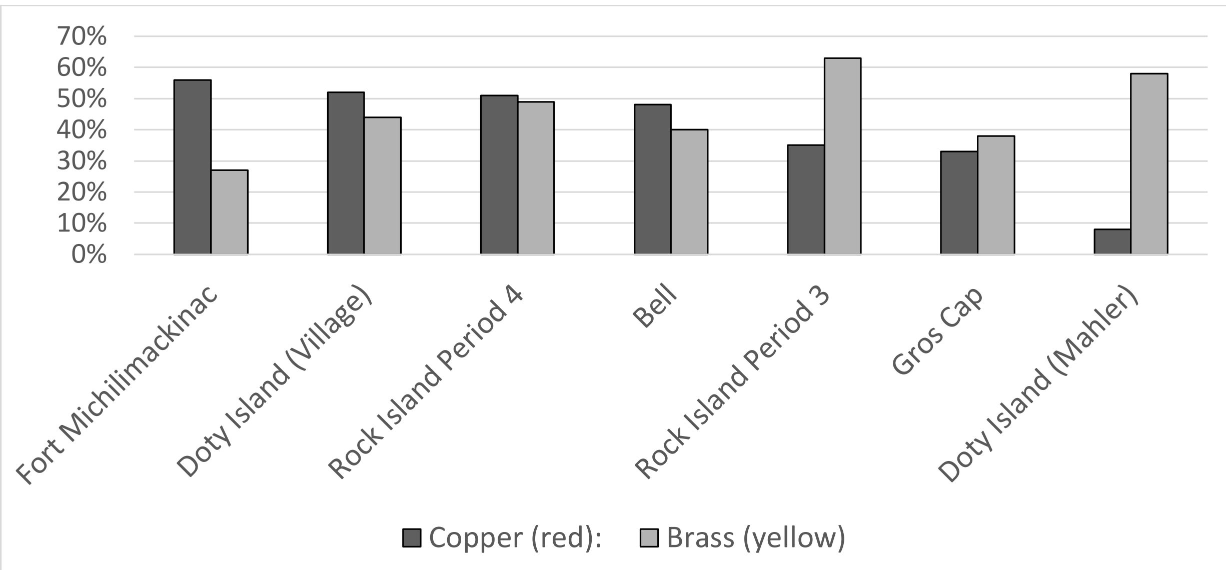


Figure 6.49: Data from scratch testing of blanks, sorted from most to least copper present

Similarly to blanks, the results of the scratch test for available sites (Figure 6.49) do not follow the temporal pattern identified in tinkling cones, with copper earlier and brass later. The patterning in the tinkling cone data set could be an anomaly, or it could indicate that there was a specific preference in the color of tinklers that changed over time, while availability of brass and copper as a whole did not shift in a temporally diagnostic way at sites in the Upper Great Lakes.

6.1.3.3 Kettle Parts, including patches and patched pieces

In the typological coding system used for metal artifacts, types 500 to 533 identify kettle parts such as lugs, which may be chronologically diagnostic, as well as rim portions, rivets, and nearly-complete kettle body portions. Types 550 to 564 identify patches, which are classified by shape and the placement of perforations and or rivets. Some fragmentary types in this group (e.g. Type 556, patch, fragmentary, likely one corner of a patch or patched piece) may describe either worked patch fragments or portions of kettle body pieces that were once patched and then later reworked. Quantifying the amount of patching that took place at sites in the study sample reveals patterns of technological style and practice for each community; these patterns may relate to both the availability of copper-base metal materials and the preferences of community members in their choices to mend worn kettles or dismantle them for repurposing as other objects.

The presence of kettle parts such as lugs, bails (handles), rim portions, and large body pieces (Table 6.33) may indicate that a community was receiving intact or nearly intact kettles rather than already-modified copper base metal in the form of sheets, pieces, or finished artifacts. For example, the Bell Site assemblage includes numerous intact lugs and manipulated lug portions, large body fragments with rivets, and individual rivets suitable for attaching the lug to the kettle body. Therefore, intact kettles were probably readily available to residents of the Bell Site during at least some portion of its occupation. Only a single, heavily manipulated lug fragment came from the early period of Rock Island (c. 1640s), but by Periods 3 and 4, rivets, large body fragments, and lugs were more common, demonstrating an increase in availability of whole kettles at the site over time. In contrast, since just one lug and a few bail fragments were recovered at the Iliniwek Site, Ehrhardt suggested that complete kettles rarely were traded as far as the Illinois region, or that intact kettles were reserved for mortuary use (2005: 107).

Table 6.33: Kettle parts from all sites in the study sample

Site name:	505: rivet (complete)	506: body fragment with rivet attached	507: lug, manipulated (intact)	508: lug, manipulated (fragmentary)	519: almost whole kettle body, partially worked	532: rim portion, sometimes with perforations for lug attachment	533: rivet, fragmentary	N
20 CN 51	0	1	0	0	0	0	0	**1**
Bell	3	3	10	5	0	0	0	**21**
Doty Island Mahler	1	0	0	1	0	0	0	**2**
Doty Island Village	1	0	1	0	0	0	0	**2**
Elmwood Island	1	0	0	0	1	0	0	**2**
Fort Michilimackinac	0	1	0	0	0	0	0	**1**
Fort St. Joseph	2	0	0	1	0	0	0	**3**
Marquette Mission	3	0	0	0	1	3	1	**8**
Marina	0	0	2	0	0	0	0	**2**
McCauley	0	0	0	1	0	0	0	**1**
Peshtigo Point	0	0	0	1	0	0	0	**1**
Rock Island Period 1	0	0	0	1	0	0	0	**1**
Rock Island Period 3	3	2	0	6	0	0	0	**11**
Rock Island Period 4	1	1	1	3	0	0	0	**6**
Rock Island General	1	2	0	1	0	0	0	**4**
Zimmerman	1	0	0	0	0	0	0	**1**
TOTAL:	**17**	**10**	**14**	**20**	**2**	**3**	**1**	**67**

The forms of kettle lugs may be temporally diagnostic. Ten intact lugs (Type 507) from the Bell site (c. 1680 – 1730) and one from Rock Island period 4 (c. 1760s) are all of the folded sheet style, made from a doubled-over sheet of metal with the corners then folded or “eared” to maintain the shape (Figure 6.50). This is the most common style in the study sample, including both intact and fragmentary pieces. Another lug form, from the Doty Island Village site (c. 1720 to 1780), is an iron lug attached to a copper kettle body with copper rivets (Figure 6.51), classified as similar to lugs of Type 2, Variety a (Mason and Mason 1993:245), according to the lug typology that Stone developed for Fort Michilimackinac (Stone 1974: 171-175). One of the two intact lugs from the Marina site (occupied during the eighteenth century) is a modified eared variety, while the other is a cast bronze or brass piece (Figure 6.52) similar to those found on sites in eastern North America during the 1680s to 1710s (James Bradley, pers. comm. 2013). The iron and brass lug forms are rarer and may be more useful as markers of time than the eared style, which appears across the seventeenth and eighteenth century sites.

Figure 6.50: Obverse and reverse of a typical "eared" lug from the Bell Site (HW-00867)

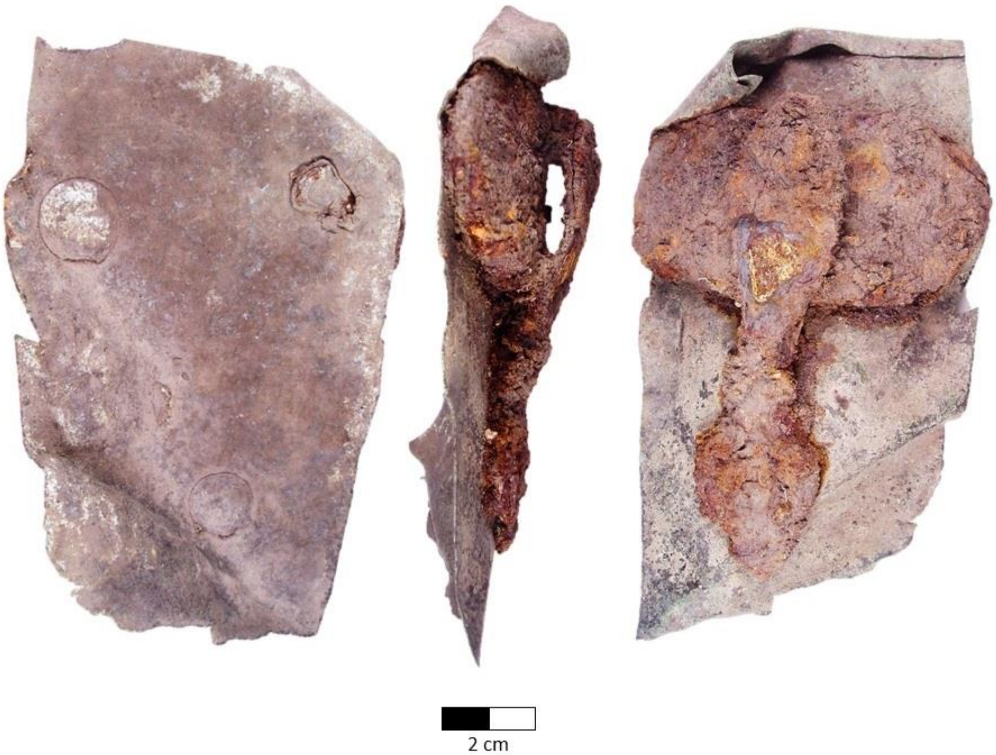


Figure 6.51: Iron lug from the Doty Island Village site (HW-01470)

Figure 6.52: Cast copper-base metal lug from the Marina site (HW-00723)

The other artifacts in the kettle parts category reflect the degree of patching activity taking place at sites. There were a total of 269 artifacts identified as patches or patched pieces, including 84 pieces that could be intact patches or portions of intact patches (Table 6.34). Metric attributes for patch portions are not summarized because the recorded size of patches includes any kettle body material still attached to the patch, and patches come in a variety of shapes, including rectangular, square, triangular, and irregular. Patches, like other kettle parts, often showed signs of reworking, including scoring, bending, and folding (Figure 6.53).

Table 6.34: Intact patches from all sites, tabulated by category

Site name:	550: patch, rectangular, perforations/rivets at all four corners	553: patch, rectangular, perforations and/or rivets at irregular placements	554: patch, irregular, geometric, irregular shape, perforations or rivets	555: patch, rectangular, long and flat, at least one rivet or perforation	560: patch, intact, attached to one or more kettle fragments by rivets	562: patch or other attached piece (decoration?) rolled, with rivets	TOTAL
Bell	12	12	22	3	4	1	54
Doty Island Mahler	0	0	0	0	0	1	1
Elmwood Island	0	0	0	1	0	0	1
Fort St. Joseph	0	1	0	0	0	0	1
Gros Cap	1	0	0	1	0	0	2
Markman	0	0	0	1	0	0	1
Marquette Mission	0	0	2	0	0	0	2
Rock Island Period 3	5	5	4	1	0	0	5
Rock Island Period 4	0	0	1	2	1	0	4
Rock Island General	0	0	0	0	1	0	1
Winston-Cadotte	0	0	0	2	0	0	2
Total	18	18	29	11	6	2	84

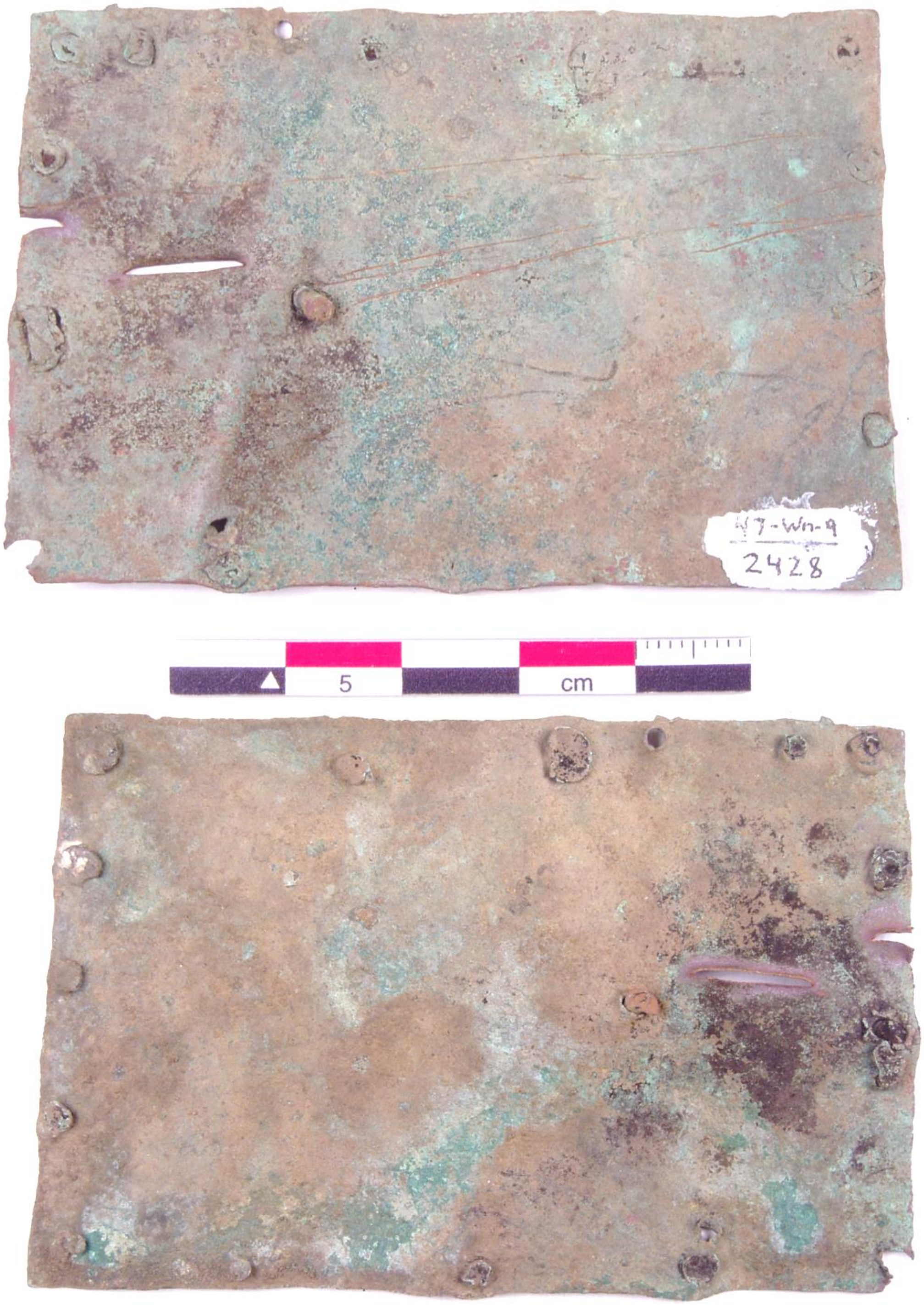


Figure 6.53: Obverse and reverse of a typical intact patch from the Bell Site (HW-00863), with rolled tube type rivets and scoring visible on one side

The fragmentary patch categories include the remaining 185 objects, most of which are probable repaired kettle body portions, with rivets and perforations intact from the mending process, rather than patches themselves. As with complete patches, types are enumerated (Table 6.35) but metric attributes are not comparable to one another.

Table 6.35: Fragmentary patch or patched pieces from all sites

Site name:	551: patch, rectangular, long and flat, at least one rivet, short end broken	552: patch, rectangular, broken at perforation	556: patch, fragmentary, likely one corner or other portion of a patch, at least one perforation	557: patch, parallelogram, long and flat, broken at perforation	558: patch, rectangular, scraplike piece, one or more perforations or rivets	559: patch, trapezoidal, scraplike piece, one or more perforations or rivets	561: patch, irregular scraplike piece, one or more perforations or rivets	564: patch, rectangular, modified portion of a rectangular piece with regular perforations	TOTAL
20 CN 51	0	0	1	0	0	0	0	0	1
Bell	12	11	45	1	16	6	21	0	112
Camp Shaginappi	0	0	2	0	0	0	0	0	2
Doty Island Mahler	0	0	1	0	0	0	0	0	1
Doty Island Village	1	1	6	0	2	0	7	0	17
Fort Michilimackinac	0	0	0	0	0	1	0	0	1
Fort St. Joseph	0	0	1	0	0	1	1	0	3
Gros Cap	0	1	1	0	0	2	0	0	4
Marquette Mission	1	0	3	0	0	0	0	0	4
McCauley	0	0		0	0	1	0	0	1
North Shore Village	0	1	4	0	0	1	0	0	6
Rock Island Period 1	0	0	0	0	0	0	0	1	1
Rock Island Period 3	0	0	11	1	5	1	2	3	23
Rock Island Period 4	0	0	0	0	0	1	0	0	1
Rock Island General	0	1	4	0	0	0	1	1	7
TOTAL	14	15	79	2	23	14	32	5	184

6.1.3.4 Tubes, tubing and wire fragments

This is a final "catchall" category for remaining fragments of tubing or long rolled tubes, distinguished from tubular beads or hair tubes (Table 6.36). Tubes are long, narrow objects not usually found used as beads (i.e. with string or organic material inside or in positions of adornment in burial contexts), and they are at least 10 times as long as they are wide, though fragments of tubes may be shorter (Ehrhardt, personal communication 2013).

Table 6.36: Tubes, tubing, and wire fragments from all sites

	200: tube, hollow, ends abut	**201: tube, hollow, ends overlap**	**203: tubing, B-shaped hollow segment - curved or straight**	**204: tubing, e-shaped hollow segment - curved or straight**	**205: tubing, o-shaped hollow segment - curved or straight**	**206: wire, solid, curved**	**207: long rectangular strip**	**228: tubing, straight, hollow, twisted post-rolling**	**TOTAL**
Arrowsmith	0	0	0	0	0	1	0	0	1
Bell	0	1	0	0	0	4	1	1	7
Doty Island Village	0	0	0	0	1	9	1	0	11
Elmwood Island	0	0	0	0	1	2	0	0	3
Farley Village	0	0	6	0	0	1	0	0	7
Fort St. Joseph	0	0	0	0	0	7	3	0	10
Marquette Mission	5	18	22	0	2	6	5	2	60
Rock Island Period 3	0	2	5	2	3	0	10	0	22
Rock Island Period 4	0	0	0	1	0	1	0	0	2
Rock Island General	0	0	1	1	1	0	1	0	4
Zimmerman	0	0	25	0	1	0	0	0	26
TOTAL	5	21	59	4	9	31	21	3	153

No summary metric data are presented, since the morphological differences among tubes, tubing, and wire, and fragment length make it difficult to compare these in a meaningful way. Rather, the counts of each type of tubing as well as its representation as a portion of the metal assemblage of tubing for each site illustrate that tubes and tubing fragments, along with wire and wire strips cut from flat blanks are overall a very small portion of most assemblages in the Upper Great Lakes. An additional category, type 227, tubing, hollow, at least one perforation, was created for a single unique artifact, a piece of possible tubing made from reworked patch or patched material at the Bell Site.

6.1.3.5 Summary and discussion of regional and temporal interpretations for unfinished artifact categories examined in the attribute analysis

Findings from the unfinished artifact categories clarify local production processes, relate to resource availability, and correspond to some patterns identified in the finished artifact analyses. The predominant types of blanks and scrap forms for all sites have straight edges and geometric forms that demonstrate that the reworking of copper-based metal was a widespread practice across the Upper Great Lakes region. At the Zimmerman site, the mean length and width of blanks and scraps is much smaller than at other sites in the region, and this may correspond to more limited availability of copper-base-metal trade items in this area. For the Zimmerman, Gros Cap, and Fort St. Joseph sites, the shapes of blanks in the assemblages did match the prevalence of tinkling cones, made with trapezoidal blanks, and rolled beads, made with rectangular blanks. The outcome of scratch testing blanks and scraps did not match the pattern of increasing use of brass over time identified in tinkling cones; this either may indicate that there is not a temporal pattern to the introduction of brass artifacts in the Upper Great Lakes, or that metal color preferences relate to tinkling cones but not other forms of reworked metal.

The presence of kettle parts such as lugs, large rivets, rim fragments and substantial portions of the kettle body demonstrate that the Bell Site, Rock Island (Periods 3 and 4), Marquette Mission, and possibly the Marina site were locales where whole kettles arrived via trade networks. French colonial fortification sites would also be expected to have received intact kettles, but the lack of kettle parts in these assemblages could indicate that dismantling kettles for reuse as adornments or other objects did not take place there as frequently as at predominantly Native habitation sites. Repair of kettles with patching rather than recycling worn kettles into other forms was most common at the Bell Site, which also produced tubing with a perforation and a tinkling cone with perforations and rivets. I suggest that as a result of historically-documented conflict with the French, copper-base metal became a scarce resource at this site and the Meskwaki inhabitants practiced recycling and patching at a greater intensity than was seen at other sites in the Upper Great Lakes region. A discussion of the entire attribute analysis project including finished and unfished artifacts in relation to the research questions is presented in section 6.3. Two archaeometric pilot studies provided complementary data on metal artifacts.

6.2 Metals compositional analysis results

In two small-scale studies, I explored the possibility of using archaeometric methods to differentiate between smelted and native copper, and to identify different compositional groups of copper and brass artifacts that might have been cut from the same kettle or original object. Compositional groups can be delineated using NAA, and this information has been used to approximate the chronology and intensity of trading activity that took place at a site and identify spatial patterns of metal discard within a site (Michelaki et al. 2013). Results from my preliminary investigations (section 6.2.1) provide feasibility information for scholars considering undertaking a similar study in the future. Through my exploration of archaeometric approaches to the metal assemblages, I confirmed that pXRF is as effective as LA-ICP-MS for differentiating between native and smelted copper (section 6.2.2). Separating native from smelted copper can provide evidence of protohistoric, possibly down-the-line trade, and the continuity of native copper-working technology well into the historic era.

6.2.1 Pilot study: comparison of ICP-OES and LA-ICP-MS

This section presents the results and interpretations of the pilot study described in the Methods chapter, part 4.4.2.1. The purpose of the experiment was to explore using a non-destructive method to delineate distinct compositional groups of copper-base metal artifacts that may have originated from individual trade kettles or other whole objects, in order to clarify resource acquisition and production processes, as previous researchers had accomplished using NAA to analyze artifacts from the Ball site, an early seventeenth century Huron village in Ontario (Michelaki et al. 2013). Since NAA is a destructive method unsuitable for my project, I attempted to identify similar patterns by applying LA-ICP-MS, a minimally invasive technique, and compared the results against those obtained from the same samples using Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES), a more destructive technique appropriate as a control analysis method for verifying the LA-ICP-MS results.

I analyzed the composition of samples taken from fourteen metal artifacts from the Bell site. These pieces from the Peterson collection were uncovered during early metal-detecting surveys in the 1970s, and the provenience information associated with them is limited, so some destructive analysis of samples was acceptable. A primary goal of the study was to determine if it is possible to mitigate for the effects of the heterogeneity of archaeological metal objects and the unintentional sampling of corrosion products during LA-ICP-MS analysis. LA-ICP-MS produced comparable results to ICP-OES, though corrosion remained a problematic factor.

6.2.1.1 Previous archaeometric investigation of the problem

LA-ICP-MS, as well as more destructive techniques like ICP-OES, have been used to characterize metals in numerous archaeological studies. LA-ICP-MS has proven useful in determining the basic metallic composition of artifacts, such as native copper (Lattanzi 2007), and European copper and brass, though corrosion of artifacts is a significant limiting factor in trace element analysis (Chiavari et al. 2011; Deraisme et al. 2008; Dussubieux et al. 2008; Giumlia-Mair 2005; Resano et al. 2010). LA-ICP-MS functions best when samples have a high degree of internal homogeneity, and brass and copper are less homogeneous than the glass beads analyzed in my study. Dussubieux has elaborated on the problems of using LA-ICP-MS as a procedure for characterizing archaeological metals (Dussubieux et al. 2008).

The composition of European metals on the Bell site had been previously examined using Scanning Electron Microscopy – Energy Dispersive Spectroscopy (SEM-EDS) and atomic absorption spectroscopy (AAS) to characterize the compositions of twelve samples of highly corroded surface finds from the James Peterson artifact collection (Freeman and Behm 1998). In that study, levels of zinc were so low that all of the trade metal analyzed was identified unalloyed European copper, not brass; however, there were also significant differences in the percent of copper detected with each method.

6.2.1.2 Results

Five kettle metal artifacts from the original Freeman and Behm (1998) project were analyzed along with ten additional samples from the Peterson collection. Artifacts were selected based on their unmodified appearance; other than having been cut from an original kettle or sheet of metal, none were worked into ornamental or other forms. Two artifacts were tested both by cutting through the corroded surface (693 cor. and 701 cor.), and on the clean, uncorroded cut edges (artifact IDs 693 and 701). The compositional analysis revealed that four out of ten additional artifacts selected for sampling were in fact made of brass, while the rest were of European smelted copper, and that LA-ICP-MS not an ideal method for identifying compositional subgroups of copper and brass (Table 6.37, Table 6.38, and Table 6.39).

Table 6.37: LA-ICP-MS data for major and trace elements present. Artifact IDs are the UW-Oshkosh Lot number for each artifact; they can be identified in the database as 1990-10-###.

Artifact ID	Cu	Zn	Al	P	Mn	Fe	Co	Ni	As	Ag	Sn	Sb	Pb	Bi
612	98.55%	0.01%	0.001%	0.000%	0.000%	0.040%	0.004%	0.158%	0.255%	0.062%	0.034%	0.359%	0.520%	0.008%
634	98.98%	0.04%	0.001%	0.001%	0.000%	0.021%	0.001%	0.094%	0.130%	0.083%	0.071%	0.268%	0.306%	0.005%
636	98.69%	0.02%	0.002%	0.002%	0.001%	0.075%	0.002%	0.086%	0.152%	0.088%	0.257%	0.263%	0.336%	0.005%
693	99.41%	0.01%	0.001%	0.000%	0.000%	0.027%	0.001%	0.038%	0.075%	0.099%	0.032%	0.083%	0.224%	0.008%
693 cor.	98.73%	0.01%	0.117%	0.240%	0.007%	0.116%	0.001%	0.027%	0.075%	0.122%	0.159%	0.134%	0.251%	0.012%
701	70.61%	28.59%	0.026%	0.028%	0.006%	0.078%	0.004%	0.033%	0.063%	0.040%	0.003%	0.009%	0.519%	0.001%
701 cor.	94.55%	4.61%	0.062%	0.186%	0.006%	0.169%	0.001%	0.005%	0.071%	0.062%	0.003%	0.007%	0.264%	0.000%
704	98.16%	0.02%	0.000%	0.006%	0.000%	0.000%	0.001%	0.113%	0.234%	0.085%	0.149%	0.561%	0.653%	0.018%
706	98.43%	0.05%	0.001%	0.004%	0.000%	0.034%	0.002%	0.099%	0.082%	0.085%	0.903%	0.119%	0.192%	0.004%
707	99.43%	0.00%	0.000%	0.002%	0.000%	0.007%	0.000%	0.088%	0.094%	0.090%	0.029%	0.144%	0.108%	0.002%
711	98.95%	0.07%	0.001%	0.000%	0.000%	0.021%	0.001%	0.130%	0.129%	0.091%	0.114%	0.242%	0.231%	0.005%
726	65.71%	32.05%	0.000%	0.001%	0.007%	0.064%	0.001%	0.019%	0.048%	0.081%	0.016%	0.013%	1.987%	0.003%
751	78.07%	18.60%	0.001%	0.006%	0.000%	0.515%	0.003%	0.131%	0.127%	0.089%	1.933%	0.037%	0.479%	0.003%
757	63.47%	35.31%	0.001%	0.003%	0.010%	0.116%	0.001%	0.029%	0.035%	0.025%	0.041%	0.009%	0.949%	0.002%
775	98.27%	0.14%	0.001%	0.001%	0.001%	0.006%	0.001%	0.099%	0.372%	0.087%	0.163%	0.307%	0.549%	0.010%
825	99.21%	0.01%	0.001%	0.002%	0.000%	0.003%	0.000%	0.094%	0.131%	0.089%	0.014%	0.226%	0.204%	0.003%
833	99.45%	0.01%	0.019%	0.028%	0.001%	0.019%	0.003%	0.010%	0.049%	0.120%	0.016%	0.015%	0.236%	0.012%

Table 6.38: ICP-OES compositional results for copper objects

Artifact ID	Weight (g)	As 188.980	Ag 328.068	Cu 324.754	Cu 327.395	Fe 238.204	Ni 231.604	Pb 220.353	Zn 206.200
612	0.0206	1.12	0.74	1000	1002	0.06	1.31	2.04	
636	0.0197	0.78	1.02	937	935	0.03	0.65	0.98	
711	0.0197	0.95	0.96	908	911	0.02	0.77	1.60	0.0
825	0.0209	1.04	1.08	1031	1033	0.01	0.81	1.51	
634	0.0204	0.84	1.09	1015	1018	0.06	0.70	1.03	
693	0.0209	0.52	0.46	1059	1055	0.01	0.43	2.06	0.0
704	0.0203	1.01	1.85	974	970	0.06	0.67	1.80	0.0
706	0.0203	0.68	1.02	946	948	0.01	0.52	1.51	
707	0.0197	0.81	1.03	965	970	0.02	0.62	1.01	
775	0.0204	1.96	1.01	1001	1001	0.06	0.73	2.95	0.1
divided by weight (g)									
612	0.0206	54	36	48532	48637	3	64	99	
636	0.0197	40	52	47539	47447	2	33	50	
711	0.0197	48	49	46075	46254	1	39	81	2
825	0.0209	50	52	49314	49448	0	39	72	
634	0.0204	41	53	49740	49918	3	34	51	
693	0.0209	25	22	50690	50471	0	20	99	2
704	0.0203	50	91	47979	47783	3	33	89	1
706	0.0203	34	50	46617	46714	1	26	75	
707	0.0197	41	52	49000	49217	1	31	51	
775	0.0204	96	50	49055	49088	3	36	145	6
multiplied by volume (ml) produces results in ppm									
612		1087	721	970633	972748	62	1272	1981	1
636		791	1031	950786	948942	34	658	993	1
711		967	979	921496	925076	23	777	1620	45
825		999	1035	986278	988967	10	772	1444	1
634		825	1066	994804	998353	56	681	1014	1
693		502	442	1013799	1009426	7	409	1974	34
704		993	1823	959584	955665	59	663	1773	27
706		674	1004	932348	934279	14	513	1492	1
707		823	1047	980002	984331	24	626	1028	1
775		1918	992	981108	981755	61	718	2892	116
divided by 10,000 to obtain %									
612		0.1	0.1	97.1	97.3	0.0	0.1	0.2	
636		0.1	0.1	95.1	94.9	0.0	0.1	0.1	
711		0.1	0.1	92.2	92.5	0.0	0.1	0.2	0.0
825		0.1	0.1	98.6	98.9	0.0	0.1	0.1	
634		0.1	0.1	99.5	99.8	0.0	0.1	0.1	
693		0.1	0.0	101.4	100.9	0.0	0.0	0.2	0.0
704		0.1	0.2	96.0	95.6	0.0	0.1	0.2	0.0
706		0.1	0.1	93.2	93.4	0.0	0.1	0.2	
707		0.1	0.1	98.0	98.4	0.0	0.1	0.1	
775		0.2	0.1	98.1	98.2	0.0	0.1	0.3	0.0

Table 6.39: ICP-OES compositional results for brass objects

Artifact ID	Weight (g)	Zn 334.502	Zn 206.200	Zn 330.258	As 188.980	Ag 328.068	Cu 324.754	Co 238.892	Cu 327.395	Fe 238.204	Hg 184.887	Mn 257.610	Ni 231.604	Pb 220.353	V 292.401
701	0.0201	364	353	360	0.62	0.388	675	0.079	667	0.57	0.6	0.06	0.42	13.2	0.02
726	0.0205	366	353	358	0.48	0.884	651	0.025	644	0.67	0.50	0.06	0.22	21.60	0.01
751	0.0196	244	230	237	1.06	0.723	799	0.053	781	5.04	0.00	0.01	1.47	9.50	0.00
757	0.02	397	381	386	0.37	0.332	636	0.021	626	1.21	0.00	0.08	0.31	12.80	0.00
divided by weight (g)															
701	0.0201	18126	17543	17926	31	19	33569	4	33175	28	28	3	21	658	1
726	0.0205	17867	17229	17473	23	43	31750	1	31391	33	22	3	11	1054	0
751	0.0196	12474	11721	12091	54	37	40743	3	39863	257	2	0	75	486	0
757	0.02	19838	19029	19293	19	17	31786	1	31287	61	1	4	16	641	0
multiplied by volume (ml) produces results in ppm															
701		362524	350867	358527	618	386	671376	78	663495	569	554	60	417	13159	16
726		357348	344589	349464	469	863	634991	24	627822	651	442	59	215	21077	7
751		249481	234415	241815	1082	737	814853	54	797260	5144	37	9	1498	9718	3
757		396763	380588	385860	372	332	635714	21	625742	1212	25	79	314	12822	2
divided by 10,000 to obtain %															
701		36.25	35.09	35.85			67.14		66.35	0.06	0.06	0.01	0.04	1.32	0
726		35.73	34.46	34.95			63.5		62.78	0.07	0.04	0.01	0.02	2.11	0
751		24.95	23.44	24.18			81.49		79.73	0.51	0	0	0.15	0.97	0
757		39.68	38.06	38.59			63.57		62.57	0.12	0	0.01	0.03	1.28	0

This pilot study demonstrated that while LA-ICP-MS produces comparable major element results to ICP-OES on cut (non-corroded) surfaces, sampling of corroded surfaces affected the LA-ICP-MS results, and therefore, the method would not be appropriate for artifacts when removal of corrosion was not allowed. LA-ICP-MS could be applied to artifacts if cleaning is allowable in a small area designated for laser ablation, similar to a technique suggested for pXRF analysis (Ehrhardt and Kaiser 2011). To sample artifacts without surface preparation, it is also possible to adjust the diameter of the laser for each analysis point (Dussubieux et al. 2008), but this was not attempted in my pilot study. To assess the difference between using LA-ICP-MS on clean-cut metal and through corroded surfaces, a copper artifact (693) and a brass artifact (701), were sampled both on the cut surface and through the corrosion (Figure 6.54)

Figure 6.54: Bell Site Artifacts 1990-10-693 (HW-00153) and 1990-10-701 (HW-00154). Scales in cm.

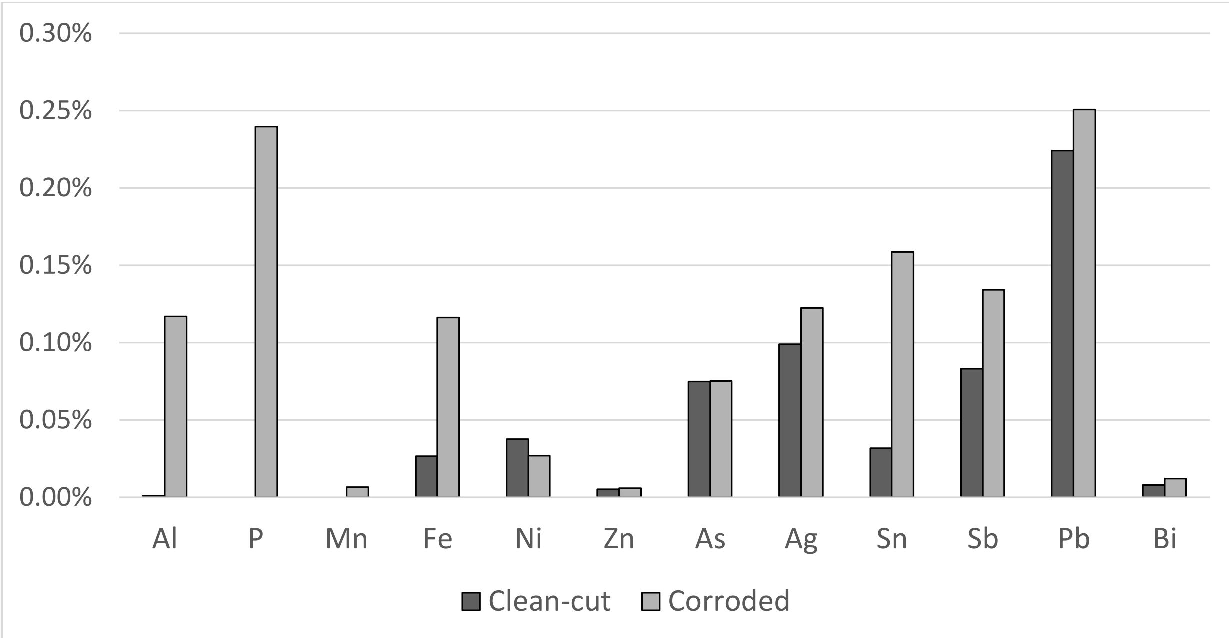


Figure 6.55: Sampling Artifact 693 through a clean-cut versus through corroded metal

In the sample of corroded copper artifact 693, more trace elements, and in greater quantities, were detected (Figure 6.55). Elements detected in the corroded sample but not the cut sample include aluminum (Al), phosphorus (P), and manganese (Mn), which are common in both soil and copper corrosion products. Furthermore, higher quantities of iron, tin, antimony, and lead were detected in the sample that cut through the corrosion, indicating that these elements were part of the corrosion process and were present in lesser quantities in the original metal object. Trace elements make up .59% of the composition of the cut sample contrasted with 1.27% in the corroded sample. Therefore, taphonomic processes would affect any study of metal compositional subgroups if LA-ICP-MS samples were taken through the corroded surface.

There were also differences between the cut and corroded samples of brass artifact 701 (Figure 6.56 and Figure 6.57). The sample through the corrosion layer detected much less Zn than the clean-cut sample, as a result of zinc-depletion that occurs on the surface of brass objects

(Dussubieux et al. 2008). Therefore, LA-ICP-MS analysis without surface preparation of brass artifacts also would not be an appropriate sampling method to differentiate brass subgroups.

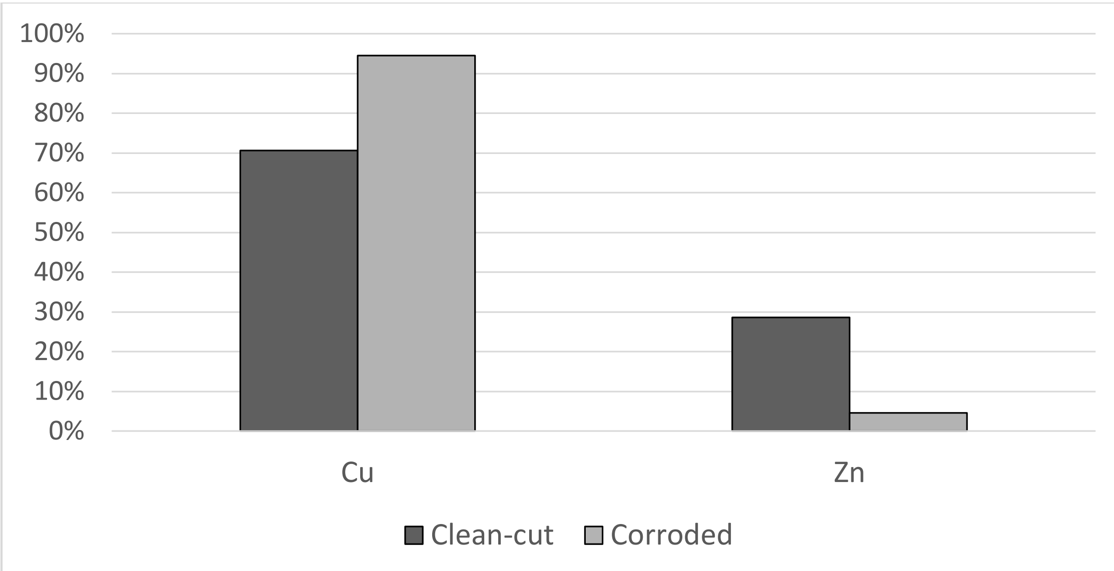


Figure 6.56: Sampling Artifact 701 through a clean-cut versus through corroded metal (major elements only).

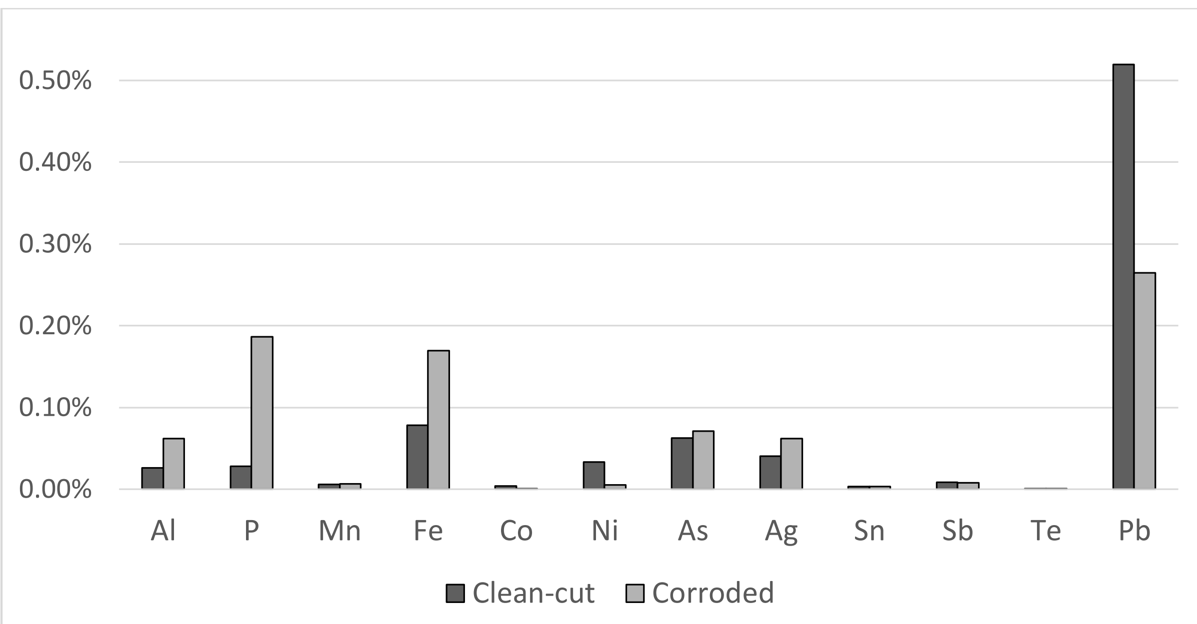


Figure 6.57: Sampling Artifact 701 through a clean-cut versus through corroded metal (trace elements only)

Trace element detection in Artifact 701 was also affected by cutting through the corrosion layer (Figure 6.57). As in the copper artifact, higher levels of aluminum, phosphorus, and iron were detected in the corrosion-influenced sample. Lead levels were nearly twice as high in the clean cut sample, which may be the result of a lead inclusion being directly sampled during the analysis. Lead does not homogenize in copper-base metal alloys but rather separates from other elements and forms small sheets or grains (Dussubieux et al. 2008:651-652).

6.2.1.3 Discussion and Interpretation

Despite the presence of corrosion in the samples, it was possible to determine using LA-ICP-MS (and confirm with ICP-OES) that all artifacts in the study were copper-base smelted metals; none were native copper. Results differed when compared to the earlier study of the same materials from the Bell Site (Figure 6.58, Freeman and Behm 2008), and the authors of that study suggested that the presence of soil and other contaminants in the AAS samples likely resulted in very low copper concentrations being recorded even for objects of pure copper.

COMPARISON OF COMPOSITIONAL DATA

Artifact Idetification Number	X-Ray Microanalysis	Atomic Absorption
UWO/A-1990-10-612	65.96%	62.49%
UWO/A-1990-10-619	69.99%	54.49%
UWO/A-1990-10-623	30.38%	22.77%
UWO/A-1990-10-636	61.27%	20.47%
UWO/A-1990-10-656	62.34%	21.18%
UWO/A-1990-10-711	68.43%	66.96%
UWO/A-1990-10-795	82.39%	47.16%
UWO/A-1990-10-815	84.00%	16.08%
UWO/A-1990-10-825	90.31%	25.77%
UWO/A-1990-10-829	61.21%	25.63%
UWO/A-1990-10-833	86.69%	27.83%

Figure 6.58: Reproduction of Table 4 of Freeman and Behm (1998), reporting percentages of copper detected using X-Ray Microanalysis and AAS. Artifacts sampled in the current study are circled.

The X-ray Microanalysis (SEM-EDS) likewise sampled surface corrosion and adhering soil, resulting in lower Cu% being recorded. The differing results among all methods demonstrate the importance of removing the contaminated or corroded surface metal of the artifacts to produce meaningful data about compositional subgroups for brass and copper artifacts.

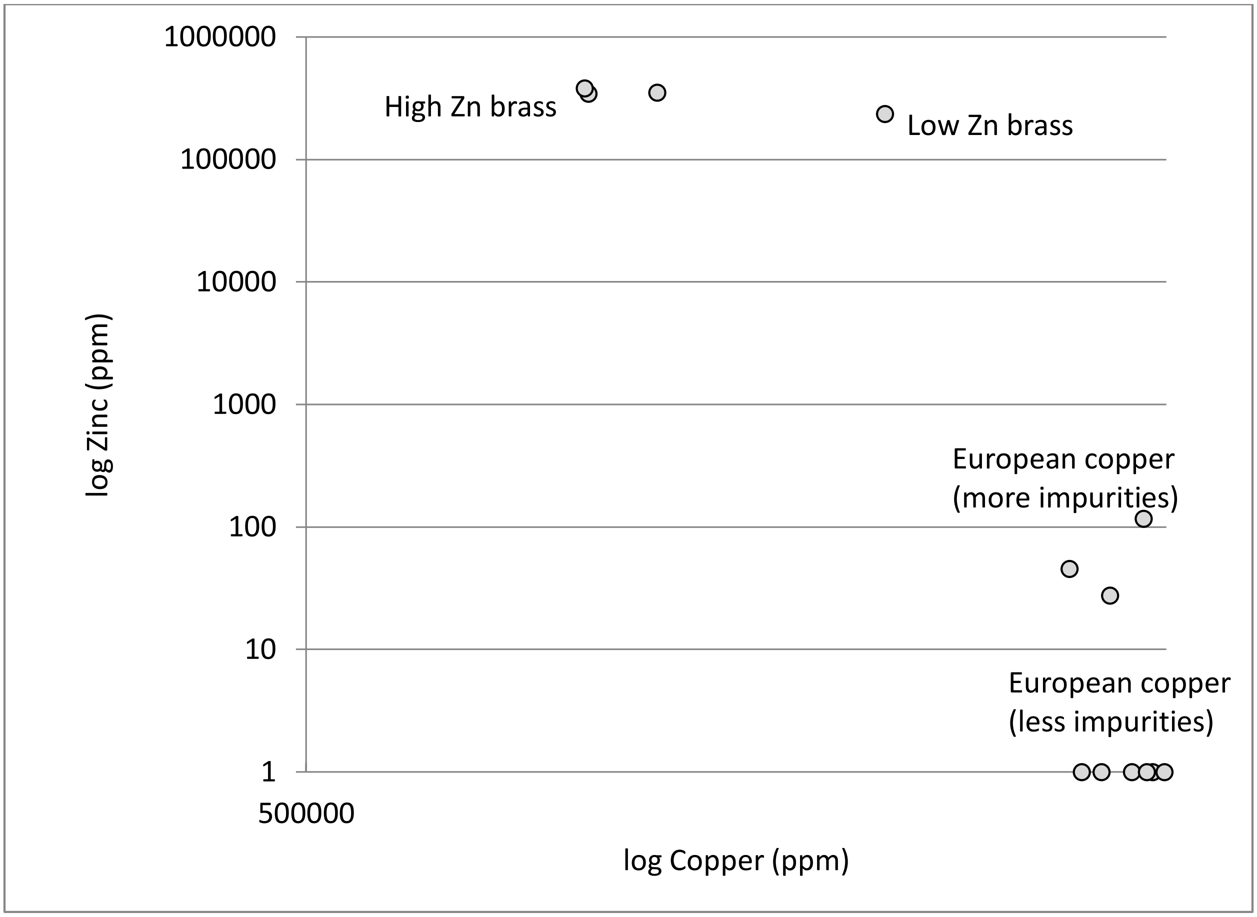


Figure 6.59: ICP-OES results, illustrating compositional subgroups. Data are logged to show separation; original values are found in Tables 6.38 and 6.39.

Within the control results taken using ICP-OES to analyze sample fragments with corrosion completely removed, there is some differentiation among subgroups of European metal, both copper and brass (Figure 6.59). The four subgroups may represent at least four different original sources of metal, i.e. trade kettles or other European-manufactured items. The log scale is used to illustrate better separation between the European copper with more and less impurities, but this scale makes the difference between low and high Zn brass appear quite small; however, the Low Zn artifact (751) contained less Zn (25.0%) than the other three brass artifacts in both the LA-ICP-MS and the ICP-OES results (mean 37.2%). Other elements such as Pb, Sn, and As could be assessed to better understand possible subgroups within the copper sample, but results are inconclusive with this small sample size and the destructive nature of obtaining the ICP-OES result prohibited the expansion of this analysis method to the broader study sample.

If it were permissible to obtain samples from a larger number of artifacts, a highly diverse assemblage of European metal subgroups would potentially indicate sustained and frequent trade at a colonial-era Native American site, while a relatively homogeneous assemblage might indicate less frequent or occasional trade. If the study were expanded to include ornamental objects, it might become possible to address raw material choice as a factor in the Native production processes of reworking European metals into ornamental objects. Analysis of kettle metal composition using LA-ICP-MS remains a difficult prospect at this time because detected variations between kettle metal pieces could be attributed either to variation in corrosion sampling, taphonomic processes, or to differences in original production processes. Without a way to sufficiently compensate for the sampling of corroded metal, was not possible to draw further conclusions about the manufacturing processes or raw material choices in reworked metal at the Bell Site. A future archaeometric study with the ability to mitigate for corrosion in a non-destructive way would provide the opportunity to assess the nature and intensity of trade at a site by identifying compositional subgroups that could be linked to particular kettles or other metal objects. This would address research questions related to the social and economic factors influencing trade in European-made items and could be executed at a regional scale.

6.2.2. Comparison of LA-ICP-MS and pXRF to differentiate native from smelted coppers by testing unprepared metal surfaces

This section presents the results and interpretations of the comparative study described in the Ch. 4, Section 4.4.2.2. With the help of Laure Dussubieux, I assessed the reliability of portable x-ray fluorescence (pXRF) as a fast, effective, and completely non-invasive method of differentiating smelted from native coppers, as compared with LA-ICP-MS (Dussubieux and Walder 2015). These techniques were applied to artifacts from two archaeological sites in the Upper Great Lakes region, the Rock Island site and the Clunie site. Results indicate that for the specific purpose differentiation between native and smelted copper types, pXRF can be used reliably, without sample preparation and despite surface corrosion. This study demonstrates that pXRF analysis of copper-base metal assemblages provides a non-destructive way to clarify European trade item distribution and continuity of native copper object use among Indigenous peoples of North America during the colonial period.

This small-scale archaeometric study assessed the reliability of portable x-ray fluorescence (pXRF) as a fast and effective method of identifying cold-worked native versus smelted coppers without any sample preparation. Differentiating the compositions of North American native and European smelted copper allows the recognition of possible “protohistoric” sites, where smelted European copper might be the only trade item present in the assemblage, likely obtained through down-the-line trade. Identifying native copper objects from sites later in time provides information about the persistence of traditional copper-working technology among Native American peoples who also were obtaining items originally manufactured in Europe.

This study also provides evidence that archaeometric techniques are more reliable than visual differentiation of copper types based on working methods or archaeological contexts, which is a common practice in the Great Lakes region, especially in the sub-discipline of cultural resource management. Copper-base metal objects found in seventeenth century contexts are often considered “brass” or “kettle scrap” from “historic” or “trade items,” while copper from older or ambiguous contexts is labeled “prehistoric” or “native” (e.g. Freeman and Behm 1998; Salkin 1989: 198-209; Van Dyke and Riggs 2003:107). These interpretations are based on context of artifacts, visual appearance, and sometimes working methods (hammered copper = native copper; cut metal = European brass). Using pXRF study is an accurate and non-destructive way to identify protohistoric European-trade items in early or otherwise materially “pre-historic” contexts and to assess the continuity of native copper object use on historic-era archaeological sites dated to later in the colonial period. Rather than making assumptions about the raw material choices and technological practices of Native peoples, it is now possible to test hypotheses about these practices and the continuity of copper-working traditions.

6.2.2.1 Previous archaeometric investigation of the problem

In both lab-based and portable applications, XRF measures the surface composition of an artifact, only penetrating a few microns into the sample, which is problematic in the case of copper or copper-based artifacts that can be corroded with a layer of oxidized material that may be 30 microns thick or more (Dussubieux et al. 2008). Previous research established that it was possible to discriminate North American native copper from European smelted copper using LA-ICP-MS even on a very corroded surface based on the concentrations of As, Ni, Ag and Sb (Dussubieux et al 2008). Portable XRF can detect these same trace elements, although the composition of the corrosion layer is usually depleted in copper and can be enriched in a variety of trace elements (Moreau and Hancock 1999). In addition, pXRF has relatively high limits of detection compared to other techniques routinely used with North American copper, such as INAA (e.g. Michelaki et al. 2013).

Current research on the possibility of differentiating between native and smelted copper using pXRF is divided. One study showed that it was possible to differentiate European smelted copper and North American Native copper using portable XRF on artifact surfaces after removal of corrosion material (Ehrhardt and Kaiser 2011). However, such cleaning is unacceptable to curators and institutions in some cases. Two additional recent studies focused on XRF methods and their usefulness for copper-based metal artifacts (Abel and Burke 2014; Orfanou and Rehren 2014). Abel and Burke applied 1990s era lab-based XRF technology to materials from protohistoric sites in Northwest Ohio, and identified Pb, Fe, Ca, Ag, and As as elements indicative of European smelted copper in these assemblages. Based on these findings, native copper persisted as an important raw material in the Great Lakes region well after European contact and the widespread availability of smelted metals (Abel and Burke 2014:16). Orfanou and Rehren (2014) investigated the effectiveness of pXRF for examining copper-based metal objects as compared to a more expensive and invasive method, in this case, electron probe microanalyzer (EMPA). They found that surface analysis using pXRF on corroded artifacts did affect outcomes and that results differed from EMPA analyses on polished metal cross sections. Furthermore, in comparing XRF samples of clean and corroded metals, they found enrichment in certain elements in the corrosion layer; these include Sn, Pb, As, Sb, Fe, which might come from the depositional environment of the artifact. The authors advised archaeologists to proceed with caution in the interpretation of pXRF data obtained from corroded surfaces, taking into account instrumental limitations and the effects of corrosion on artifacts stating that "for corroded surface[s]… data obtained in this study appears to be generally not reliable or useful" (2014:9-10). Based on findings from my initial pXRF study with Dussubieux, I disagree with this statement; as a tool for simply differentiating copper types, unprepared surface sampling using pXRF is a useful and appropriate method, and cleaning is not necessary to simply differentiate between native and smelted copper artifacts using pXRF.

6.2.2.2 Archaeological Background and Research Questions

In North America prior to European contact, Native peoples did not smelt copper ore, but practiced cold-working, annealing, and other forms of non-transformative pyrotechnic metallurgy (Chastain et al. 2011; Cobb et al. 2008; Ehrhardt 2009; Martin 1999; Schroeder and Ruhl 1968). However, smelted European-made copper objects later became available to Native Americans during trading encounters. Differentiating smelted from non-smelted or native copper is useful in two situations: 1) recognizing possible "protohistoric" sites, where smelted European copper might be the only trade item present in the assemblage, likely obtained through down-the-line trade and, 2) demonstrating persistence of traditional copper-working technology in later historic periods among Native American peoples who also were obtaining items originally manufactured in Europe.

Two sites in the dissertation study sample, Rock Island (47 WN 128) and Clunie (20 SA 722), had copper-based metal assemblages with potential to include both cold-worked and smelted copper artifacts. Rock Island is a multi-component village site on an island off the tip of the Door Peninsula in Wisconsin has prehistoric Woodland and Oneota components (R. J. Mason 1990, 1991), along with extensive historic-era occupations. The Clunie site was initially attributed exclusively to Late Woodland period peoples (pre-European contact) until two glass trade beads, several several gunflints, and a possible 'trade axe' were recovered, suggesting at least limited trading activities during historic times (Sommer 2013:46). Archaeologists tentatively date one glass bead to the early seventeenth century, but no ethnic attribution has been made for the historic component of the Clunie site. For further review of these sites, see Chapter 3.

There are four research questions addressed in this pilot study:

1) Does pXRF differentiate native from smelted coppers as effectively as LA-ICP-MS? This is the primary research question for this study, relevant for scientists and archaeologists who work in regions of the Americas where native coppers were used without smelting prior to European contact. This methodological exploration can help address archaeological questions:

2) Are smelted copper objects present in a seemingly native copper assemblage at the Clunie site? Expectation: All artifacts were expected to be native copper based on late prehistoric dates for the ceramic assemblage materials, but smelted copper may be present.

3) Were smelted copper objects obtained in the proto-historic period at Rock Island? Expectation: Since a few other European-made trade goods were present in association with Lake Winnebago Trailed Oneota ceramics, smelted copper could be present in those contexts.

4) Does the use of native copper persist into historic-era occupations of Rock Island? Expectation: European-made trade items, including cut copper and brass scrap are abundant in this period, but native copper objects also might be present in the assemblage.

These questions relate directly to the broader research questions of this dissertation. Unrecognized smelted copper artifacts in otherwise "prehistoric" appearing contexts can provide evidence to help recognize protohistoric sites where down the line trade or migration may have brought only small quantities of trade items to sites far from European colonial centers. Identifying smelted copper objects from protohistoric contexts at Clunie and Rock Island contribute to a better understanding of early trade in European-made materials among Indigenous groups of the Upper Great Lakes region prior to direct contact. Conversely, identifying native copper in the later historic-era occupation of Rock Island would provide evidence for continuity of the technological practice of native copper working, which could be used to support an interpretation of cultural continuity in a colonial situation.

6.2.2.3 Sample Selection and Categorization

Samples were selected to test the archaeological research questions and compare the reliability of pXRF and LA-ICP-MS methods. Portable XRF alone was applied to 43 copper artifacts from the two study sites, and a subset of 18 artifacts were then re-analyzed using LA-ICP-MS. PXRF and LA-ICP-MS results concurred well. All Rock Island objects were first scratch tested to preliminarily check that they were copper, not brass (Fitzgerald and Ramsden 1988). The Clunie site materials were too fragile to scratch test, but all were assumed to be copper; the presence of brass objects would only strengthen the argument for European trade items in a protohistoric context. Samples were selected on the basis of other artifacts present in the context or stratum and the metalworking methods evident through visual analysis. Selected materials are NOT representative of total metal assemblages for each context. This study could be expanded to sample complete artifact assemblages, but the large number of copper-based metal artifacts from the Rock Island site (>1000) prohibited 100% sampling in this case study. Each selected artifact was assigned to one of four categories that describe the artifact contexts, technological working methods, and visual appearance (Figure 6.60). Categories were:

Category A (n= 21) – Native Copper. Proto-historic contexts with Native-made ceramics or other materials; working methods may be hammering or indeterminate

Category B (n=7) – Smelted Copper. Proto-historic contexts with Native-made ceramics or other materials; working methods may include scoring, clipping, or other use of European-made tools

Category C (n=6) – Native Copper. Later-historic contexts with European-made trade items present; working methods may be hammering or indeterminate

Category D (n = 9) – Smelted Copper. Later-historic contexts with European-made trade items present; working methods may include scoring, clipping, or possible use of European-made tools

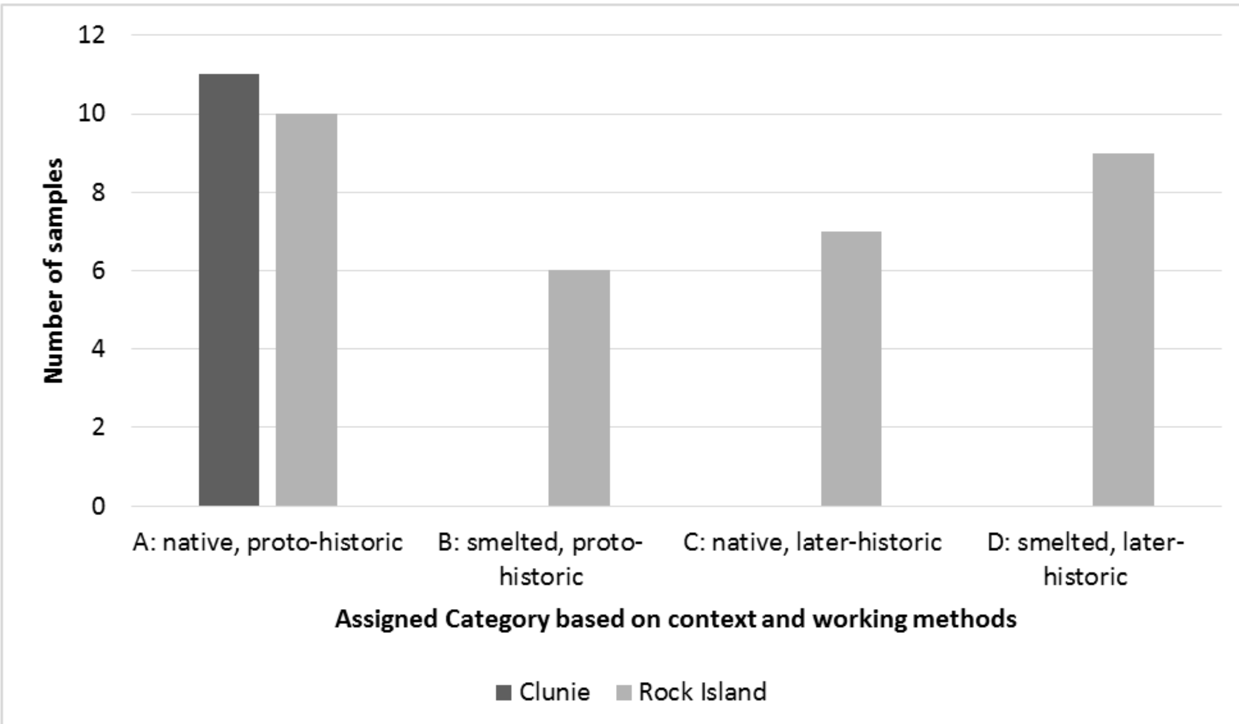


Figure 6.60: Samples assigned to categories, based on visual identification of copper-working methods and on dating and associated artifacts in the archaeological context of each sample

6.2.2.4 Results

Results obtained using pXRF show that all the European smelted copper artifacts (as identified by LA-ICP-MS) exhibit significantly higher concentrations of 2 or more of the following elements: Ni, As, Sn and Pb. Native copper had concentrations for all these elements below these levels, with a few exceptions. Some North American copper ore sources have rather high As concentrations, and the average As concentrations in Lake Superior native copper sources is 430 ppm (Rapp et al. 2000:55).Therefore, As alone does not indicate that an object is made of smelted copper. Using the other diagnostic trace elements it was possible to separate native from smelted coppers. A biplot of Sb and Ni in LA-ICP-MS results separates the artifacts into smelted and native materials (Figure 6.61). These elements were then used along with Pb and As to differentiate smelted and native copper in the pXRF results (Figure 6.62)

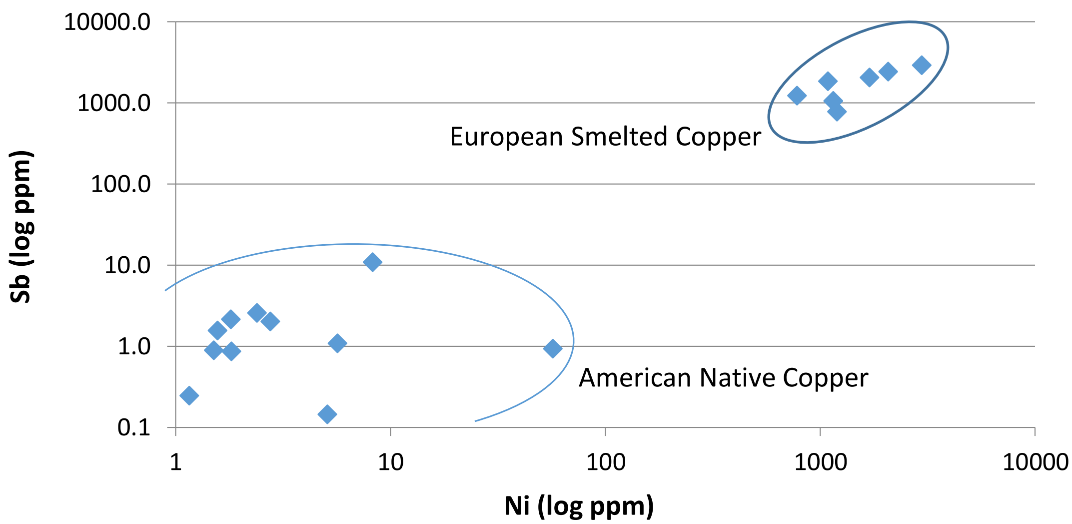


Figure 6.61: Biplot of LA-ICP-MS results differentiating smelted and native copper using Sb and Ni; graph produced in collaboration with Laure Dussubieux, Chicago Field Museum.

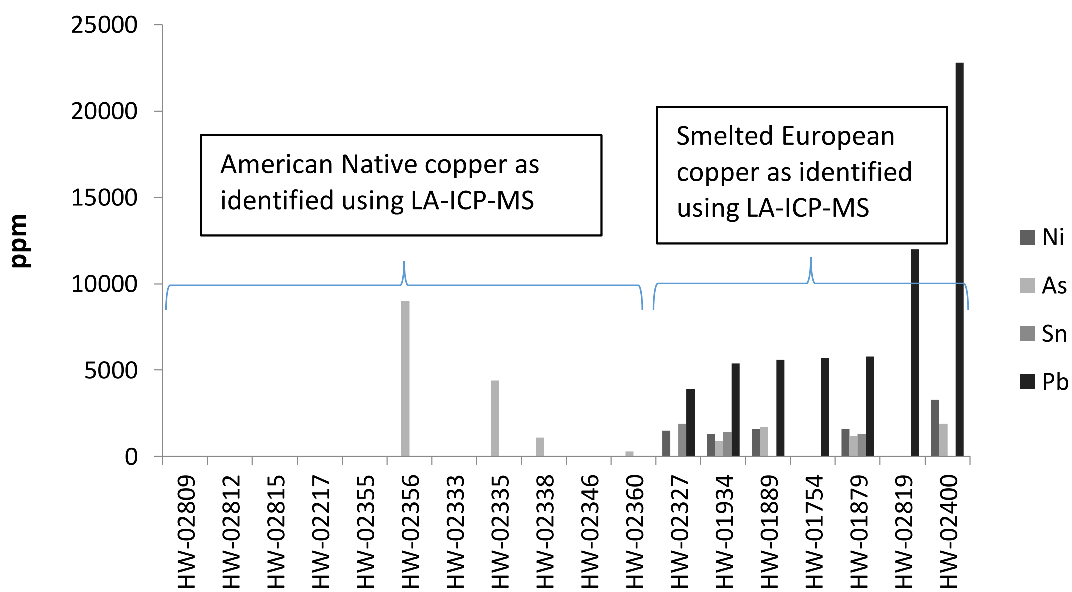


Figure 6.62:Results of pXRF for subset of objects analyzed with pXRF and LA-ICP-MS, graph produced in collaboration with Laure Dussubieux, Chicago Field Museum.

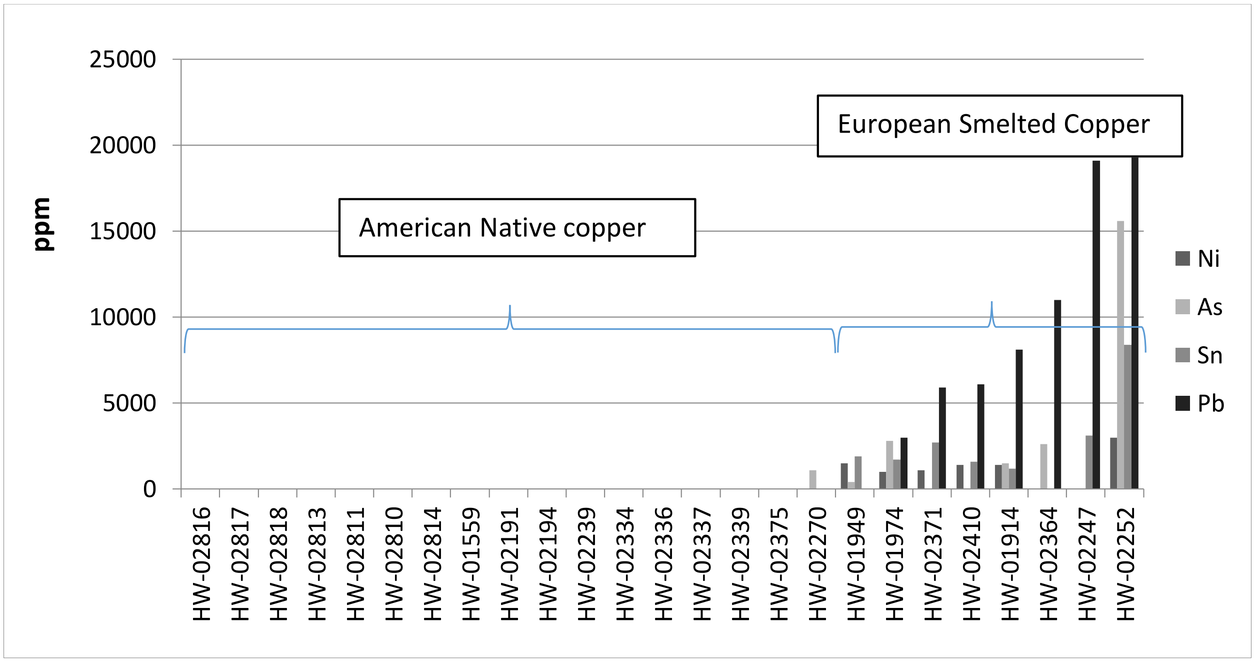


Figure 6.63: Group attribution for sample tested only with pXRF, not by LA-ICP-MS, graph produced in collaboration with Laure Dussubieux, Chicago Field Museum

Based on the finding that pXRF and LA-ICP-MS results concurred well, group attribution was performed for the samples that were only analyzed using pXRF (Figure 6.63).

6.2.2.5 Discussion and Interpretation

In addition to confirming the usefulness of pXRF to differentiate between native and smelted copper, this study addresses archaeological research questions by demonstrating that protohistoric, possibly down-the-line trade took place at Rock Island and Clunie, and that the technological practice of working native copper persisted at Rock Island long after trade items and Europeans themselves arrived on-site. The single smelted copper example (HW-02819) from the Clunie site strengthens the excavator's interpretation that the predominantly Late Woodland site may have a small protohistoric component. Without chemical analysis, the tiny copper scrap could not be identified as a European-made object. Like the European-made glass trade beads at the Clunie site, the scrap may have arrived via down-the-line trade since there is no known direct European presence there in the early 1600s. At Rock Island, results demonstrate early acquisition of European smelted copper objects, which were recovered in association with Oneota ceramics and other Native-made artifacts, as well as continued use of native copper objects well into the eighteenth-century occupation of the site. Therefore, ideological significance of local copper may have persisted even after brass and smelted copper were available.

Identifications of smelted or native copper based on archaeological context and visual observation to determine technological working methods took place before the archaeometric study and disagree with pXRF results in 37% (16/43) of all cases (Table 6.40). Although this high error rate may be influenced by my personal skill level, it would be fair to consider that other archaeologists may have a similar error rate when attempting to differentiate smelted from native copper using the same approach. Copper artifacts are often subject to heavy corrosion that will modify very dramatically the features of the artifacts. In this study, the visual identification of smelted copper in proto-historic contexts (Category B) was very unsuccessful, correctly identified only 14% of the time. It seems possible that traditional cold-working methods such as hammering might have been applied to European-made metal objects, making them appear more like cold-worked native copper. Using archaeometric methods to distinguish objects in Category B (European smelted copper in early contexts) and Category C (native copper in later contexts) is especially important because artifacts of these types are “unexpected” in their contexts and might not be noticed in a large assemblage of metal artifacts. Artifacts from Category B show Native peoples’ early adoption and modification of European materials, while Category C illustrates persistence of Indigenous copper-working technologies (or at least artifacts made with these methods) long after European materials become available.

Table 6.40: Comparison of visual identifications and results of p-XRF:

Category	**Visual Identification**	**pXRF**	**Visual ID correct**	**Visual ID incorrect**
A (native, proto-historic)	21	20	15	5
B (smelted, proto-historic)	6	7	1	6
C (native, later-historic)	7	8	5	3
D (smelted, later-historic)	9	8	6	2
TOTAL	43	43	27	16

Differences between visual identifications and results determined through compositional analysis demonstrate how an archaeologist might misinterpret an artifact or site if they only categorized copper based on the appearance and site context of the artifact. Assessment of copper type based on physical attributes and archaeological context is a less accurate method of differentiating between native and smelted copper than archaeometric analyses. Although researchers should continue to be cautious when attempting to apply pXRF results in a quantitative comparison with other methods, such as EPMA or LA-ICP-MS, in this case, pXRF is an appropriate tool for answering the particular research questions of this study. PXRF is as reliable as LA-ICP-MS in all cases in this sample, despite corroded surfaces. These results should provide archaeologists with an effective and affordable archaeometric means of addressing research questions similar to those posed for this pilot study (section 6.2.2.2).

6.3 Interpretations of attribute and archaeometric metal analyses as related to the research questions

I applied a regional scale attribute analysis of reworked copper-base metal artifacts and two compositional analysis pilot studies examine relationships between technological style of metal-working practices and resource availability, trade connections, and cultural affiliations in the historic-era Upper Great Lakes region. In this section, I reiterate the research questions and expectations of this project as they relate to the exchange and modification of copper-base metal objects to produce personal adornments and other objects and discuss the findings as they relate to the larger research questions of this project. The metals analyses proved to be most useful for addressing research questions one and two, regarding the social outcomes of colonial interaction.

6.3.1 Research Question 1: In the region of study, is there archaeological evidence for commonly recognized historically-documented outcomes of colonial interaction, such as multi-ethnicity, hybridity, and ethnogenesis?

In the metal attribute analysis, I expected to identify material evidence of colonial interaction, such as hybrid adornment forms made from European metal shaped in similar way as pre-contact forms. I also expected greater diversity of technological style within artifact types, such as tinkling cones, at historically documented multi-ethnic communities than at sites attributed to predominantly one ethnic group. Expectations were supported by the presence of hybrid material culture, and in the diversity of the Rock Island site assemblage, but it is difficult to determine if the diversity in the Rock Island assemblage reflects true cultural diversity, or if this is an outcome of the large sample size of copper-base metal artifacts from the site.

Reworked smelted-copper objects from early contact and colonial-era archaeological sites associated with Indigenous in North America are a form of "hybrid" material culture (following Bhabha 1994; Card 2013) because such items reflect traditions of adornment in the Upper Great Lakes prior to European contact (Quimby 1966: 29, 37-39) but incorporate available newly available raw materials such as smelted copper, as demonstrated in my pXRF analyses of artifacts from the Rock Island and Clunie sites. The widespread regional use reworked, smelted copper in the form of personal adornments demonstrates continuity and elaboration of the long-standing practice of using copper to produce beads and other adornments in the Great Lakes region (Martin 1999:156-167). While multi-ethnicity in the historic era is difficult to identify without the aid of documentary evidence, the diversity of tinkling cone styles, metal pendant shapes, and metal projectile point types at Rock Island may be attributed to socially-structured learned technological practices differing among individuals or family groups at that site, but differences also may relate to individual preferences or crafting styles. The strip-spiral bead form was produced both in native copper and smelted copper and found in several temporal components at the Rock Island site, further demonstrating the continuity of forms into the historic era and the continued ideological significance of making objects out of copper materials. Conversely, the proportions of finished and unfinished objects in metal assemblage of the multiethnic community at Fort St. Joseph (Nassaney 2012) was more similar to Fort Michilimackinac than to Rock Island or other sites predominantly occupied by Native peoples. I interpret this finding as evidence that a sustained European presence led to a distinctive reworking pattern and that cultural differences between European and Native settlements were greater than differences among practices of the various Indigenous groups of the region.

The brass cuff bracelet recovered at the O'Neill site in northwestern Lower Michigan is different in form, working methods and decoration from the more common C-shaped bracelets recovered at other Upper Great Lakes sites, but it is similar to bracelets recovered at several Iroquoian sites of eastern North America (Anselmi 2004: 195-197). This artifact attests to the population movement and exchange that were both hallmarks of the early period of interaction, as eastern North American populations moved westward ahead of violence and disease. Native newcomers might have encountered others on Drummond Island, potentially forming a multi-ethnic community or using the bracelet to represent group affiliation. The bracelet also may have moved independently inland via down-the-line trade or as an idea of that style reproduced locally. This single artifact represents broader patterns of population movement and intercultural exchange of materials and ideas, but its mode of delivery to northern Michigan is unknown.

Hybridity of material forms is not limited to personal adornments. The forms of copper-based metal projectile points from differ by site. Perforated triangular points dominate the Marquette Mission assemblage, stemmed forms are common on Madeline Island, and a unique serrated miniature harpoon form is present at Rock Island along with a diverse collection of other types. The triangular and stemmed and notched point forms reflect the shapes of earlier lithic projectile point traditions (e.g. Justice and Kudlaty 1999) and illustrate hybridity in using new materials to produce existing point styles or shapes. Like the geographic differences in abutting and overlapping tinkling cone closures, the attribute study indicates that historically documented ethnic groups across the Upper Great Lakes may have favored different styles of copper-based metal projectile points, and that Meskwaki may have eschewed copper projectile points altogether, perhaps in favor of firearms, which are common at the Bell Site (Bodoh 2004).

Geographic differences in the styles of hybrid objects might reflect the preferences of different cultural groups in how to best manipulate the raw material to suit their particular needs for both adornment and utilitarian objects. Unique objects, like the red-pigment container from the Rock Island site, and the copper-mail neckpiece from Gros Cap now in a private collection (Figure 6.21), highlight the diversity of technological practices applied to European copper-based metal as a raw material used for a variety of adornment purposes. The difficulty of visually differentiating between native, generally cold-worked copper objects and finished forms of objects made from European smelted copper illustrates the long term continuity of forms inherent in copper-based-metal hybrid material culture of the Upper Great Lakes. The differences between these objects are only in material type, not form or even methods of working in most cases. As the archaeometric study of copper from Rock Island and Clunie demonstrates, smelted copper materials became available on some sites before any other non-native materials, but the use of native-copper persisted into the eighteenth century in some cases. This demonstrates hybridity of technological practice, which may stand in for hybrid or multiethnic identities of this time.

6.3.2 Research Question 2: Do spatial and temporal patterns of variation in the chemical composition of glass beads and the reworking styles of metal objects correlate with present understandings of the locations of ethnic groups on the regional landscape?

I expected that patterns of variation in the forms and types of copper-based metal objects would differ across sites attributed to different historically-documented ethnic groups. Some patterns of variation present in the copper-based metal data set, particularly variations in tinkling cone closure, projectile point style, and preferences for rolled-metal beads, support current interpretations about the ethnic affiliation of peoples who inhabited sites in this study. The proportions of finished objects and waste projects present also differ among sites (Table 6.15 and Figure 6.6). For example, greater proportions of unfinished objects at the French colonial sites in the study sample suggest that French and Métis individuals who may have been responsible for deposition of copper-based metal objects did not utilize the materials in the same way as Indigenous peoples at contemporary sites. Relative to the sampled assemblage size, far more scrap is present at Fort Michilimackinac than at other locales, and in in the broader unfinished artifacts category, both Michilimackinac and Fort St. Joseph include the highest proportion of unfinished artifacts. Conversely, the greater proportions of finished objects among the Illinois-attributed sites such as Zimmerman and Iliniwek Village (Ehrhardt 2005; 2013) may be interpreted as a result of resource availability at interior sites, or as part of the Illinois identity-formation process as these people were relative newcomers to the region (Shackelford 2007).

However, the geographic locations where different groups resided changed through time, and with these moves, resource availability and socially-structured trade networks would have changed as well. Therefore, I focused on technological style of artifact forms to test questions related to ethnicity. I expected to find evidence that technological style was linked to tribal ethnicity among the Meskwaki, producing artifact reworking styles that would remain consistent among locales primarily associated with the Meskwaki during their time in Wisconsin at the Markman, Doty Island Village, and Bell sites. I expected that the region of this reworking pattern would be limited to the Lake Winnebago and Fox Valley area, but by the time the Meskwaki moved to Illinois in 1730, both materials access and utilization strategies could have shifted, so I expected to see a different reworking strategy at Arrowsmith, an early eighteenth century Meskwaki site in northern Illinois. The expectation that reworking style in copper-based metal artifacts would be shared among Meskwaki sites and reflective of Meskwaki identity is supported with evidence from the styles of tinkling cones present on Meskwaki sites, including from the Arrowsmith site, which I interpret as evidence that during an era of displacement and conflict, the Meskwaki maintained a relatively consistent technological style of producing tinkling cones as the primary finished object of copper-base metal personal adornment.

Tinkling cones may have served as an important aspect of ethnic identity performance in the Upper Great Lakes region, and other artifact styles reflect both localized and generalized examples of long-term continuity in the Upper Great Lakes region. The rings, coils, and spirals made of tubing and strips present at Rock Island reflect continuity forms identified in the protohistoric levels of Rock Island. The native-copper spiral from protohistoric or later prehistoric contexts containing only grit-tempered ceramics is formally similar to spirals made from European smelted copper in later periods. This continuity may reflect enduring importance of this spiral form to its makers or users. More widespread formal continuity is likewise evident in the use of small rolled beads, which have a long history of use in the Upper Great Lakes region in native copper (Martin 1999:233-235). The small size category of rolled beads (<8 mm) represented native copper at the Clunie site's late Late Woodland contexts is a category seen throughout sites in the Upper Great Lakes in the subsequent, slightly later historic periods.

The Illinois-affiliated Zimmerman site assemblage analyzed in the course of this project differs from any of the other assemblages in working methods and physical attribute styles. Collaborating with Ehrhardt on these materials allowed us to recognize close similarity with the Iliniwek Village site copper-base metal objects that she examined in her dissertation research (2002). For the nine tinkling cones recorded at Zimmerman, scoring was not identified in any cone, despite this being the most common working method present on other cones in the study sample. The most common tinkling cone type, 307, a trapezoidal scrap-like blank with tip open, neck, midsection, and base overlap, was not the most common type at any other site. The small size of blanks and scraps, and the proportion of beads and clips in the assemblage relative to tinkling cones is also distinct and much closer to the Iliniwek Site than any of the assemblages in my study sample. The individuals making copper-base metal objects at Zimmerman relied on distinct working methods to produce a fundamentally different copper-base metal assemblage for use as personal adornments, but it not possible to pinpoint the cause or causes of this difference: it may relate to limited resource availability in the Illinois region, socially-structured trade partners delivering less copper material, preferences of personal adornment related to ethnic identity, but most likely a combination of all of these factors.

6.3.3 *Research Question 3*: In the Upper Great Lakes, when and where did non-local trade items arrive, and how did economic and social factors influence their distribution?

I expected that more abundant copper-base metal resource availability would be reflected in greater proportions of scrap and unfinished objects to finished objects and in the presences of kettle parts such as lugs. Temporally earlier, possibly down-the-line trading was expected to deliver less copper-base metal and was expected to be evident in greater proportions of finished to unfinished objects, as well as smaller-size finished objects, but fewer kettle parts. A sudden decrease trade kettle availability was expected to lead to greater reworking and patching of kettles. Evidence of how economic and social factors influence the distribution of copper-based metal objects in trade networks include the prevalence of patching and kettle parts at some but not all sites, the small size of blanks at the Zimmerman and Iliniwek sites, and the relative continuity through time of some styles and proportions of artifact types at Rock Island.

Prevalence of patching and the quantity of intact kettle parts like lugs and rim portions at the Bell site is interpreted as evidence of both social and economic influences on the copper-base metal assemblage. The prevalence of intact kettle parts indicates copper-base metal trade items were readily available at some point in the occupation of the site. I have interpreted the high incidence of patching as a possible outcome of decrease in trade item availability as a results of inhabitants' conflicts with French traders (Behm 2008; Edmunds and Peyser 1993) possibly coupled with socially-structured preference for metal containers over ceramic vessels. It may have been easier to patch a metal vessel than to mend a broken ceramic vessel, or to produce a new one during a period of conflict. The widespread use of firearms at the Bell site may relate to the lack of any copper-base metal projectile points identified in the assemblage, though one iron point was recovered (Behm 2008:46). Triangular stone points were also recovered and may have continued in use through the historic era there, though this is difficult to demonstrate because of stratigraphic mixing with earlier, prehistoric components. Trade opportunities may have been oriented towards obtaining firearms rather than kettles, though significant evidence of repair and general gunsmithing activity at the Bell Site has been documented (Bodoh 2004). Repair of metal objects, both firearms and kettles, was apparently a common practice at the Bell Site.

The Illinois sites are unique in the small size of scrap, blanks, and finished objects. The preference of site inhabitants for small beads and clips at Zimmerman and Iliniwek could be a social response to an economic situation that limited the supply of European-made copper-base metal items. Tinkling cones would require more raw material, and in larger blank sizes, than small rolled beads. This contrasts with the greater quantities of unfinished and partially worked metal pieces at the French colonial locales, where such resources would have been more readily available. Small rolled beads or copper-mail are not well-represented in the finished object assemblages from either of Fort St. Joseph or Fort Michilimackinac.

Finally, the Rock Island components provide an opportunity to look at social and economic change in the copper-based metal assemblage over time at a single locale. When proportions of identified types metal artifacts from all components are compared (Figure 6.5), there is continuity of artifact types over time despite the attribution of different ethnic groups to each period, with multi-ethnic refugee groups, including a historically-documented Potawatomi group, in Periods 1 and 2, followed by a more permanent Potawatomi village and a probable-Odawa occupation by the mid-eighteenth century. The proportions of artifact types might reflect a general continuity of technological practice in a multi-ethnic community focused on defending and maintaining a strategic trading location.

This study did not identify a particular form or technological style that would identify "early" sites, nor has it clarified the specific routes that materials traveled to reach sites in the Upper Great Lakes. The decoratively-scored tinkling cones from Rock Island, Peshtigo Point, and Marquette Mission illustrate the movement of distinctive adornment styles between Green Bay and the Straits of Mackinac, but this is already a known mid-late seventeenth century exchange route (Mason 1986). Based on the presence of only small amounts of copper-base metal at some of the earliest sites in the study, such as Farley Village and Goose Lake Outlet #3, some materials were arriving into the interior via down-the-line trade, probably moving along river trade routes. If, in each assemblage, the proportion of scrap to finished objects is indicative of resource supply, then this relationship may relate to timing but also the relative abundance of copper-base metal trade items in that location, but it is not possible to separate these factors.

Small rolled beads may be a somewhat temporally-sensitive phenomenon of the mid-late seventeenth century in the Upper Great Lakes region. Small beads or mail were documented qualitatively at Hanson, Gros Cap, Marquette Mission, Rock Island, Winneconne Park, Doty Island, Bell, Zimmerman, the Iliniwek Village (Ehrhardt 2005), and in other contemporary locales not included in this study such as Lasanen (Cleland 1971) and Summer Island (Brose 1970). These artifacts are small, fragile, and easily missed during excavations, making them less-useful as diagnostic artifacts since their absence may be a result of recovery processes, not absence from a location. However, copper mail (or other series of rolled beads affixed to organic materials) does not seem to persist much into the eighteenth century, and the quantity of "mail fragments" documented at Marquette Mission (Branstner 1986:108-109) and at the Lasanen site (Cleland 1971) may indicate that some of the earliest smelted metal objects reaching the St. Ignace area were used in this way. Since mail-decorated objects rarely preserve intact, and no segments larger than the 37 bead fragment from Gros Cap, the woven piece with eight small rolled beads from Rock Island, and the string of beads very from Hanson were examined in the study sample, this is not a conclusive statement. Conversely, small rolled beads (n= 31) persist at the both portions of the Doty Island site on Lake Winnebago, from the same contexts as glass beads falling into the post-1700 chemical subgroup. The twelve rolled beads from a single unit at the Bell site also do not fit a generalization that rolled beads are restricted to the seventeenth century. Rolled metal beads are not a temporally diagnostic category by themselves, but in context with other materials, they seem most abundant on late seventeenth century sites.

During the 1700s, Fort St. Joseph, Fort Michilimackinac, and the Marina site on Madeline Island became historically-documented hubs of fur trading activity and colonial influence. Their strategic positions along waterways and trade routes would have allowed for easier access to copper-base metal trade items such as intact kettles. With greater access to materials and the expansion of the fur trade in the eighteenth century, more copper-based metal objects would have been available in these areas. I suggest that the greater proportions of scrap and unfinished objects at these sites result from a decreased need to recycle every small scrap of metal. Kettle lugs are also found more frequently at sites where Native American habitation extended to the eighteenth century, such as Bell and Doty Island century, demonstrating trade in intact kettles rather than fragments. Lugs styles may be temporally diagnostic, but there were not enough lugs in my sample to contribute a new seriation of kettle lug styles and types.

6.4 Summary of copper-base metals analysis findings

Regional scale attribute and archaeometric analysis of reworked metal objects of adornment, such as rolled beads and tinkling cones, along with production waste, scrap, kettle parts, and other artifacts, has produced new information regarding the socially-structured trade networks and technological practices of various ethnic groups of the historic-era Upper Great Lakes region. The findings were discussed in relation to the research questions in section 6.3. However, equifinality in the interpretations of outcomes is a greater consideration in the metals chapter than in the glass chapter because metal attribute analyses provide more subjective and qualitative data and patterns are less robust than those observed in glass compositional subgroups. Sample size and bias from different excavation procedures across the region also make metal assemblages as a whole less comparable than comparisons of the compositions of individual glass trade beads. Despite issues of equifinality and sampling, the metals analysis allowed me to address different aspects of the research questions, especially those related hybridized ethnic identity and resource availability at the regional level.

I documented variations in patterns of copper-base metal reworking and preferences of finished forms across the region, with smaller-size finished forms, blanks, and scrap documented in the Illinois country and larger size artifacts, especially tinkling cones, more prominent throughout the Upper Great Lakes. Furthermore, variation in working methods applied to metals, proportions of finished and unfinished forms, and the style of artifacts within typological categories also vary even among geographically close, contemporary sites, illustrating differential treatment of copper-base metal items when they arrived in the region. Therefore, I am able to reject the null hypothesis proposed in Chapter 1: *Among Native archaeological assemblages of comparable temporal range, activity patterns, and access to materials, there will be minimal or no variation in the technological style of utilization and reworking of European trade goods, regardless of occupants' social or ethnic affiliations.* Rejecting the null hypothesis demonstrates that social and cultural or ethnic affiliations of communities influenced the trade items available, technological working methods applied, and desired finished object forms.

Archaeometric pilot studies contribute to understanding of appropriate methodological approaches to the study of copper-based metal assemblages from late prehistoric, protohistoric, and later historic-era contexts. Compositional analysis using the non-destructive pXRF method was demonstrated to be a suitable means of differentiating native and smelted copper objects, and this information can be used to identify previously unrecognized copper trade items in assemblages or assess the persistence of native-copper objects in later periods.

The attribute and archaeometric analyses of copper-based metal objects from throughout the Upper Great Lakes region have provided qualitative insight into the technological practices of the diverse peoples interacting in this region in the seventeenth and eighteenth centuries. The copper-base metal data set provides evidence of the regional differences in the development of a hybrid material culture category, in the form of tinkling cones, rolled beads, and metal projectile points, and therefore complements the glass bead analyses conducted. The metal attribute analysis fulfills the expectation that historically-documented ethnic groups produced personal adornments using diverse technological strategies with regionally-specific preferences for the methods of producing different finished types. Resource availability, shaped by socially-controlled trade networks, also probably influenced the outcomes reflected in technological style of ornaments. In the final chapter (Chapter 7), I synthesize results of glass and metal beads analysis to illustrate economic, social, and cultural patterning in the data sets, and I highlight areas of productive future research in these material categories.

Chapter 7. Summary of Results and their Significance

7.1 Introduction

This chapter summarizes the regional and chronological findings of the research project, demonstrating how expectations for each of the research questions have been fulfilled. I show how applying the post-colonial concept of material hybridity to my assessment of technological style through the analytical framework of *chaîne operatoire* provided new information about patterns of variation in adornment exchange and production style. This theoretical framework allowed me to explore the role of ethnic and cultural affiliation in structuring trade and technological practice in the colonial-era Upper Great Lakes region, with its relatively balanced power structures and a diverse social landscape of local Native groups, displaced newcomers and migrants, and European explorers, traders and missionaries (White 1991; Wigten 2012). My work made significant methodological contributions in the application of LA-ICP-MS and pXRF to artifacts from protohistoric and colonial archaeological contexts at a regional scale and highlights the value of investigating curated archaeological collections for addressing new research questions. I outline productive avenues of future lab-based and field research identified during the project and conclude with an overview of the main intellectual contributions of this dissertation, focusing on how this research has produced archaeological evidence of intercultural exchange at the regional level in a colonial situation unlike any other in North America.

7.2 Research Questions and Hypotheses

In the Introductory Chapter, I presented my primary hypothesis, a null hypothesis, and three research questions. Here, I reiterate the research questions and related expectations, and I discuss to what extent each of the expectations were fulfilled, summarizing the overarching regional findings of my project as they relate to each research question. I then explain how the null hypothesis was falsified and present support for the primary hypothesis.

7.2.1 Research Question 1: In the region of study, is there archaeological evidence for common historically-documented outcomes of colonial interaction, such as multi-ethnicity, hybridity, and ethnogenesis?

Expectation: I expected that patterns of technological style or reworking methods related to adornment production would include diverse or innovative styles at multi-ethnic or hybridized sites and greater standardization at sites associated with only one archaeologically-visible cultural group. The development of new adornment styles would provide evidence for processes of ethnogenesis or cultural innovation.

The study of the distinctive historic-era material culture of adornments found in this region shows how different Native communities manipulated the versatile material properties of glass and metal, and combined materials to reinforce multifaceted and sometimes shifting social and economic relationships and identities. Personal adornments such as reworked glass pendants and copper-base metal tinkling cones or beads were used to signify various broadly defined aspects of identity, including ethnic affiliation and social status, which do not simply correlate with any single material category or technological attribute. Furthermore, the high diversity of stylistic traits observed in metal reworking may indicate that metal objects themselves did not function as ethnic or cultural indicators; rather, in when worn or used combination with other adornments in their original contexts, metal beads, tinkling cones, and other objects might have been more socially significant. Without more examples of intact use-contexts for beads and adornments, examination of ethnic identity with these lines of evidence is limited.

Patterns of variation in the two “hybrid” forms of material culture considered in my project, reworked copper-base metal and refired glass pendants, provided evidence corroborating the existence of previously identified multi-ethnic communities and the practice of material hybridity in the colonial-era Upper Great Lakes. At Fort St. Joseph and Fort Michilimackinac, the French colonial fortifications examined in this study, metal reworking patterns differed from sites identified as Native habitation sites, with proportionally more scrap and unfinished objects and less finished adornment forms in each assemblage. In this case, differences among Indigenous communities were not as pronounced as the differences between the sites with a sustained French military presence and those without.

At Fort Michilimackinac, an array of refired glass pendants compositionally similar to glass beads from that site calls into question the "Native made" (Brown 1972) origin of the pendants. When recovered from clearly Indigenous habitation contexts, such an Odawa-affiliated structure on Rock Island, glass pendants embody the hybrid qualities so common in other colonial situations (e.g. Bayman 2009; Card 2013b; Deagan 2013), but the compositional similarity of glass beads and reworked glass pendants at Michilimackinac is more difficult to interpret. Pendants from that site come from both French and British-associated stratigraphic contexts, as well as from near the Métis-affiliated house of Southeast Rowhouse House D (Evans 2001). No glass pendant production waste was identified in the limited subsample of copper-based metal objects from that site. However, because of the compositional similarity between beads and pendants, it is possible that the refired glass pendants were made in the fort itself, perhaps by Metis individuals or by the French and British occupants. These pendants may not be "hybrid" material culture at all, but rather could have been objects produced by Europeans for trade, as souvenirs, or for personal use. Conversely, at Fort Michilimackinac, wearing or making glass pendants may have been a way to signal participation in the culture of accommodation and shared enterprise of the middle ground (White 1991) and could have been practiced by inhabitants regardless of their ethnic affiliation.

Tinkling cones, metal beads, metal pendants, and even copper and brass projectile points are also examples of hybrid material culture, and patterns of variation in their forms and production processes identified in Chapter 6 demonstrate localized differences in the use and production of these items. The emphasis on small rolled beads and smaller adornment types among the Illinois groups, varying patterns of tinkling cone closure, and regional differences in metal projectile point usage and shape demonstrate that methods of reworking metal trade goods were not homogenous across the Upper Great Lakes landscape, and technological style varied with geographic area and cultural affiliation attributed to archaeological sites. Unique metal forms, like the cross-shaped pendant, red pigment container, and serrated points recovered from Rock Island provide glimpses into a the particular adaptations of community using readily available copper-based metal trade items.

The assortment of metal adornment styles at Marquette Mission and the Rock Island site, including tinkling cones, “copper mail,” coils and spirals, pendants, and other miscellaneous types support interpretations of documentary evidence that mark these places as diverse and bustling trading locations (Mason 1986; Branstner 1992). This finding is consistent with the highly diverse ceramic assemblage of the Rock Island site, further supporting the presence of a multi-ethnic community there. Patterns of variation in unmodified glass beads do not necessarily mark the same kind of diversity; for example, at the Bell site, beads were present from several of the different chemical subgroups identified in this project, but such differences seem to relate to the temporal periods of site occupation rather than to a diversity of trading partnerships.

Of the outcomes of colonial interaction expected in Research Question 1, ethnogenesis was the least apparent in the patterns of variation identified in this study. I expected that the development of new ways of producing or reworking adornments from trade items could represent ethnogenesis because outwardly signifying a newly-formed identity is an important aspect of the formation of new ethnic groups (Emberling 1997:308-309; Voss 2009:423). The adoption and modification of trade items in each locale in my study sample might reflect ethnic identities shaped by colonial interaction, but evidence supporting the specific developments of "new" ethnicities or communities can be obscured by technological innovation or material hybridity unrelated to ethnogenesis. Glass refiring or metalworking styles by themselves may not have distinguished some communities from others, and if ethnogenesis occurred, technological practices may have remained consistent in newly formed groups. A more robust site-level data set where historically-documented households could be compared (e.g. Mann 2008) would be necessary to understand how metal and glass objects might reflect ethnogenesis.

The differences in metal reworking style between other Upper Great Lakes assemblages and those from Zimmerman and Iliniwek Village (Ehrhardt 2005; 2013) in Illinois and northeastern Missouri provide the possible evidence for ethnogenesis in my study because the pattern of metalworking difference may be related to the historically hypothesized formation of Illinois communities who may have migrated into the territory south of Wisconsin from the Ohio Valley sometime during the sixteenth and early seventeenth centuries (Shackelford 2007:199-201). To test this hypothesis, and rule out migration as a cause of difference, it would be necessary to compare the reworked metal artifacts and the compositions of glass beads from Illinois-affiliated sites to those of their possible protohistoric forbearers in the Madisonville Fort Ancient communities of the Ohio River (Drooker 1996, 1997; Shackelford 2007:199), to identify similarities or differences in metal reworking style and determine if they shared access to glass beads through the same networks.

7.2.2 Research Question 2: Do spatial and temporal patterns of variation in the chemical composition of glass beads and the reworking styles of metal objects correlate with present understandings of the locations of ethnic groups on the regional landscape?

Expectation: Patterns of variation would fit with archaeologically and historically documented locations of ethnic groups; if variation did not match the existing understanding, new hypotheses would be developed using the framework of cultural hybridity, multi-ethnicity, and ethnogenesis.

The expectation that patterns of variation in reworking style of metal artifacts and the distribution of identified glass bead subgroups would correspond with archaeologically and historically-documented locations of ethnic groups in the Upper Great Lakes region was met. Unsurprisingly, glass beads recovered at the same site and from the same archaeological feature tended to be similar to one another and sorted into the same chemical subgroups. When glass beads came exclusively from surface collections, as at Peshtigo Point, Red Banks, and Chautauqua Grounds, there was more variability in the sampled glass compositions, and this may be a result of multiple groups of people visiting those locations over time and depositing beads from many different trade sources there. Slight variations in the closure styles of tinkling cone seams also have a regional distribution that might correspond to predominant historically-documented ethnicities, with Meskwaki communities slightly preferring overlapping seams and the Rock Island and Marquette Mission sites producing more abutting-seam objects.

The Meskwaki presence in the Upper Great Lakes is marked by differences in metal reworking practices and glass bead availability. Based on the outcomes of the glass compositional analyses, sites affiliated with the Meskwaki did not have access to all of the same kinds of beads as other contemporary sites in the region. In the metal attribute analyses, I found that tinkling cones from Meskwaki sites are more likely to have an overlapping closure rather than an abutting seam, patching is a metalworking practice frequently applied at Meskwaki sites, and rolled metal beads are large and irregular as compared to those from other sites in the region. I interpret the differing material practices of the Meskwaki compared to other peoples in the Upper Great Lakes in the latter part of the seventeenth century as evidence of their status as relative newcomers to Wisconsin, which has been recorded in both oral tradition and historic-era texts (Behm 2008; Buffalo 2008; Gearing 2009).

Some material practices seem to be shared among sites affiliated with certain ethnic groups but not others. Tinkling cones with parallel, scored lines across the blanks have been found at Rock Island, Peshtigo Point, and Marquette Mission, all locales of interaction among diverse ethnic groups including the Potawatomi, Menominee, Ho-Chunk, and Huron, but no examples of decoratively scored tinkling cones come from Anishinaabe, Meskwaki or Illinois affiliated sites. Triangular projectile points were favored at St. Ignace, while stemmed types were preferred on Madeline Island; the Rock Island assemblage contains the greatest variety of metal projectile point types, supporting the documented presence of numerous ethnic groups and multi-ethnic community at this strategic trading location (Mason 1986). Copper-base metal projectile points are not present in the Meskwaki or Illinois assemblages examined. The use of "copper mail" made of rolled metal beads likewise was fashionable in the communities of St. Ignace and in Illinois country at the end of the seventeenth century, but evidence for the use of "mail" is minimal at contemporary occupations in the Green Bay and Door Peninsula area, and at Meskwaki sites. Based on all of these findings, intercultural interaction between the Meskwaki and other groups present in the Upper Great Lakes, and between the Illinois and other Great Lakes peoples, appears more limited in scope than the trading relationships or connections among other peoples of the Upper Great Lakes region, particularly those groups situated along the busy corridors of transit along the shores of the Door Peninsula and the St. Ignace area.

In the glass bead data set, there was differential access to beads that included high levels of zinc in the glass recipe, coming from perhaps a particular European trading source only available to some cultural or ethnic groups but not others in the Upper Great Lakes region. High zinc levels were not present in the beads sampled from Meskwaki sites or from Rock Island, but they were identified from sites in the Green Bay area, at the St. Ignace sites, on Madeline Island, and in Illinois country. Based on this finding, ethnicity may have structured who had access to traders providing high zinc beads: Huron, Ho-Chunk, Menominee, Anishinaabe, and Illinois groups may have accessed trade networks that the Potawatomi and Meskwaki did not. This result could be influenced by both timing of the arrival of beads of this type as well as ethnicity; perhaps the Potawatomi and Meskwaki, as relative latecomers to the region, did not have access to high zinc beads because they were no longer widely circulated by the time they arrived.

7.2.3 Research Question 3: In the Upper Great Lakes, when and where did non-local trade items arrive, and how did socio-economic factors influence their distribution?

Expectation: Patterns of variation in the chemical composition of glass beads would correspond to occupation dates of sites and known trade networks; contemporary communities thought to participate in the same trade networks would have similar access to both metal and glass trade items and communities would modify objects with shared technological practices.

This expectation was fulfilled: Patterns of variation in glass recipes did correspond to the known occupation dates of sites, and the chemical markers of a c. AD 1700 glass recipe shift were described in detail in Chapter Five. The chemical subgroups identified within the glass bead data set offer a new way of delineating the occupation period of historic-era glass bead-bearing archaeological sites with less secure occupation dates from the mid seventeenth to early eighteenth centuries. Temporally-contemporary communities thought to participate in the same trade networks (either because of their locations along a particular water route, or because of shared cultural affiliation) did generally share glass bead subgroups and technological practices of reworking metal objects. Furthermore, my project identified differences in metal reworking style and patterns of variation in glass bead recipes that may illustrate how the socio-economic factor of resource availability can affect the distribution of trade items on the landscape, which in turn may have influenced how people chose to manipulate copper-based metal objects. For example, glass beads sorted into pre-1700 chemical subgroups were recovered at the Marquette Mission site as well as from the early components of the Rock Island site, and high zinc beads have a limited distribution across the landscape. The diversity of chemical subgroups within the "early blue" or IIa40 glass bead type likewise illustrate variation in access to different materials. The presence of only pre-1700 glass recipe subgroups at the c. AD 1730 Arrowsmith battleground site could be an outcome of the historically-documented conflicts on Meskwaki resource availability, leaving them with only curated beads as they migrated south. While it is not possible to identify particular European sources such as French, Dutch, or other suppliers of glass beads or metal trade items, that glass recipe patterning provides evidence that contemporary sites located along the same trade networks obtained compositionally similar glass trade beads.

For metal artifacts, reworking style seems directly linked to resource availability as well. The extent of patching taking place at the Bell Site indicates that the supply of copper-based metal kettles or other items may have been restricted during Meskwaki conflicts with the French, and that kettles may have had more value as containers than as raw material for recycling as adornments, which was common practice at most other contemporary Upper Great Lakes sites. At the Zimmerman site, and as illustrated in Ehrhardt's work with the Iliniwek Village materials (2005; 2013), metalworkers in Illinois country used smaller blanks and produced smaller ornaments, particularly clips and beads, while tinkling cones were more popular elsewhere in the Upper Great Lakes, including Rock Island and Marquette Mission. The high proportions of scrap metal not recycled into finished forms at Fort Michilimackinac and Fort St. Joseph is interpreted as evidence of greater availability of copper-based metal at French colonial fortification sites.

7.2.4 Falsified Null Hypothesis and Support for the Primary Hypothesis

To address the sampling issues associated with using a regional data set to investigate the research questions, in Chapter One I presented both a primary hypothesis and a broader null hypothesis because it may be possible to falsify a null hypothesis without identifying enough evidence to support a related primary hypothesis (Connor and Simberloff 1986). My null hypothesis was: *Among Native archaeological assemblages of comparable temporal range and activity patterns there will be <u>minimal or no variation in the technological style of utilization and reworking of European trade goods,</u> regardless of the social or ethnic affiliation of the assemblage.* The null hypothesis was falsified: patterns of reworking in copper-based metal assemblages did vary among contemporary habitation sites even in the same geographic areas, such as Lake Winnebago or the Straits of Mackinac. While differential access to trade items among these areas cannot be ruled out, since the historical record demonstrates that trade was socially-structured (White 1991; Witgen 2012), ethnic affiliation may have contributed to the variation in technological style of utilization and reworking of European trade goods. By demonstrating that different chemical compositional subgroups in glass bead recipes correspond to the known occupation dates for sites in the region, I refined interpretations of the timing of the arrival of trade goods at less well-dated sites in the region. I also suggested that some chemical subgroups might be related to both time and trade sources, since these subgroups were present at some geographically close, temporally contemporary sites with different cultural affiliations.

I also identified evidence supporting the primary hypothesis of this research: *Different Native social groups practiced varying strategies of using and reworking European trade goods.* Reworked glass pendants appear on some but not all sites in the study sample, and pendant compositions are similar to glass bead chemical subgroups at only a few of those sites, indicating that some places, including the Straits of Mackinac and Rock Island were likely locales of production, and that some ethnic groups, especially the Meskwaki of the Lake Winnebago region, did not produce or trade for the glass pendants. No evidence for pendant making or use was identified in the glass assemblage or the 100% sample of copper-based metal from the primary Meskwaki village, the Bell Site, making the lack of pendants unlikely to be a result of sampling strategies employed in excavation. The Meskwaki pattern of frequently patching artifacts at the Bell Site and the technological style favoring small clips and beads in Illinois Country are also distinct from other Upper Great Lakes metalworking practices. Individual artifacts, such as the Iroquoian-style brass cuff bracelet from O'Neill, and the conspicuous compositional difference of the Hanson site glass beads provide evidence of material difference in obtaining and reworking European trade goods in archaeological contexts that may be associated with the migration of Native peoples from eastern North America. Therefore, the primary hypothesis of this dissertation was supported in both the metal and glass datasets.

7.3 Methodological Significance

Regional scale analyses in archaeological research have the potential to connect disparate site collections with shared cultural or historical events and processes while addressing the "curation crisis" (Bawaya 2007) in collections management by utilizing and revitalizing existing archaeological resources. This regional scale investigation of glass and metal objects from the Upper Great Lakes sites is a unique approach to synthesizing and re-evaluating decades of archaeological research on early historic intercultural interactions in this area. Using the minimally-invasive technique of LA-ICP-MS, I identified patterns of blue glass bead recipe variation that directly correspond with the chronology of site occupations, and other glass recipe patterns that may reflect economic or social differences in the trading relationships among contemporary communities. The application of LA-ICP-MS to 874 glass artifacts across the region constitutes one of the most comprehensive studies of its kind and provides a reference for other glass bead researchers working in this time period around the world. The regional scale copper-base metal attribute analysis of 3,705 artifacts likewise produced a broad overview of *chaine opératoire* for metal ornament production across the Upper Great Lakes, using a method comparable with research conducted in other regions of North America. The metal artifact attribute analysis also brought to light copper-base metal production waste from glass pendant-making processes never before documented in Wisconsin or Michigan. This indicates that metal reworking and the recycling of glass beads as pendants were not unrelated technological practices during the colonial era, which furthers the archaeological understanding of hybrid material culture and highlights the importance of expanding analyses of artifacts beyond single material types.

My project also led to the verification of pXRF as an appropriate archaeometric method for differentiating between native and smelted coppers from archaeological contexts, without need for surface treatment or corrosion removal (Dussubieux and Walder 2015). This technique offers a fast and cost-effective approach that could be applied to a large copper artifact assemblage in the field or in museum setting. Such a research program could help identify otherwise unrecognized protohistoric components of archaeological sites and document the persistence of native-copper artifacts and metalworking technology at later historic-era sites. In these ways, pXRF studies of copper assemblages can clarify the material evidence for technological continuity and change in contexts of early interactions between Native Americans and Europeans in North America, and in other colonial situations.

7.4 Theoretical Significance

This dissertation contributes to the study of cultures in contact and colonial encounters through a regional investigation of hybrid material types interpreted as reflections of ethnic and cultural identity. The technological style differences identified in copper-based metal-working practices revealed local situations of interaction and resource availability as well as cultural continuity and innovation. Likewise, this research has identified use and production of refired glass pendants at Native-occupied habitation sites and a French fortification, and I interpret the pendants as representative of intercultural interaction and accommodation in the colonial-era Upper Great Lakes. Glass bead analyses provide the temporal foundation for the study of socially-structured trade networks moving European-made items into the hands of many different historically-documented ethnic groups and archaeologically distinct cultures.

Hybridity is a documented outcome of colonial encounters (Bhabha 1994; Card 2013a; Liebmann 2008; Said 1979), and a decolonized approach that rejects binary distinctions between colonizer and colonized requires addressing the prospect of hybridity and multi-ethnicity in the archaeological record using appropriate data sets and scales of analysis. Through a regional focus on broad interactions among historically-documented ethnic groups, and a material emphasis on trade goods reworked into or used as personal adornments, I developed an innovative and comprehensive research program to investigate hybridity in the colonial-era Upper Great Lakes. The interconnectedness of population movements, resource availability, ethnicity, trade routes, and fictive kinship or other social relationships create equifinality in the archaeological record, making it difficult to separate these related factors that influenced the movement of trade items and their deposition in the archaeological record. However, this interconnectedness is also a strength; blue glass beads and copper-based metal adornments physically represent trading partnerships, reciprocal gift-giving, and ethnic affiliation through identity performance. This has allowed me to discuss ethnicity and hybridity in a colonial situation through material means, which is not always possible in assessing the archaeological record of interaction.

The analytical framework of *chaîne opératoire* allowed me to consider how social and economic factors might have influenced the reworking of copper-based metal kettles and glass beads into socially significant objects of adornment or other objects. My analyses of artifacts from all stages of the metal ornament production process show that the various Native ethnic groups and French colonial communities of the Upper Great Lakes used and modified copper-base metal trade items differently, varying in the kinds of objects produced, the amount of scrap and partially-worked material that it was acceptable to discard, the extent to which worn-out kettles were patched instead of repurposed, and the styles of producing the same kinds of finished objects. Theorizing technological style as inherently connected to ethnic identity (following Lechtman 1977; 2014; Ehrhardt 2005; 2013) enabled the examination of the social significance of metal reworking practices alongside temporal and geographic constraints on resource availability.

7.5 Future Research

Through the investigation of existing archaeological site collections, I identified several productive directions of future research that include additional analyses of artifacts and collections already accessed during the project as well as materials from surrounding regions. The completely non-destructive pXRF method of differentiating between smelted and native coppers (Dussubieux and Walder 2015) could be applied to each of the copper-based metal assemblages in my study sample, prioritizing "protohistoric" sites or and late-prehistoric Oneota assemblages (those with Valley View, Allamakee Trailed, or Lake Winnebago Trailed ceramics) that also include copper objects. Smelted European copper may be present in assemblages of artifacts containing otherwise Native-made artifacts; this could help identify more protohistoric sites in the Upper Great Lakes region. A pXRF study of later seventeenth and eighteenth century metal assemblages could likewise identify the persistence of the use of native copper objects during the colonial period; care should be taken to exclude contexts where earlier components that might have included native copper objects could be mixed in to later-historic levels and features, such as at McCauley and Bell Site.

Scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS) should be applied to the copper-based metal artifacts with probable blue glass adhering to the surface recovered from the Rock Island site and ambiguous blue residue on copper artifacts from the Marquette Mission site. This would easily confirm if the blue material is in fact glass, or if it is an unusual form of copper corrosion products. If confirmed as glass, then the glass recipe could be further analyzed to link the residue to glass beads found at the same archaeological site as the production waste. Metal pendants and refired glass fragments that seem to have metal adhering to them, recovered at the Gros Cap and Zimmerman archaeological sites, could also be analyzed to confirm that the adhering material is in fact metal or copper-based corrosion products. Analyses of the glass pendants themselves with SEM-EDS could better illustrate the structure of the glass and help clarify the temperature to which they were heated by revealing whether or to what extent glass grains are fused to one another. An in-depth SEM-EDS analysis of glass pendants and production waste could provide information on *chaîne opératoire* for glass pendants, which would be necessary to conduct an accurate experimental replication of the entire glass pendant production process, from powdering glass beads, reshaping and refiring, to the removal of the pendant from the firing pan after cooling.

The LA-ICP-MS data for glass beads and pendants should be integrated with existing databases of historic-era glass beads. The NAA data collected at the SLOWPOKE reactor during the 1980s and 1990s has been compiled by Ronald Hancock and his colleagues, and future research could integrate these existing data sets, as well as the work of other scholars around North America using archaeometric methods to analyze glass beads (e.g., Blair 2015). In turn, the continental database could then be compared with the few existing analyses of glass from seventeenth century glass workshops in Europe (Dussubieux 2009; Karklins et al. 2002; Sempowski et al. 2001; Van der Linden et al. 2005) to trace beads back to their origins.

Only a few glass workshops or production sites of the appropriate age have been excavated or investigated, in Amsterdam, Paris, London, and Venice (Dussubieux 2009; Janssens et al. 2013; Tyler and Willmott 2005; Van der Linden et al. 2005), and it is necessary to gather further comparative samples using non-destructive analysis methods. A future project could analyze glass samples from seventeenth century archaeological sites in Europe. Because

British-colonial influences (and associated material culture such as trade silver) did not reach Midwestern North America in great quantities until the c. 1750s, I expect that most of the beads in my dissertation study sample were produced in France, Venice, and Amsterdam. Dussubieux wrote, "The rare attempts to trace North American glass beads back to Europe have been largely unsuccessful, however, because of a lack of comparative data for contemporaneous European material" (2009:95). Future research could identify and collect the comparative data necessary to better understand the production of glass beads for trade to North America, even if this does not result in specific links between beads analyzed in my dissertation research and beads excavated in Europe. There have been no studies of batch-variability within workshops, and this could also provide an opportunity to assess variation among beads known to have been produced in the same place, testing my assumptions of relative homogeneity within workshops.

This dissertation has demonstrated that visual typologies or classification systems for glass beads based on subjective identification of physical attributes (e.g., Kidd and Kidd 1970; Stone 1974) can lead to differences among observers and confusion among types. Therefore, I suggest that promoting a simpler and broader glass bead typology might alleviate some of the classificatory issues: beads could be grouped into basic, standard color varieties such as red, black, blue, or white. Use of a generalized color scheme has already been published (Panich 2014: Table 3) as a way to classify a glass bead assemblage that did not fit well with the existing typologies. In the Kidd and Kidd trinomial system (1970; see Chapter 4), using a general color classification system would eliminate the third element, classifying by production method and shape, while in the Stone system for seed and necklace beads (1974), eliminating particular colors would leave off the fourth element (variety), sorting by class of manufacturing method, construction (simple or compound) and type (shape). This process would work well for "simple" beads or seed beads, and still allow the specific classification of the more complex multicolored wound bead types. Since the original seventeenth century consumers of glass trade beads likely did not employ a "color dictionary" or Munsell color notation system when selecting beads, it makes sense from an archaeological standpoint to employ typologies that treat bead colors as their users likely did: by assigning beads to broad color categories in a way that might actually reflect the color preferences of the wearers or users of beads.

Additional LA-ICP-MS analyses of black, white, and red drawn beads recovered on North American archaeological sites could further refine chemical chronologies and build on the work already conducted on this topic (Hancock et al. 1997; Hancock et al. 1999; Moreau et al. 2002; Moreau et al. 2004; Sempowski et al. 2000). While a larger sample of white beads from sites in the Upper Great Lakes region was beyond the scope of this study, results clearly indicate that this would be a productive line of future research for the dating of archaeological sites of this period, especially when combined with the chemical chronology developed for blue beads.

Finally, new geophysical surveys and archaeological excavations could be undertaken at several of sites in the Upper Great Lakes region, focusing on locations where existing possible protohistoric deposits been positively identified, such as at the Chickadee site near New London, Wisconsin, or the Cadotte Site on Madeline Island. Other sites with potential to yield protohistoric materials but that have not been excavated in a controlled manner are 47 WN 853, the Lake Winneconne Park site, where a tree-tip revealed smelted-copper rolled beads possibly associated with Lake Winnebago Trailed ceramics, and the Horn's Pier and Clay Banks sites, on the eastern shores of the Door Peninsula. Excavations should also be undertaken just north of the town of Jacksonport at the mouth of Hibbard's Creek, also in Door County on the eastern side of the peninsula, where continuing development threatens potential historic deposits (Mason

2015:127). Although the Red Banks site is now either completely obliterated or buried under layers of gravel fill (see Speth 2000; Richards 2003), the Green Bay and Brown county area also still hold potential for protohistoric sites, especially at the Astor site (Overstreet 1993; Sasso, personal communication 2013) and underwater at Peshtigo Point (Overstreet 2014). Any future excavation project at the sites listed must assess existing archaeological collections and previous investigations at these sites, which have the potential to provide new information about protohistoric interaction in the Upper Great Lakes region.

7.6 Summary of Intellectual Contributions

This dissertation has addressed questions regarding the timing of introduction, exchange, and social implications of glass trade beads and reworked copper-base metal artifacts recovered from archaeological sites of the Upper Great Lakes dated to c. 1630 to 1730. My material-culture focused study is the most comprehensive archaeological investigation of intercultural contact and colonial interactions ever undertaken in this region.

All of my dissertation research findings were gleaned from existing archaeological collections in museums, universities, and other curation facilities, using relatively new analysis methods and framed with current paradigms in historical archaeology. Conducting new laboratory-based analyses on previously-excavated artifacts has enhanced the value of existing collections and highlights the importance of long-term curation strategies for artifacts as well as associated excavation records, maps, and other primary documentation of provenience information and recovery methods. Dissimilar site formation processes and excavation and recovery methods do not fully account for patterns of regional variation that have emerged in the data sets of glass trade bead chemistries and technological style of copper-based metal artifact working. Therefore, these variations are interpreted as representative of past human behaviors, including population movement, trade and exchange, and technological practices under various circumstances of contact among local and non-local Native groups and Europeans, during the first century of European presence in the Upper Great Lakes. My study exemplifies how to work within a current theoretical framework to develop new research questions that can be addressed by using existing cultural resources and building upon decades of cultural-resource management and academic archaeological investigations in a region.

The methodological, theoretical and interpretive contributions of my dissertation result from my combination of distinct lines of evidence, glass trade beads and copper-based metal objects made from European-made trade kettles. While prior studies of interaction and colonial encounters in the Great Lakes region address similar questions of ethnicity or chronology through more localized data sets, diagnostic ceramic types, or from the perspective of a particular ethnic or cultural group, my work has demonstrated the value of a broader, regional approach involving multiple lines of material evidence. This wide-ranging scale necessarily obscures the fine details of intra-site spatial patterning and glosses over some intricacies of interpreting the historical record of past peoples; however, my regional, multi-method approach has identified connections and patterns of human interaction not recognized in past site-level studies.

Through multiple scales of analysis, intra-site-level interactions, comparisons of material culture though regional archaeometric investigations, and careful consideration of the documentary record (Lurie and Jung 2009; Mason 2014; 2015), archaeologists and historians are continuing to investigate the complexity and contingency of intercultural interaction and colonial encounters in the Upper Great Lakes. Theorizing the hybridized nature of multi-ethnic communities has already begun for French colonial sites in Michigan (Carlson 2012; Nassaney 2008; 2012) and in Illinois country (Ehrhardt 2013), and my work applies a similar theoretical perspective to the wide expanse of territory between, the *pays d'en haut*. Gifts of "a thousand beads to each nation" recorded in the *Jesuit Relations* can now be traced as they move across the region through socially-structured trading relationships strengthened by ties of shared ancestry and fictive kinships. Future emphasis on existing but under-studied material culture types and archaeological appreciation for the historically-documented balanced power structures of colonial era of the Upper Great Lakes have the potential to energize a new program of colonial studies in the Midwestern region of North America.

Bibliography

Abel, Timothy J. and Adrian Burke
2014 The Protohistoric Time Period in Northwest Ohio: Perspectives from the XRF Analysis of Metallic Trade Materials. *Midcontinental Journal of Archaeology* 39(1):1-21.

Alex, Lynn M. (editor)
2008 From the Great Lakes to the Great Plains: Meskwaki Ethnohistory and Archaeology. *The Wisconsin Archeologist* 89 (1 & 2).

Alexander, Rani
1998 Afterword: Toward an Archaeological Theory of Culture Contact. In *Studies in Culture Contact: Interaction, Culture Change, and Archaeology*, edited by J. G. Cusick, pp. 476-495. Occasional Paper No. 25. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Allouez, Claude Jean
1917a Father Allouez's Journey into Wisconsin, 1669-70. In *Early Narratives of the Northwest, 1634-1699.*, edited by L. P. Kellogg, pp. 141-160. Charles Scribner's Sons, New York, New York.
1917b Father Allouez's Journey to Lake Superior, 1665-1667. In *Early Narratives of the Northwest, 1634-1699. Original Narratives of Early American History*, edited by L. P. Kellogg, pp. 93-137. Charles Scribner's Sons, New York, New York.

Anderson, Dean L.
1991 Variability in Trade at Eighteenth-Century French Outposts. In *French Colonial Archaeology: the Illinois Country and the Western Great Lakes*, pp. 218-236. University of Illinois Press, Urbana.
1992 *Documentary and Archaeological Perspectives on European Trade Goods in the Western Great Lakes Region.* Ph.D. dissertation, Department of Anthropology, Michigan State University, East Lansing.
1994 The Flow of European Trade Goods into the Western Great Lakes Region 1715-1760. In *The Fur Trade Revisited - Selected papers of the Sixth North American Fur Trade Conference, Mackinac Island, Michigan 1991*, pp. 93-115. Michigan State University, East Lansing.

Angel, Michael
2002 *Preserving the Sacred: Historical Perspectives on the Ojibwa Midewiwin*. University of Manitoba Press, Winnipeg.

Anselmi, Lisa Marie
2004 *New materials, old ideas: Native use of European-introduced metals in the Northeast.* Ph.D. dissertation, Department of Anthropology, University of Toronto, Toronto.
2008 *Native Peoples Use of Copper-based Metals in Northeastern North America: Contact Period Interactions.* VDM Verlag Dr. Müller, Saarbrücken, Germany.

Appadurai, Arjun
1986 Introduction: Commodities and the Politics of Value. In *The Social Life of Things: Commodities in Cultural Perspective*, edited by A. Appadurai, pp. 3-63. Cambridge University Press, Cambridge.

Armour, David A.
1977 Beads in the Upper Great Lakes: A Study of Acculturation. In *Beads: Their Use by Upper Great Lakes Indians*, pp. 9-26. Grand Rapids Public Museum, Grand Rapids.

Bahrani, Zainab
2006 Race and Ethnicity in Mesopotamian Antiquity. *World Archaeology* 38(1):48-59.

Balash, A.M.
2008 *How Maps Tell the Truth by Lying: An Analysis of Delisle's 1718 Carte de la Louisiane*. Master's thesis, Department of History, The University of Texas at Arlington.

Baram, Uzi and Daniel Hughes (editors)
2012 Cosmopolitanism and Ethnogenesis, Colonialism and Resistance: Themes in the *Historical Archaeology* of Florida. Society for *Historical Archaeology*. *Historical Archaeology* 46(1).

Barth, F.
1969 Introduction. In *Ethnic Groups and Boundaries: The Social Organization of Culture Difference*, edited by F. Barth, pp. 9-38. Little, Brown, & Co. , Boston.

Bawaya, Michael
2007 Curation in Crisis. *Science* 317(5841):1025-1026.

Bawden, Garth
2005 A Case Study of Ethnogenesis in Ancient Peru. In *Ethnicity and Identity in the Archaeological Record,* edited by R. M. Reycraft, pp. 12-33. UCLA: Cotsen Institute of Archaeology Monograph N. 53, Los Angeles.

Baxter, M. J.
1999 Detecting Multivariate Outliers in Artefact Compositional Data. *Archaeometry* 41(2):321-338.

2008 Mathematics, Statistics, and Archaeometry: The Past 50 Years or So. *Archaeometry* 50(6):968-982.

Baxter, M. J., H. E. M. Cool and C. M. Jackson

2006 Comparing Glass Compositional Analyses. *Archaeometry* 48(3):399-414.

Bayman, James M.

2009 Technological Change and the Archaeology of Emergent Colonialism in the Kingdom of Hawai‘i. *International Journal of Historical Archaeology* 13(2):127-157.

2010 The Precarious “Middle Ground”: Exchange and the Reconfiguration of Social Identity in the Hawaiian Kingdom. In *Trade and Exchange*, edited by C. D. Dillian and C. L. White, pp. 129-148. Springer New York.

Beaudoin, Matthew A.

2013 A Hybrid Identity in a Pluralistic Nineteenth-Century Colonial Context. *Historical Archaeology* 47(2):46-64.

Behm, Jeffery A.

1993a Archaeological Investigations at the Bell Site, The Grand Village of the Mesquakie. *The Magazine of the Midwest Open-Air Museums Coordinating Council* 14(3-4):26-35.

1993b *The 1992 and 1993 Archaeological Survey and Evaluation of the Bellhaven Estates Property, Section 7, Town of Algoma, Winnebago County, Wisconsin: Further Excavations at the Bell (47-Wn-9) and Findeisen (47-Wn-394) Sites.* Report of Investigations #4. Archaeology Laboratory, University of Wisconsin-Oshkosh.

1998 The Bell Site: Community Plan of the Grand Village of the Meskwaki. *The Wisconsin Archeologist* 79(1):131-174.

1999 Newspaper Accounts Describing the Discovery of Five Meskwaki Burials at the Bell Site (47-Wn-9) in July 1911. *Fox Valley Archeology* 28:47-61.

2003 Historic Native American Ceramics from the Bell site. Paper presented at the 49th Annual Midwest Archaeological Conference, Milwaukee, Wisconsin.

2008 The Meskwaki in Eastern Wisconsin: Ethnohistory and Archaeology. *The Wisconsin Archeologist* 89(1 & 2):7-85.

Bellin, Jacques Nicolas and Antoine François Prévost

1774 *Atlas de l'histoire des voyages [1738-1774 : maps taken from La Harpe's and Bellin's Abrégé de l'histoire générale des voyages]*. New York Historical Society Archives. Electronic document, http://www.historicalatlas.ca/website/hacolp/national_perspectives/exploration/UNIT_06/images/Bellin_Original_High.jpg, accessed January 24, 2014.

Bellina, Berenice
2003 Beads, Social Change and Interaction between India and South-east Asia. *Antiquity* 77(296):285.

Bennett, Mary, Johnathan Lantz Buffalo, Dawn Suzanne Wanatee and State Historical Society of Iowa
2004 *Meskwaki History*. CD-ROM. State Historical Society of Iowa, Iowa City, Iowa.

Betts, Colin M.
1998 The Oneota Orr Phase: Space, Time and Ethnicity. *The Wisconsin Archeologist* 79(2):227-237.
2006 Pots and Pox: The Identification of Protohistoric Epidemics in the Upper Mississippi Valley. *American Antiquity* 71(2):233-259.

Bhabha, H.K.
1994 *The Location of Culture*. Routledge, New York.

Billeck, Bill
2010 Seventeenth Century Glass Beads from the New Lenox Site in Will County, Illinois. Paper presented at the Society for American Archaeology National Meetings, St. Louis.

Billeck, Bill and L. Dussubieux
2006 Chemical and Chronological Variation of 17th, 18th, and early 19th Century Blue Glass Beads from the Plains. Poster presented at the Plains Anthropological Conference, Topeka, Kansas.

Binford, Lewis R. and George I. Quimby
1963 *Indian Sites and Chipped Stone Materials in the Northern Lake Michigan Area*. Chicago Natural History Museum, Chicago, Illinois.

Bird, M. Catherine
2003 Temporal, Spatial, and Social Trends: Late Prehistoric and Protohistoric Group Interaction. In *Theory, Method, and Practice in Modern Archaeology*, edited by R. J. Jeske and D. K. Charles, pp. 212-222. Praeger, Westport, Connecticut.

Birmingham, Robert A.
1992 Historic Indian Period Archeology at La Pointe in Lake Superior: An Overview. *The Wisconsin Archeologist* 73 (3 & 4):177-198.
2005 National Register of Historic Places Registration Form: Cadotte Site. Report On File at the Madeline Island Museum, La Pointe, Wisconsin.
2009 The Location and Description of a French Fur Trade Fort on Madeline Island in Lake Superior. *The Wisconsin Archeologist* 90(1 & 2):225-234.

2014 Seventeenth Century French Trade Goods from the Crabapple Point Site: A Possibility for a Historic Period Oneota Component on Lake Koshkonong. Paper presented at the Midwest Archaeology Conference, Champaign, Illinois.

Birmingham, Robert A., C. I. Mason and J. Stoltman (editors)
1997 *Wisconsin Archeology*. 78 Number 1/2. Wisconsin Archaeological Society, Milwaukee.

Birmingham, Robert A. and Robert J. Salzer
1984 The Marina Site Excavations. Unpublished Monograph Number 1 of the Wisconsin Archeological Society. Manuscript on File at the Wisconsin Historical Society.

Blair, Elliot H.
2013 Elemental Analysis of Glass Beads from Mission Santa Catalina de Guale. Paper presented at the 78th Annual Meeting of the Society for American Archaeology, Honolulu, HI.
2015 Glass Beads and Global Itineraries. In *Things in Motion: Object Histories, Biographies and Itineraries*, edited by R. Joyce and S. D. Gillespie. SAR Press. In Press

Blair, Elliot H., L. S. A. Pendleton and Peter Francis
2009 *The Beads of St. Catherine's Island* Anthropological Papers of the American Museum of Natural History, Volume 89. New York.

Blake, Leonard and Hugh C. Cutler
1963 Plant Materials from the Bell Site, Wn 9, Wisconsin. *The Wisconsin Archeologist* 44(1):70-71.

Bodoh, Brad
2004 Meskwaki Flintlocks: Cultural Accommodation and Adaptation During the Early Fur Trade in the Western Great Lakes. Manuscript on file, Archaeology Laboratory, University of Wisconsin-Oshkosh.

Bonneau, Adelphine, Jean-Francois Moreau, Ronald G. V. Hancock and Karlis Karklins
2014 Archaeometrical Analysis of Glass Beads: Potential, Limitations, and Results. *Beads Journal of the Society of Bead Researchers* 26:35-46.

Boszhardt, Robert
1998 Oneota Horizons: A La Crosse Perspective. *Wisconsin Archeologist* 79(2):196-226.

Bradley, James W.
1987 *Evolution of the Onondaga Iroquois: Accommodating Change, 1500-1655.* Syracuse University Press, Syracuse, New York.

2007 *Before Albany: An Archaeology of Native-Dutch Relations in the Capital Region, 1600-1664*. University of the State of New York, State Education Dept., Albany, New York.

2012 Glass Beads. In *St. Croix Island International Historic Site, Calais, Maine: History, Archaeology, and Interpretation*, edited by S. Pendery, pp. 157-169. Occasional Publications in Maine Archaeology. Maine State Museum, Maine Historic Preservation Commission, Augusta.

Bradley, James W. and S. Terry Childs

1991 Basque Earrings and Panther's Tails: The Form of Cross-Cultural Contact in Sixteenth-Century Iroquoia. In *Metals in Society: Theory Beyond Analysis*, edited by R. M. Ehrenreich, pp. 7-18. MASCA, The University Museum, University of Pennsylvania, Philadelphia.

Brandao, Jose Antonio and Michael Nassaney

2006 A Capsule Social and Material History of Fort St. Joseph and Its Inhabitants (1691-1763). *French Colonial History* 7(1):61-75.

Branstner, Christine N.

1995 *Archaeological Investigations at the Cloudman Site (20CH6): A multicomponent Native American Occupation on Drummond Island, Michigan 1992 and 1994 Excavations*. Consortium for Archaeological Research Michigan State University, East Lansing, Michigan.

Branstner, Susan M.

1984 *1983 Archaeological Investigations at the Marquette Mission Site*. The Michigan State University Museum.

1985 *1984 Archaeological Investigations at the Indian Village Associated with the Marquette Mission Site, St. Ignace, Michigan*. The Michigan State University Museum.

1986 *1985 Archaeological Investigations at the Indian Village Associated with the Marquette Mission Site, 20 MK 82 St. Ignace, Michigan*. The Michigan State University Museum.

1987 *1986 Archaeological Investigations at the Indian Village Associated with the Marquette Mission Site, 20 MK 82 / 20 MK 99 St. Ignace, Michigan*. The Michigan State University Museum.

1991 Decision-Making Processes in a Culture Contact Context: The Case of the Tionontate Huron of the Upper Great Lakes, Ph.D. Dissertation, Department of Anthropology, Michigan State University, East Lansing.

1992 Tionontate Huron Occupation at the Marquette Mission. In *Calumet and Fleur-de-Lys: Archaeology of Indian and French Contact in the Midcontinent*, edited by J. A. Walthall and T. E. Emerson, pp. 177-201. Smithsonian Institution Press, Washington DC.

Bray, P. J., A. M. Pollard and Martin Carver
2012 A New Interpretative Approach to the Chemistry of Copper-alloy Objects: Source, Recycling and Technology. *Antiquity* 86(333):853-867.

Bray, Robert T.
1978 European Trade Goods from the Utz Site and the Search for Fort Orleans. *The Missouri Archaeologist* 39:1-75.

Brill, Robert H.
1999 *Chemical Analyses of Early Glasses Vol. 2, Tables of Analyses / with a contrib. by Brandt A. Rising.* Corning Museum of Glass, Corning, N.Y.

Brose, D.
1970a Summer Island III: An Early Historic Site in the Upper Great Lakes. *Historical Archaeology* 4:3-33.
1970b *The Archaeology of Summer Island: Changing Settlement Systems in Northern Lake Michigan*. University of Michigan, Ann Arbor.
1983 Rethinking the French Presence in the Upper Great Lakes. In *Lulu Linear Punctated: Essays in Honor of George Irving Quimby*, edited by R. C. Dunnell and D. K. Grayson, pp. 209-252. Museum of Anthropology, University of Michigan, Ann Arbor, Michigan.

Brown, Charles E.
1904 The Native Copper Ornaments of Wisconsin. *The Wisconsin Archeologist* 3(3):101-128.

Brown, Charles E. and Leopold E. Drexel
1921 Fox Lake. *Wisconsin Archeologist* 20(4):110-150.

Brown, Ian W.
1979 Functional Group Changes and Acculturation: A Case Study of the French and the Indian in the Lower Mississippi Valley. *Midcontinental Journal of Archaeology* 4(2):147-165.

Brown, James A. (editor)
1961 *The Zimmerman Site*. Reports of Investigations, Vol. 9. Illinois State Museum, Springfield, Illinois.

Brown, James A. and R. F. Sasso
2001 Prelude to History on the Eastern Prairies. In *Societies in Eclipse: Archaeology of the Eastern Woodland Indians A.D. 1400-1700*, edited by D. Brose, W. Cowan and R. C. Mainfort. Smithsonian Institution Press, Washington.

Brown, Margaret Kimball
1972 Native Made Glass Pendants from East of the Mississippi. *American Antiquity* 37(3):432-439.
1975 The Zimmerman Site: Further Excavations at the Grand Village of Kaskaskia. State of Illinois, Department of Registration and Education, Illinois State Museum, Springfield, Illinois

Brubaker, Rogers
2002 Ethnicity without Groups. *European Journal of Sociology* 43(2):163-189.

Brubaker, Rogers and Frederick Cooper
2000 Beyond 'Identity'. *Theory and Society* 29:1-47.

Bruhy, Mark E. and Kathryn C. Egan-Bruhy
2014 Archibald Lake Mounds (47OC309): A Late Prehistoric Horticultural Village in Wisconsin's Northern Highland. *The Wisconsin Archeologist* 95(1):29 - 49.

Bruseth, James E. and Toni S. Turner
2005 *From a Watery Grave: the Discovery and Excavation of La Salle's Shipwreck*, La Belle. Texas A&M University Press, College Station.

Buffalo, Johnathan Lantz
2008 Oral History of the Meskwaki. *The Wisconsin Archeologist* 89(1&2):3-6.

Burpee, Lawrence J.
1914 *Highways of the Fur Trade*. Royal Society of Canada, Ottawa.

Buzon, Michele R.
2006 Biological and Ethnic Identity in New Kingdom Nubia: A Case Study from tombos. *Current Anthropology* 47(4):683-695.

Card, Jeb J. (editor)
2013a *The Archaeology of Hybrid Material Culture. Southern Illinois University Press, Carbondale.*

Card, Jeb J.
2013b Introduction. In The Archaeology of Hybrid Material Culture, edited by J. J. Card, pp. 1-24. Southern Illinois University Press, Carbondale, IL.

Carlson, Jenna K.
2012 *Culinary Creolization: Subsistence and Cultural Onteraction at Fort Michilimackinac, 1730-1761.* Mackinac Island State Park Commission, Mackinac Island, Mich.

Carr, C. and D.T. Case
2005 *Gathering Hopewell: Society, Ritual and Ritual Interaction*. Springer.

Carter, Alison Kyra
2011 Trade and Exchange Networks in Iron Age Cambodia: Preliminary Results from a Compositional Analysis of Glass Beads. *Bulletin of the Indo-Pacific Prehistory Association* 30:178-188.
2013 *Trade, Exchange, and, Sociopolitical Development in Iron Age (500 BC – AD 500) Mainland Southeast Asia: An Examination of Stone and Glass Beads from Cambodia and Thailand*, Ph.D. dissertation, Department of Anthropology, University of Wisconsin - Madison, Madison, WI.

Ceci, Lynn
1989 The Anthropology of Shell Beads: Subsistence, Systems, and Symbols. In *Proceedings of the 1986 Shell Bead Conference*, edited by C. F. I. Hayes, pp. 1-6. Research Division of the Rochester Museum and Science Center, Rochester.

Chafe, Anne, R. G. V. Hancock and I. Kenyon
1986 A Note on the Neutron Activation Analysis of 16th and 17th century blue glass trade beads from the eastern Great Lakes. *Beads Journal of the Society of Bead Researchers* 1986(9):13-18.

Champlain, Samuel de, Henry Percival Biggar, H. H. Langton, William Francis Ganong, John Home Cameron, John Squair and William Dawson LeSueur
1922-1956 *The works of Samuel de Champlain.* 7 vols. Champlain Society, Toronto.

Champlain, Samuel de and Association of Canadian Map Libraries
1980 *Carte de la Nouvelle France*. Association of Canadian Map Libraries, in co-operation with the National Map Collection, Public Archives of Canada, Ottawa.

Chastain, Matthew L., Alix C. Deymier-Black, John E. Kelly, James A. Brown and David C. Dunand
2011 Metallurgical Analysis of Copper Artifacts from Cahokia. *Journal of Archaeological Science* 38(7):1727-1736.

Chiavari, C., M. Degli Esposti, G. L. Garagnani, C. Martini and F. Ospitali
2011 Ancient Metallurgy at Sumhuram (Sultanate of Oman): Technical Aspects of Raised Inscriptions on South Arabian Bronzes. *Archaeometry* 53(3):528-546.

Church, Minette C.
2002 The Grant and the Grid: Homestead Landscapes in the Late Nineteenth-Century Borderlands of Southern Colorado. *Journal of Social Archaeology* 2(2):220-244.

Cipolla, C.N.

2013 Native American Historical Archaeology and the Trope of Authenticity. *Historical Archaeology* 47(3):12-22.

Cleland, Charles E. (editor)

1971 *The Lasanen Site*. Museum of Michigan State University, East Lansing.

Cleland, Charles E.

1992 *Rites of Conquest: the History and Culture of Michigan's Native Americans*. University of Michigan Press, Ann Arbor.

1993 Economic and Adaptive Change among the Lake Superior Chippewa of the Nineteenth Century. In *Ethnohistory and Archaeology*, edited by J. D. Rogers and S. Wilson, pp. 111-122. Interdisciplinary Contributions to Archaeology. Springer, US

1999 Cultural Transformation: The Archaeology of Historic Indian Sites in Michigan, 1670-1940. In *Retrieving Michigan's Buried Past: The Archaeology of the Great Lakes State*, edited by J. R. Halsey, pp. 279-290. Cranbrook Institute of Science, Bloomfield Hills, Michigan.

Clifton, J.A.

1977 *The Prairie People: Continuity and Change in Potawatomi Indian culture, 1665-1965*. Regents Press of Kansas.

1998 *The Prairie People: Continuity and Change in Potawatomi Indian Culture, 1665-1965*. University of Iowa Press.

Cobb, K. C., T. Evans and B. V. Karas

2008 Riveting Technology! The Documentation of Mississippian Metalwork. *ICOM Committee for Conservation* 1:393-400.

Comaroff, John L.

1987 Of Totemism and Ethnicity: Consciousness, Practice and the Signs of Inequality. *Ethnos* 52(3-4):301-323.

Connor, E. F. and D. Simberloff

1986 Competition, Scientific Method, and Null Models in Ecology. *American Scientist* 74:155-162.

Coronelli, Vincenzo

1980 *Partie occidentale du Canada ou de la Nouvelle France. Association des cartothèques canadiennes.* Ottawa.

Creese, John L.

2013 Social Contexts of Learning and Individual Motor-performance. In *Archaeology and Apprenticeship: Body Knowledge, Identity, and Communities of Practice*, edited by W. Wendrich, pp. 43-60. University of Arizona Press, Tucson.

Cushing, Frank Hamilton

1894 Primitive Copper Working: An Experimental Study. *American Anthropologist* 7(1):93-117.

Cusick, James G.

1998a Historiography of Acculturation: An Evaluation of Concepts and Their Application in Archaeology. In *Studies in Culture Contact: Interaction, Culture Change, and Archaeology*, edited by J. G. Cusick, pp. 126-145. vol. Occasional Paper No. 25. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Cusick, James G. (editor)

1998b *Studies in Culture Contact: Interaction, Culture Change, and Archaeology*. Occasional Paper No. 25. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Dalton, A.

2011 *The Fur-Trade Fleet: Shipwrecks of the Hudson's Bay Company*. Heritage House Pub.

de l'Isle, Guillaume

1733 *Carte de la Louisiane et du cours du Mississipi.* Amsterdam.

d'Errico, Francesco, Christopher Henshilwood, Graeme Lawson, Marian Vanhaeren, Anne-Marie Tillier, Marie Soressi, Frederique Bresson, Bruno Maureille, April Nowell, Joseba Lakarra, Lucinda Backwell and MichÃ¨le Julien

2003 Archaeological Evidence for the Emergence of Language, Symbolism, and Music: An Alternative Multidisciplinary Perspective. *Journal of World Prehistory* 17(1):1-70.

Deagan, K.

1996 Colonial Transformation: Euro-American Cultural Genesis in the Early Spanish-American Colonies. *Journal of Anthropological Research* 52(2):135-160.

2004 Reconsidering Taíno Social Dynamics after Spanish Conquest: Gender and Class in Culture Contact Studies. *American Antiquity* 69(4):597-626.

2013 Hybridity, Identity, and Archaeological Practice. In *The Archaeology of Hybrid Material Culture*, edited by J. J. Card, pp. 260-278.

Degryse, Patrick

2013 Isotope–Ratio Techniques in Glass Studies. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 235-245. John Wiley & Sons Ltd.

Delamarche, Charles François

1785 *États-Unis de l'Amérique septentrionale: avec les Isles Royale, de Terre Neuve, de St. Jean*, l'Acadie & Chez Delamarche, Paris.

Deloria, Philip J.
2006 What Is the Middle Ground, Anyway? *The William and Mary Quarterly* 63(1):15-22.

Demers, Paul A.
1991 *Report on the St. Mary's River Archaeological Survey: Archaeological Reconnaissance and Limited Testing on the Lower St. Mary's River, Chippewa County, Michigan*. Bureau of History, Michigan Department of State; Michigan State University Museum.

Deraisme, Aurelie, Laure Dussubieux, Garrard Frot, Christopher Stevenson, Amy Creech and Yves Bienvenu
2008 Copper-based Artefacts from Virginian Sites: Microstructures and Compositions. *Historical Archaeology* 42(1):39-49.

Dietler, Michael and Ingrid Herbich
1998 Habitus, Techniques, Style: An Integrated Approach In *The Archaeology of Social Boundaries,* edited by M. T. Stark, pp. 232-263. Smithsonian Institution Press, Washington D.C.

Dillian, Carolyn D. and Carolyn L. White
2010 Introduction: Perspectives on Trade and Exchange. In *Trade and Exchange*, edited by C. D. Dillian and C. L. White, pp. 3-14. Springer New York.

Donley-Reid, Linda W.
1990 The Power of Swahili Porcelain, Beads and Pottery. In *Powers of Observation: Alternative Views in Archaeology*, edited by S. M. Nelson and A. B. Kehoe, pp. 47-60. Archaeological Papers of the American Anthropological Association, No. 2. American Anthropological Association, Washington, D. C.

Drennan, Robert D.
2009 *Statistics for Archaeologists a Common Sense Approach.* 2nd Edition. Springer, New York.

Drooker, Penelope B.
1996 Madisonville Metal and Glass Artifacts. *Midcontinental Journal of Archaeology* 21(2):145-190.
1997 *The View from Madisonville: Protohistoric Western Fort Ancient Interaction Patterns.* Memoirs of the Museum of Anthropology, University of Michigan, 31. University of Michigan, Ann Arbor.

Dussubieux, Laure
2009 Chemical Investigation of Some 17th-Century French Glass Personal Ornaments. *Journal of Glass Studies* 51:95-110.

Dussubieux, Laure and Heather Walder
2015 Identifying American native and European smelted coppers with pXRF: A case study of artifacts from the Upper Great Lakes region. *Journal of Archaeological Science* 59:169-178.

Dussubieux, Laure, Aurelie Deraisme, Gerard Frot, Christopher Stevenson, Amy Creech and Yves Bienvenu
2008 LA-ICP-MS, SEM-EDS, and EPMA Analysis of Eastern North American Copper-Based Artefacts: Impact of Corrosion and Heterogeneity on the Reliability of the LA-ICP-MS Compositional Results. *Archaeometry* 50(4):643-657.

Dussubieux, Laure, Peter Robertshaw and Micheal D. Glascock
2009 LA-ICP-MS analysis of African glass beads: Laboratory inter-comparison with an emphasis on the impact of corrosion on data interpretation. *International Journal of Mass Spectrometry* 284(1-3):152-161.

Eccles, William J.
1998 *The French in North America : 1500 - 1783*. Michigan State Univ. Press, East Lansing.

Edmunds, R.D. and J.L. Peyser
1993 *The Fox Wars: The Mesquakie Challenge to New France*. University of Oklahoma Press.

Ehrenreich, Robert M. (editor)
1991 *Metals in Society: Theory beyond Analysis*. MASCA, The University Museum, University of Pennsylvania, Philadelphia.

Ehrhardt, Kathleen
2002 *European Materials in Native American Contexts: Rethinking Technological Change.* Ph.D. dissertation, Department of Anthropology, New York University, New York.
2004 Linking History and Prehistory in the Midcontinent: Archaeological Investigations at Marquette and Jolliet's 'Peouarea". In *Aboriginal Ritual and Economy in the Eastern Woodlands: Essays in Memory of Howard Dalton Winters*, edited by A.-M. Cantwell, L. A. Conrad and J. E. Reyman, pp. 287-299. vol. Illinois State Museum Scientific Papers Series Vol. XXX. Illinois State Museum, Springfield, Illinois.
2005 *European Metals in Native Hands.* University of Alabama Press, Tuscaloosa, Alabama.
2009 Copper Working Technologies, Contexts of Use, and Social Complexity in the Eastern Woodlands of Native North America. *Journal of World Prehistory* 22(3):213-235.

2010 Problems and Progress in Protohistoric Period Archaeology in the Illinois Country since Calumet and Fleur-De-Lys. *Illinois Archaeology* 22(1):255-286.

2012 Metals in Motion? Native Copper and European Copper-base Metals in the 17th Century Protohistoric North American Interior Paper presented at the Society for American Archaeology Annual Meeting, Memphis, TN.

2013 “Style” in Crafting Hybrid Material Culture. In *The Archaeology of Hybrid Material Culture*, edited by J. J. Card, pp. 364-396. vol. Occasional Paper No. 39. Center for Archaeological Investigations, Southern Illinois University, Carbondale, IL.

2014 Copper Working Technologies, Contexts of Use, and Social Complexity in the Eastern Woodlands of Native North America. In *Archaeometallurgy in Global Perspective*, edited by B. W. Roberts and C. P. Thornton, pp. 303-328. Springer New York.

Ehrhardt, Kathleen and Bruce Kaiser

2011 TRACER III V+ and ARTAX Compositional Analysis of the Copper-base Metal Industry at the New Lenox Site, Will County, Illinois. In *FIRST Bruker AXS Newsletter*. March 2011. Bruker Elemental, Kennewick, WA.

Emberling, Geoff

1997 Ethnicity in Complex Societies: Archaeological Perspectives. *Journal of Archaeological Research* 5(4):295-344.

Emerson, Thomas E. and James A. Brown

1992 The Late Prehistory and Protohistory of Illinois. In *Calumet and Fleur-de-Lys: Archaeology of Indian and French Contact in the Midcontinent*, edited by J. A. Walthall and T. E. Emerson, pp. 77-128. Smithsonian Institution Press, Washington DC.

Evans, Lynn L. M.

2001 *House D of the Southeast Rowhouse: Excavations at Fort Michilimackinac, 1989-1997*. Mackinac State Historic Parks, Mackinac Island, Mich.

Fahlander, Fredrik

2007 Third space encounters. Hybridity, mimicry and interstitial practice. In *Encounters-Materialities-Confrontations. Archaeologies of social space and interaction*, edited by P. Cornell and F. Fahlander, pp. 15-43.

Fernández–Navarro, José–María and María–Ángeles Villegas

2013 What is Glass?: An Introduction to the Physics and Chemistry of Silicate Glasses. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 1-22. John Wiley & Sons Ltd.

Ferris, N.
2009 *The Archaeology of Native-lived Colonialism: Challenging History in the Great Lakes.* University of Arizona Press.

Finney, Fred A.
2013 Intrasite and Regional Perspectives on the Fred Edwards Site and the Stirling Horizon in the Upper Mississippi Valley. *Wisconsin Archeologist* 94(1&2):3-248.

Fitting, James E.
1973 *An Archaeological Survey of Beaver Island, Charlevoix County, Michigan*. Michigan History Division.
1976a Archaeological excavations at the Marquette Mission Site, St. Ignace, Michigan, in 1972. *The Michigan Archaeologist* 22(2-3):103-282.
1976b Patterns of Acculturation at the Straits of Mackinac. In *Cultural Change and Continuity: Essays in Honor of James Bennett Griffin,* edited by C. E. Cleland, pp. 321-334. Academic Press, New York.

Fitting, James E. and Mark J. Lynott
1974 The Norge Village Site (SIS-16). *The Michigan Archaeologist* 20(3 & 4):195-226.

Fitzgerald, William R. and Peter G. Ramsden
1988 Copper Based Metal Testing as an Aid to Understanding Early European-Amerindian Interaction: Scratching the Surface. *Canadian Journal of Archaeology* 12:153-161.

Fitzgerald, William R., Laurier Turgeon, Ruth Holmes Whitehead and James W. Bradley
1993 Late Sixteenth-Century Basque Banded Copper Kettles. *Historical Archaeology* 27(1):44-57.

Fox, George R.
1911 The Ancient Copper Workings on Isle Royale. *The Wisconsin Archeologist* 10(2):73-100.

Fox, George R. and Harvey O. Younger
1918 Marinette County. *The Wisconsin Archeologist* 17(2):33-45.

Fox, W. A., R. G. V. Hancock and L. A. Pavlish
1995 Where East Met West: The New Copper Culture. *The Wisconsin Archeologist* 76:269-293.

Francis, Peter
1999 The Venetian Bead Story, Part 2: The Beads. *The Margaretologist* 12(1)(27).

Franzen, John
1974 *An Archaeological Survey of Chippewa County, Michigan*. Michigan History Division, Michigan Department of State.

Freeman, Joan E.
1956 *An Analysis of the Point Sauble and Beaumier Farm sites.* Master’s thesis, Department of Anthropology, University of Wisconsin-Madison, Madison, WI.

Freeman, Paula and Jeffery A. Behm
1998 Metallurgical Analysis of "Kettle Brass" Objects from the Bell Site. *Fox Valley Archaeology* 27:29-43.

Gallagher, James P.
1990 *The Farley Village Site 21HU2, an Oneota/Ioway site in Houston County*, Minnesota Reports of Investigations, Number 117. Mississippi Valley Archaeology Center at The University of Wisconsin-La Crosse, La Crosse, WI.

Galloway, P.
1998 *Choctaw Genesis, 1500-1700*. University of Nebraska Press.

Garrad, Charles
2014 *Petun to Wyandot : the Ontario Petun from the Sixteenth Century*. University of Ottawa Press, Ottawa, Canada.

Gearing, Tom
2009 *Meskwaki and Saukie Migration*. Map on file. Meskwaki Planning Department, Meskwaki Nation, Tama, Iowa.

Gibbon, Guy
1995 Oneota at the Periphery: Trade, Political Power, and Ethnicity in Northern Minnesota and on the Northeastern Plains in the Late Prehistoric Period. In *Oneota Archaeology Past, Present, and Future*, edited by W. Green, pp. 175-202. Report 20. Office of the State Archaeologist and the University of Iowa, Iowa City.

Gibson, Jon L
1996 Poverty Point and Greater Southeastern Prehistory: The Culture that Did Not Fit. *Archaeology of the Mid-Holocene Southeast,* pp. 288-305. University Press of Florida, Gainesville

Gilmore, Melvin R.
1924 Glass Bead Making by the Arikara. *Indian Notes* 2(1):20-21.

Giordano, Brock A.
2005 Crafting Culture at Fort St. Joseph: An Archaeological Investigation of Labor Organization on the Colonial Frontier. Master's thesis, Department of Anthropology, Western Michigan University, Kalamazoo, Michigan.

Giumlia-Mair, A.
2005 Copper and Copper Alloys in the Southeastern Alps: An Overview. *Archaeometry* 47(2):275-292.

Gladysz, Kevin
2011 *The French Trade Gun in North America, 1662-1759*. Mowbray Publishers, Woonsocket, RI.

Glascock, Michael D.
2013 Application of Neutron Activation Analysis to Archaeological Studies of Natural and Man–Made Glasses. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 185-199. John Wiley & Sons Ltd.

Goldstein, Lynne G.
1997 *The Southeastern Wisconsin Archaeology Program: 1996-97*. University of Wisconsin - Milwaukee Archaeological Research Laboratory.

Goldstein, Lynne G. and Elizabeth D. Benchley
1990 *The Southeastern Wisconsin Archaeology Program: 1989-90.* University of Wisconsin - Milwaukee Archaeological Research Laboratory.

Gosden, Chris
2004 *Archaeology and Colonialism: Cultural Contact from 5000 B.C. to the Present*. Cambridge University Press, Cambridge, UK ; New York.

Grantham, Larry
1993 The Illini Village of the Marquette and Jolliet Voyage of 1673. *Missouri Archaeologist* 54:1-20.

Gratuze, Bernard
2013 Glass Characterisation Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry Methods. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 201-234. John Wiley & Sons Ltd.

Green, William
1993 Examining Protohistoric Depopulation in the Upper Midwest. *The Wisconsin Archeologist* 74(1-4):290-369.

Greer, Allan

2000 *The Jesuit Relations: Natives and Missionaries in Seventeenth-Century North America*. Bedford/St. Martin's, Boston.

Griffin, James B.

1960 A Hypothesis for the Prehistory of the Winnebago. In *Culture in History: Essays in Honor of Paul Radin*, edited by S. Diamond, pp. 809-865. Columbia University Press, New York.

1961 *Lake Superior Copper and the Indians: Miscellaneous studies of Great Lakes Prehistory*. Museum of Anthropology, University of Michigan.

Gross, Rich and Misty Jackson

2014 Historical Context and Documentation for La Salle's Le Griffon. Paper presented at the Society for Historical Archaeology 47th Annual Meeting, Quebec City, Quebec, Canada.

Grumet, R.S.

1995 *Historic Contact: Indian People and Colonists in Today's Northeastern United States in the Sixteenth through Eighteenth Centuries.* University of Oklahoma Press.

Haley, Brian D. and Larry R. Wilcoxon

2005 How Spaniards Became Chumash and Other Tales of Ethnogenesis. *American Anthropologist* 107(3):432-445.

Hall, Robert L.

1947 A Preliminary Report on the Iroquois Aspect in Wisconsin. *The Wisconsin Archeologist* 28(2):34-39.

1962 *The Archaeology of Carcajou Point*. 2 vols. University of Wisconsin Press, Madison.

1993 Red Banks, Oneota, and the Winnebago: Views from a Distant Rock. *The Wisconsin Archeologist* 74(1-4):10-79.

1995 Relating the Big Fish and the Big Stone: Reconsidering the Archaeological Identity and the Habitat of the Winnebago in 1634. In *Oneota Archaeology Past, Present, and Future*, edited by W. Green, pp. 19-32. Report 20. Office of the State Archaeologist and the University of Iowa, Iowa City.

1997 *An Archaeology of the Soul: North American Indian Belief and Ritual.* University of Illinois Press. Hall, Robert L.

2003 Rethinking Jean Nicolet's Route to the Ho-Chunks in 1634. In *Theory, Method, and Practice in Modern Archaeology*, edited by R. J. Jeske and D. K. Charles, pp. 238-251. Praeger, Westport, CT.

Halsey, John R.

1986 20MK6 Transcribed Field Notes on File. Michigan Office of the State Archaeologist, Lansing, MI.

Hamell, George R.

1983 Trading in Metaphors: The Magic of Beads. In *Proceedings of the 1982 Glass Trade Bead Conference*, Sponsored by the Arthur C. Parker Fund for Iroquois Research, Research Division Rochester Museum and Science Center,pp. 5-28. Rochester, New York

1987 Strawberries, Floating Islands, and Rabbit Captains: Mythical realities and European Contact in the Northeast During the Sixteenth and Seventeenth Centuries. *Journal of Canadian Studies* 21(4):72-94.

1992 The Iroquois and the World's Rim: Speculations on Color, Culture, and Contact. *American Indian Quarterly* 16(4):451-469.

Hammett, Julia E. and Beverly A. Sizemore

1989 Shell Beads and Ornaments: Socioeconomic Indicators of the Past. In *Proceedings of the 1986 Shell Bead Conference*, edited by C. F. I. Hayes, pp. 125-137. Research Division of the Rochester Museum and Science Center, Rochester.

Hancock, R. G. V.

2013 European Glass Trade Beads in Northeastern North America. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 459-471. John Wiley & Sons Ltd.

Hancock, R. G. V., S. Aufreiter and I. Kenyon

1997 European White Glass Trade Beads as Chronological and Trade Markers. *In Materials Issues in Art and Archaeology V*, edited by P. Vandiver, J. R. Druzick, J. F. Merkel and J. Stewart, pp. 181-191. Symposium Proceedings Volume 462. Materials Research Society, Pittsburg.

Hancock, R. G. V., S. Aufreiter, I. Kenyon and M. Latta

1999 White Glass Beads from the Auger Site, Southern Ontario, Canada. *Journal of Archaeological Science* 26(8):907-912.

Hancock, R. G. V., S. Aufreiter, J. F. Moreau and I. Kenyon

1996 Chemical Chronology of Turquoise Blue Glass Trade Beads from the Lac-Saint-Jean Region of Québec. In *Archaeological Chemistry*, pp. 23-36. ACS Symposium Series. vol. 625. American Chemical Society.

Hancock, R. G. V., Anne Chafe and I. Kenyon

1994 Neutron Activation Analysis of Sixteenth- and Seventeenth-Century European Blue Glass Trade Beads from the Eastern Great Lakes Area of North America. *Archaeometry* 36(2):253-266.

Hancock, R. G. V., R. M. Farquhar, L. A. Pavlish and W. D. Finlayson

1995a Chemical Analysis of Copper and Brass Samples from Christian Island, Georgian Bay, Ontario. *Journal of Radioanalytical and Nuclear Chemistry* 196(2):255-266.

Hancock, R. G. V., K. E. Hancock and J. K. Hancock
2008 Thoughts on the Utility of a Bivariate-Splitting Approach to Olmec Ceramic Data Interpretation. *Archaeometry* 50(4):710-726.

Hancock, R. G. V., J. McKechnie, S. Aufreiter, K. Karklins, M. Kapches, M. Sempowski, J. F. Moreau and I. Kenyon
2000 Non-Destructive Analysis of European Cobalt Blue Glass Trade Beads. *Journal of Radioanalytical and Nuclear Chemistry* 244(3):567-573.

Hancock, R. G. V., L. A. Pavlish, R. M. Farquhar and W. D. Finlayson
1995b Analysis of Copper-Based Metals from Archaeological Sites at Crawford Lake, South-Central Ontario, Canada. In *Trade and Discovery: The Scientific Study of Artefacts from Post-Medieval Europe and Beyond*, edited by D. R. Hook and D. R. M. Gaimster, pp. 283-298. Occasional Paper 109. British Museum Press, London.

Hancock, R. G. V., L. A. Pavlish, R. M. Farquhar, R. Salloum, W. A. Fox and G. C. Wilson
1991 Distinguishing European Trade Copper and North-Eastern North American Native Copper. *Archaeometry* 33(1):69-86.

Hancock, R. G. V., L. A. Pavlish, W. A. Fox and M. A. Latta
1995c Chemical Analysis of Copper Alloy Trade Metal from a Post-Contact Huron Site in Ontario, Canada. *Archaeometry* 37(2):339-350.

Harris, R. Cole and G. J. Matthews
1987 *Historical Atlas of Canada*. University of Toronto Press, Toronto.

Hauser, Mark W.
2012 Messy Data, Ordered Questions. *American Anthropologist* 114(2):184-195.

Hawkes, C.
1954 Archaeological Theory and Method: Some Suggestions from the Old World. *American Anthropologist* 56(2):155-168.

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

Heldman, Donald P. and Roger T. Grange
1981 *Excavations at Fort Michilimackinac, 1978-1979: the Rue de la Babillarde*. Mackinac Island State Park Commission, Mackinac Island, Mich.

Helms, Mary W.
1993 *Craft and the Kingly Ideal: Art, Trade, and Power*. University of Texas Press, Austin.

Henderson, Julian
2013 *The Science and Archaeology of Materials: An Investigation of Inorganic Materials*. Taylor & Francis.

Henning, Dale R.
1995 Oneota Evolution and Interactions: A Perspective from Wever Terrace, Southeast Iowa. In *Oneota Archaeology Past, Present and Future*, edited by W. Green, pp. 65-90. Report 20. Office of the State Archaeologist and the University of Iowa, Iowa City.
1998 Oneota: the Western Manifestations. *The Wisconsin Archeologist* 79(2):238-247.
2004 The Archaeology and History of Iowa/Oto Exchange Patterns. *Journal of the Iowa Archeological Society* 50:199-221.

Hickerson, Harold
1963 The Sociohistorical Significance of Two Chippewa Ceremonials. *American Anthropologist* 65(1):67-85.
1974 *Ethnohistory of Chippewa of Lake Superior*. Garland Pub. Inc., New York.
1988 *The Chippewa and their Neighbors: a Study in Ethnohistory*. Waveland, Prospect Heights (Ill.).

Hodder, Ian.
1982 *Symbols in Action: Ethnoarchaeological Studies of Material Culture*. Cambridge University Press.

Hodgen, Margaret T.
1964 *Early Anthropology in the Sixteenth and Seventeenth Centuries.* University of Pennsylvania Press, Philadelphia.

Hodges, Henry
1970 *Technology in the Ancient World.* Alfred A Knopf, New York.

Howard, James H.
1972 Arikara Native-Made Glass Pendants: Their Probable Function. *American Antiquity* 37(1):93-97.

Howey, Meghan
2011 Colonial Encounters, European Kettles, and the Magic of Mimesis in the Late Sixteenth and Early Seventeenth Century Indigenous Northeast and Great Lakes. *International Journal of Historical Archaeology* 15(3):329-357.

Howey, Meghan C. L. and John M. O'Shea
2006 Bear's Journey and the Study of Ritual in Archaeology. *American Antiquity* 71(2):261-282.

Hu, Di
2013 Approaches to the Archaeology of Ethnogenesis: Past and Emergent Perspectives. *Journal of Archaeological Research* 21(4):371-402.

Hudgins, Carter C.
2004 Old World Industries and New World Hope: The Industrial Role of Scrap Copper at Jamestown. *The Journal of the Jamestown Rediscovery Center* 2.
2005 Articles of Exchange or Ingredients of New World Metallurgy? An Examination of the Industrial Origins and Metallurgical Functions of Scrap Copper at Early Jamestown (c. 1607–17). *Early American Studies: An Interdisciplinary Journal*, 3(1):32-64.

Hunter, Mary T.
1997 Jesuit Rings from the Bell Site: The Reed Collection. *Fox Valley Archeology* (26):76-90.

Iles, Louise and S. Terry Childs
2014 Ethnoarchaeological and Historical Methods. In *Archaeometallurgy in Global Perspective*, edited by B. W. Roberts and C. P. Thornton, pp. 193-215. Springer New York.

Illinois State Geological Survey
2014 *Physiographic Divisions of Illinois*. Electronic document, http://isgs.illinois.edu/sites/isgs/files/maps/statewide/physio-w-color-8x11.pdf, Champaign, IL. Accessed November 1, 2014.

Ingold, Tim
2001 Beyond Art and Technology: the Anthropology of Skill. In *Anthropological Perspectives on Technology*, edited by M. B. Schiffer, pp 17-31, University of New Mexico Press, Albuquerque.

Janssens, K., S. Cagno, I. De Raedt and P. Degryse
2013 Transfer of Glass Manufacturing Technology in the Sixteenth and Seventeenth Centuries from Southern to Northern Europe: Using Trace Element Patterns to Reveal the Spread from Venice via Antwerp to London. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 537-562. John Wiley & Sons Ltd.

Janssens, Koen
2013a Electron Microscopy. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 129-154. John Wiley & Sons Ltd.
2013b X–Ray Based Methods of Analysis. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 79-128. John Wiley & Sons Ltd.

Janssens, Koen (editor)
2013c *Modern Methods for Analysing Archaeological and Historical Glass*, John Wiley & Sons Ltd.

Jennings, Justin
2011 *Globalizations and the ancient world*. Cambridge University Press, Cambridge; New York.

Jeske, Robert J.
2003 Lake Koshkonong 2002/2003: Archaeological Investigations at Three Sites in Jefferson County, Wisconsin. Report on File. University of Wisconsin – Milwaukee, Milwaukee, WI.

Joliet, Louis
1893 *Carte des lacs Tracy ou Supérieur, des Illinois et des Hurons avec la rivière Colbert et le pays au nord du lac Tracy, 1680*. Paris.

Jones, Sian
1997 Ethnicity and Material Culture: Towards a Theoretical Basis for the Interpretation of Ethnicity in Archaeology. In *The Archaeology of Ethnicity*, pp. 106-127. Routledge, London.

Jordan, Kurt
2009 Colonies, Colonialism, and Cultural Entanglement: The Archaeology of Postcolumbian Intercultural Relations. In *International Handbook of Historical Archaeology*, edited by T. Majewski and D. Gaimster, pp. 31-49. Springer.

Joyce, Rosemary A.
2005 Archaeology of the Body. *Annual Review of Anthropology* 34(1):139-158.

Justice, Noel D. and Suzanne K. Kudlaty
1999 *Field Guide to Projectile Points of the Midwest.* Indiana University Press, Bloomington.

Karklins, K.
1982 *Glass beads: Guide to the Description and Classification of Glass Beads*. National Historic Parks and Sites Branch, Parks Canada, Environment Canada, Ottawa.
1983 Dutch Trade Beads in North America. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by C. F. Hayes, pp. 111-126. Research Division, Rochester Museum and Science Center, Rochester, New York.

Karklins, K., R. G. V. Hancock, J. Baart, M. L. Sempowski, J. F. Moreau, D. Barham, S. Aufreiter and I. Kenyon

2002 Analysis of Glass Beads and Glass Recovered from an Early 17th-Century Glassmaking House in Amsterdam. In *Archaeological Chemistry*, pp. 110-127. ACS Symposium Series. vol. 831. American Chemical Society.

Keane, Webb

2005 Signs are Not the Garb of Meaning: On the Social Analysis of Material Things. In *Materiality*, edited by D. Miller, pp. 182-205. Duke University Press, Durham.

Kenoyer, Jonathan Mark

1992 Ornament Styles of the Indus Tradition: Evidence from Recent Excavations at Harappa, Pakistan. *Paléorient* 17(2):79-98.

2008 Indus and Mesopotamian Trade Networks: New Insights from Shell and Carnelian Artifacts. In *Intercultural Relations between South and Southwest Asia; Studies in Commemoration of E. C. L. During-Caspers (1934-1996)*, edited by E. Olijdam and R. H. Spoor. BAR International, London.

Kenoyer, Jonathan Mark, Massimo Vidale and Kuldeep Kumar Bhan

1991 Contemporary Stone Beadmaking in Khambhat, India: Patterns of Craft Specialization and Organization of Production as Reflected in the Archaeological Record. *World Archaeology* 23(1):44-63.

Kent, Timothy J.

2001 *Ft. Pontchartrain at Detroit. A Guide to the Daily Lives of Fur Trade and Military Personnel, Settlers, and Missionaries at French Posts.* 2 vols. Silver Fox Enterprises, Ossineke, Michigan.

2004 *Rendezvous at the Strait. Fur Trade and Military Activities at Fort de Buade and Fort Michilimackinac, 1669-1781*. 2 vols. Silver Fox Enterprises, Ossineke, Michigan.

Kenyon, I. and William R. Fitzgerald

1986 Dutch Glass Beads in the Northeast: An Ontario Perspective. *Man in the Northeast* 32:1-34.

Kenyon, I., R. G. V. Hancock and S. Aufreiter

1995a Neutron Activation Analysis of AD 1660-1930 European Copper-Coloured Blue Glass Trade Beads from Ontario, Canada. *Archaeometry* 37(2):323-337.

Kenyon, I., S. Kenyon, R. G. V. Hancock and S. Aufreiter

1995b Neutron Activation Analysis of Some 19th Century Faceted Glass Trade Beads from Ontario Canada that have Chemical Compositions Resembling Bohemian Glass. *Beads Journal of the Society of Bead Researchers* 27:4-9.

Kenyon, I. and T. Kenyon

1983 Comments on 17th Century Glass Trade Beads from Ontario. In *Proceedings of the 1982 Glass Trade Bead Conference*, Rochester, NY, pp. 59-74. Sponsored by the Arthur C. Parker Fund for Iroquois Research, Research Division Rochester Museum and Science Center, Rochester, NY.

Kerr, Ian B.

2012 *An Analysis of Personal Adornment at Fort St. Joseph (20BE23), An Eighteenth-Century French Trading Post in Southwest Michigan*, Master's thesis, Department of Anthropology, Western Michigan University, Kalamazoo, MI.

Kidd, Kenneth E. and Martha A. Kidd

1970 A Classification System for Glass Beads for the Use of Field Archaeologists. In *Canadian Historic Sites: Occasional Papers in Archaeology and History*. No. 1. Department of Indian Affairs and Northern Development, Ottowa.

Kingery, W. D.

1993 Technological Systems and some Implications with regard to Continuity and Change. In *History from Things: Essays on Material Culture,* edited by S. D. Lubar, pp. 215-230. Smithsonian Institution Press, Washington.

Kinietz, W. Vernon and Antoine Denis Raudot

1965 *The Indians of the Western Great lakes, 1615-1760*. University of Michigan Press, Ann Arbor, Mich.

Koziarski, Ralph

2012 *Meskwaki Fur Trade Economics: The Zooarchaeology of Cultural Contact.* Ph.D. dissertation, Department of Anthropology, University of Wisconsin-Milwaukee, Milwaukee.

Lankton, James W.

2007 How Does a Bead Mean? An Archaeologist's Perspective. In *The Global Perspective of Beads and Beadwork: History, Manufacture, Trade, and Adornment*, edited by J. Allen and V. Hector, pp. 22-32, Kadir Has University, Istanbul.

Lankton, James W. and Laure Dussubieux

2006 Early Glass in Asian Maritime Trade: A Review and Interpretation of Compositional Analysis. *Journal of Glass Studies* 48:121-144.

2013 Early Glass in Southeast Asia. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 415-443. John Wiley & Sons Ltd.

Lapham, Heather A. and William C. Johnson

2002 Protohistoric Monongahela Trade Relations: Evidence from the Foley Farm Phase Glass Beads. *Archaeology of Eastern North America* 30 :97-120.

Latta, M. A., P. Thibaudeau and L. Anselmi

1998 Expediency and Curation: The Use and Distribution of 'Scrap' Trade Metal by Huron Native Peoples in Sixteenth Century South Ontario. *The Wisconsin Archeologist* 1998(79):1.

Lattanzi, G. D.

2007 The Provenance of Pre-Contact Copper Artifacts: Social Complexity and Trade in the Delaware Valley. *Archaeology of Eastern North America* 35:1-13.

Lechtman, Heather

1977 Style in Technology- Some Early Thoughts. In *Material Culture: Styles, Organization and Dynamics of Technology*, edited by H. Lechtman and R. S. Merrill, pp. 3-20. West Pub. Co., St. Paul, Minnesota.

1984 Andean Value Systems and the Development of Prehistoric Metallurgy. *Technology and Culture* 25(1):1-36.

2014 Andean Metallurgy in Prehistory. In *Archaeometallurgy in Global Perspective*, edited by B. W. Roberts and C. P. Thornton, pp. 361-422. Springer New York.

Lemonnier, Pierre

1986 The Study of Material Culture Today: Toward an Anthropology of Technical Systems. *Journal of Anthropological Archaeology* 5:147-186.

Leroi-Gourhan, André

1943 *Évolution et techniques I - L'Homme et la matière*. Albin Michel, Paris.

1945 *Évolution et techniques II - Milieu et techniques*. Albin Michel, Paris.

Levy, Thomas E. and Augustin T.C. Holl

2002 Migrations, Ethnogenesis, and Settlement Dynamics: Israelites in Iron Age Canaan and Shuwa-Arabs in Chad Basin. *Journal of Anthropological Archaeology* 21(1):83-118.

Lewis, Tyra Lee

1979 *Neutron Activation Analysis of Glass Trade Beads*. Report on File, Michigan Office of the State Archaeologist.

Liebert, Steve and Great Lakes Exploration Group LLC

2015 La Salle - Griffon Project. Webpage, accessed January 16th, 2015. http://www.lasalle-griffon.org/

Liebmann, Matthew

2008 Introduction: The Intersection of Archaeology and Postcolonial Studies. In *Archaeology and the Postcolonial Critique*, edited by U. Rizvi and M. Liebmann, pp. 1-20. Altamira Press, Walnut Creek.

2013 Parsing Hybridity: Archaeologies of Amalgamation in Seventeenth-Century New Mexico. In *The Archaeology of Hybrid Material Culture*, edited by J. J. Card, pp. 25 - 49. Occasional Paper No. 39. Center for Archaeological Publications, Southern Illinois University.

2015 The Mickey Mouse Kachina and Other ‘‘Double Objects’’: Hybridity in the Material Culture of Colonial Encounters. *Journal of Social Archaeology*. In Press.

Liebmann, Matthew and Uzma Z. Rizvi

2008 *Archaeology and the Postcolonial Critique*. AltaMira Press, Lanham, MD.

Lightfoot, Kent G.

1995 Culture Contact Studies: Redefining the Relationship between Prehistoric and Historical Archaeology. *American Antiquity* 60(2):199-217.

Lightfoot, Kent G., Antoinette Martinez and Ann M. Schiff

1998 Daily Practice and Material Culture in Pluralistic Social Settings: An Archaeological Study of Culture Change and Persistence from Fort Ross, California. *American Antiquity* 63(2):199-222.

Linton, Ralph (editor)

1940 *Acculturation in Seven American Indian Tribes*. D. Appleton-Century Co.: New York.

Little, Keith J.

2010 Sixteenth-Century Glass Bead Chronology in Southeastern North America. *Southeastern Archaeology* 29(1):222-232.

Loren, Diana DiPaolo

2009 Material Manipulations: Beads and Cloth in the French Colonies. In *The Materiality of Individuality*, edited by C. White, pp. 109-124. Springer, New York.

2010 *The Archaeology of Clothing and Bodily Adornment in Colonial America.* University Press of Florida, Gainesville.

Loren, Diana DiPaolo and Uzi Baram

2007 Between Art and Artifact: Approaches to Visual Representations in *Historical Archaeology*. *Historical Archaeology* 41(1):1-5.

Lorenzini, Michele A.

1995 A Classification of Glass Trade Beads from the Bell Site (47-Wn-9), Winnebago County, Wisconsin. *Fox Valley Archeology* (24):59-79.

1998 *Diversity Analysis of Glass Trade Beads from Eight Middle Historic*. Master’s thesis, Department of Anthropology, University of Illinois, Urbana, Illinois.

1999 *Diversity Analysis of Glass Trade Beads from Eight Middle Historic Sites.* Report on File, Archaeology Laboratory, University of Wisconsin-Oshkosh.

Lovis, William A.

1973 *Late Woodland Cultural Dynamics in the Northern Lower Peninsula of Michigan.* Ph.D. dissertation, Department of Anthropology, Michigan State University, East Lansing, Michigan.

Lurie, Nancy Oestreich and Patrick J. Jung

2009 *The Nicolet Corrigenda: New France Revisited.* Waveland Press, Long Grove, Illinois

2015 Jean Nicolet (Again): Comment on Ronald J. Mason's "Where Nicolet and Winnebagoes First Met". *Wisconsin Archeologist* 95(2):303-307.

Mainfort, Robert C., Jr.

1979 *Indian Social Dynamics in the Period of European Contact: Fletcher Site Cemetery, Bay County, Michigan*. Michigan State University, East Lansing, Mich.

1985 Wealth, Space, and Status in a Historic Indian Cemetery. *American Antiquity* 50(3):555-579.

Malischke, LisaMarie

2009 *The Excavated Bead Eollection at Fort St. Joseph (20BE23) and its Implications for Understanding Adornment, Ideology, Cultural Exchange, and Identity.* Master's thesis, Department of Anthropology, Western Michigan University, Kalamazoo, Michigan.

Mann, Barbara A.

1995 The Fire at Onondaga: Wampum as Proto-Writing. *Akwesasne Notes* 1(1):40.

Mann, Rob

2008 From Ethnogenesis to Ethnic Segmentation in the Wabash Valley: Constructing Identity and Houses in Great Lakes Fur Trade Society. *International Journal of Historical Archaeology* 12(4):319-337.

Martin, Susan R.

1979 *Final Report: Phase II Archaeological Site Examination of the Gros Cap Cemetery Area, Mackinac County, Michigan*. Cultural Resource Management Reports No. 6. Michigan Technological University, Houghton, MI.

1999 *Wonderful Power: The Story of Ancient Copper Working in the Lake Superior Basin.* Great Lakes books. Wayne State University Press, Detroit.

Martin, Susan R. and Patrick E. Martin

1979 Preliminary Archaeological Site Examination of the Proposed Expansion of UW-2, Mackinac County, Michigan. Michigan Technological University.

Martin, Susan R. and Thomas C. Pleger
1999 The Complex Formerly Known as a Culture: The Taxonomic Puzzle of "Old Copper". In *Taming the Taxonomy: Toward a New Understanding of Great Lakes Archaeology*, edited by R. F. Williamson and C. M. Watts. Eastend Books and the Ontario Archaeological Society, Toronto.

Mason, Carol I.
1976 Historic Identification and Lake Winnebago Focus Oneota. In *Culture Change and Continuity: Essays in Honor of James Bennett Griffin*, edited by C. E. Cleland, pp. 335-348. Academic Press, New York.
1988 *Introduction to Wisconsin Indians: Prehistory to Statehood*. Sheffield Publishing Company, Salem, Wisconsin.
1997 The Historic Period in Wisconsin Archaeology, Native Peoples. *The Wisconsin Archeologist* 78(1/2):298-319.
2009 Iconographic ("Jesuit") Rings: A Case Study in Chronological Placement. In *Painting the Past with a Broad Brush*, edited by D. L. Keenlyside and J.-L. Pilon, pp. 371-391. vol. Archaeology Paper 170. Mercury Series, Quebec.

Mason, Carol I. and Kathleen Ehrhardt
2009 Iconographic (Jesuit) Rings in European/Native Exchange. *French Colonial History* 10:55.

Mason, Carol I. and James R. Paquette
2009 Early Iconographic Rings from Goose Lake Outlet #3. *The Wisconsin Archeologist* 90(1&2):235-247.

Mason, Carol L.
1994 *The 1993 Fur Trade Era Survey of the Fox River Corridor in Northeastern Wisconsin*. University of Wisconsin-Oshkosh Archaeology Laboratory.

Mason, Richard P. and Carol L. Mason
1993 The Doty Island Village Site (WN 47 30) Winnebago County, Wisconsin. *The Wisconsin Archeologist* 74(1-4):197-257.
1997 A brief report on the Mahler portion of the Doty Island Village site. *The Wisconsin Archeologist* 79(1):208-231.

Mason, Ronald J.
1966 *Two stratified sites on the Door Peninsula of Wisconsin. Museum of Anthropology*, University of Michigan.
1976 Ethnicity and Archaeology in the Upper Great Lakes. In *Culture Change and Continuity: Essays in Honor of James Bennett Griffin*, edited by C. E. Cleland, pp. 349-362. Academic Press, New York.
1986 *Rock Island Historical Indian Archaeology in the Northern Lake Michigan Basin*. MCJA Special Paper No. 6. Kent State University Press.

1990 Late Woodland and Oneota Occupations on Rock Island, Wisconsin. *The Wisconsin Archeologist* 71:115-136.

1991 Rock Island and the Laurel Cultural Frontier in Northern Lake Michigan. ROCK *Midcontinental Journal of Archaeology* 16(1):118-155.

1997 Archaeoethnicity and the Elusive Menominis. *Midcontinental Journal of Archaeology* 22(1):69-94.

2006 *Inconstant companions : archaeology and North American Indian oral traditions*. University of Alabama Press, Tuscaloosa.

2014 Where Nicolet and the Winnebagoes First Met. *The Wisconsin Archeologist* 95(1):65-74.

2015 The Search for A,otonatendïe. *Midcontinental Journal of Archaeology* 40(2):116-133.

Mauss, Marcel

1950 [2000] *The Gift: the Form and Reason of Exchange in Archaic Societies*. Routledge, London

Mazrim, Robert F.

2009 Reconsidering the Antiquity of Trade on Madeline Island: The View from the Cadotte Site in Northern Wisconsin. Sangamo Archaeological Center. *Fieldwork and Technical Reports* 19:1-46.

2011 Reconsidering the Antiquity of Trade on Madeline Island: The View from the Cadotte Site in Northern Wisconsin. *Midcontinental Journal of Archaeology, MCJA* 36(1):29-71.

2015 *Protohistory at the Grand Village of the Kaskaskia: the Illinois Country on the Eve of Colony*. Illinois State Archaeological Survey, Urbana, Illinois.

Mazrim, Robert and Duane Esarey

2007 Rethinking the Dawn of History: The Schedule, Signature, and Agency of European Goods in Protohistoric Illnois. *Midcontinental Journal of Archaeology* 32(2):145-200.

McCafferty, M.

2004 Where did Jean Nicollet Meet the Winnebago in 1634?: A critique of Robert L. Hall's "Rethinking Jean Nicollet's route to the Ho-Chunks in 1634". *Ontario History* 96(2):170-182.

McKern, W. C.

1939 The Midwestern Taxonomic Method as an Aid to Archaeological Culture Study. *American Antiquity* 4(4):301-313.

1945 Preliminary Report on the Upper Mississippi Phase in Wisconsin. *Milwaukee Public Museum Bulletin* 16:109-285.

McPherron, Alan
1967 *The Juntunen Site and the Late Woodland Prehistory of the Upper Great Lakes Area.* Anthropological Papers of the Museum of Anthropology, University of Michigan, Ann Arbor.

Melcher, Michael and Manfred Schreiner
2013 Glass Degradation by Liquids and Atmospheric Agents. In *Modern Methods for Analysing Archaeological and Historical Glass,* pp. 609-651. John Wiley & Sons Ltd.

Meskell, Lynn and R. W. Preucel
2004 Identities. In *A Companion to Social Archaeology*, edited by L. Meskell and R. W. Preucel, pp. 121-141. Blackwell, Malden, Mass.

Meyer, David and Patrick Young
2004 The Pendant Stones of Pasquatinow. *Canadian Journal of Archaeology / Journal Canadien d'Archéologie* 28(2):353-365.

Michelaki, K. and R. G. V. Hancock
2011 Chemistry versus Data Dispersion: Is There a Better Way to Assess and Interpret Archaeometric Data? *Archaeometry* 53(6):1259-1279.

Michelaki, Kostalena, Ronald G. V. Hancock, Gary Warrick and Dean H. Knight
2013 17th Century Huron Village Life: Insights from the Copper-based Metals of the Ball site, Southern Ontario, Canada. *Journal of Archaeological Science* 40(2):1250-1259.

Miller, Christopher L. and George R. Hamell
1986 A New Perspective on Indian-White Contact: Cultural Symbols and Colonial Trade. *Journal of American History* 73(2):311-328.

Miller, Daniel
2005 *Materiality*. Duke University Press, Durham.

Miller, Heather M.-L.
2007 *Archaeological Approaches to Technology*. Elsevier / Academic Press, New York.

Milner, G. R. and G. Chaplin
2010 Eastern North American population at ca. A.D. 1500. *American Antiquity* 75(4):707-726.

Minar, C. Jill and Patricia L. Crown
2001 Learning and Craft Production: An Introduction. *Journal of Anthropological Research* 57(4):369-380.

Morand, Lynn Louise

1993 *Craft Industries at Fort Michilimackinac, an Eighteenth-century Fur Trade Outpost.* Ph.D. dissertation, Department of Anthropology, University of Pennsylvania, Ann Arbor.

Moreau, J. F. and R. G. V. Hancock

1999 The Effects of Corrosion on INAA Characterizations of Brass Kettles of the Early European Contact Period in Northeastern North America. *Journal of Archaeological Science* 26(8):1119-1125.

2011 Copper-Based Kettles from Brador: A Contribution to the Study of Eastern Settlements of New France on the Shore of the Estuary of the St. Lawrence (Quebec, Canada). In *Proceedings of the 37th International Symposium on Archaeometry*, edited by Turbanti-Memmi, pp. 611-616. Springer-Verlag, Berlin.

Moreau, J. F., R. G. V. Hancock, S. Aufreiter and I. Kenyon

1997 Taphonomical and chronological studies of a concentration of Eurpean glass trade beads from Ashuapmushuan, Central Quebec (Canada). In *Proceedings of the VII Nordic Conference on the Application of Scientific Methods in Archaeology*, edited by T. Edgren, H. Jungner and M. Lavento, pp. 173-181. ISKOS, Savonlinna, Finland.

2002 Late French (1700-1750) to Early English (1750-1800) Regime White Glass Trade Beads From A Presumed Decorated Bag Found at the Ashuapmushuan Site (Eastern Central Québec), Canada. In *Archaeometry 98 Proceedings of the 31st Symposium*, edited by E. Jerem and K. T. Biro, pp. 613-619. BAR International Series.

Moreau, J. F., R. G. V. Hancock and M. Moussette

2004 Toward a Chrono-Seriation Method Based on European Trade White Beads in Northeastern North America. In *34th International Symposium on Archaeometry, pp. 85-90.* Institución "Fernando el Católico" (C.S.I.C.), Excma. Diputación de Zaragoza, 2006., Zaragoza, Spain.

Moretti, Cesare and Sandro Hreglich

2013 Raw Materials, Recipes and Procedures Used for Glass Making. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 23-47. John Wiley & Sons Ltd.

Mulholland, Susan C. and Mary H. Pulford

2007 Trace-element Analysis of Native Copper: The View from Northern Minnesota, USA. *Geoarchaeology* 22(1):67-84.

Nabokov, Peter

1996 Native Views of History. In *Cambridge History of the Native Peoples of the Americas*, edited by B. G. Trigger and W. E. Washburn, pp. 1-60. vol. Vol. 1. Cambridge University Press, Cambridge.

Nassaney, Michael
2008 Identity Formation at a French Colonial Outpost in the North American Interior. International Journal of *Historical Archaeology* 12(4):297-318.
2012 Decolonizing Archaeological Theory at Fort St. Joseph, An Eighteenth-Century Multi-Ethnic Community in the Western Great Lakes Region. *Midcontinental Journal of Archaeology* 37(1):5-23.

Nassaney, Michael and Jose Antonio Brandao
2009 The Materiality of Individuality at Fort St. Joseph: An Eighteenth-Century Mission-Garrison-Trading Post Complex on the Edge of Empire. In *The Materiality of Individuality: Archaeological Studies of Individual Lives*, edited by C. L. White, pp. 19-36. Springer.

Nassaney, Michael S., William M. Cremin, Renee Kurtzweil and Jose Antonio Brandao
2003 The Search for Fort St. Joseph (1691-1781) in Niles, Michigan. *Midcontinental Journal of Archaeology*, *MCJA* 28(2):107-144.

Nassaney, Michael, William M. Cremin and LisaMarie Malischke
2012 Native American-French Interactions in 18th - Century Southwest Michigan: The View from Fort St. Joseph. In *Contested Territories: Native Americans and Non-Natives in the Lower Great Lakes, 1700 - 1850*, edited by C. Beatty-Medina and M. Rineheart, pp. 55-79. Michigan State University Press, East Lansing.

Naum, Magdalena
2010 Re-emerging Frontiers: Postcolonial Theory and Historical Archaeology of the Borderlands. *Journal of Archaeological Method and Theory* 17(2):101-131.

Naunapper, Linda S.
2007 *History, Archaeology and the Construction of Ethnicity: Bell Type II Ceramics and the Potawatomi.* Ph.D dissertation., Department of Anthropology, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin.
2010 New Research on Bell Type II Ceramics. *The Wisconsin Archeologist* 91(1).

Nern, Craig F. and Charles E. Cleland
1974 The Gros Cap Cemetary Site, St.Ignace, Michigan: a reconsideration of the Greenless Collection. *The Michigan Archaeologist* 10(1):1-58.

Neville, A. C.
1906 *Some Historic Sites about Green Bay.* Proceedings of the State Historical Society of Wisconsin, 1905. State Historical Society of Wisconsin, Madison.

O'Gorman, Jodie A.
2007a The Myth of Moccasin Bluff: Rethinking the Potawatomi Pattern. *Ethnohistory* 54(3):373-406.

2007b Rehabilitating Old Archaeology Collections with GIS. *Collections: A Journal for Museum and Archives Professionals* 3(1):75-102.

Orfanou, V. and Thilo Rehren

2014 A (Not So) Dangerous Method: pXRF vs. EPMA-WDS Analyses of Copper-based Artefacts. *Archaeological and Anthropological Sciences*:1-11.

Orser, Charles

2010 Twenty-First-Century *Historical Archaeology*. *Journal of Archaeological Research* 18(2):111-150.

Overstreet, David F.

1993 McCauley, Astor, and Hanson -- Candidates for the Provisional Dandy Phase. *The Wisconsin Archeologist* 74(1-4):120-196.

1997 Oneota Prehistory and History. *The Wisconsin Archeologist* 78(1/2):250-296.

2009 The Mero Complex and the Menominee Tribe-- Prospects for a Territorial Ethnicity. *The Wisconsin Archeologist* 90(1 & 2):132-177.

2014 The Elusive Menominee-Protohistoric Potentials at Peshtigo Point. *The Wisconsin Archeologist* 95(1):50-64.

Panich, Lee M.

2014 Native American Consumption of Shell and Glass Beads at Mission Santa Clara de Asis. *American Antiquity* 79(4):730-748.

Paquette, James R.

1996 *Goose Lake Outlet #3 Archaeological Site Form (20 MQ 140)*. Michigan History Division, Office of the State Archaeologist.

Paterson, A.

2011 *A Millennium of Cultural Contact*. Left Coast Press, Incorporated.

Patterson, Thomas C.

2008 A Brief History of Postcolonial Theory and Implications for Archaeology. In Archaeology and the Postcolonial Critique, edited by M. Liebmann and U. Z. Rizvi, pp. 21-34. AltaMira Press, Walnut Creek.

Pavlish, L. A., R. G. V. Hancock and M. Ross

2004 Instrumental Neutron Activation Analysis of Copper-Rich samples from the Bead Hill Site, Ontario, Canada. *Historical Archaeology* 38(2):106-112.

Pearce, Nicholas J. G., William T. Perkins, John A. Westgate, Michael P. Gorton, Simon E. Jackson, Clive R. Neal and Simon P. Chenery

1997 A Compilation of New and Published Major and Trace Element Data for NIST SRM 610 and NIST SRM 612 Glass Reference Materials. *Geostandards Newsletter* 21(1):115-144.

Penman, John T.
1977 The Old Copper Culture: an Analysis of Old Copper Artifacts. *The Wisconsin Archeologist* 58(1):3-23.

Perttula, Timothy K.
2003 The Glass Beads from the 1686 La Belle Shipwreck, Matagorda Bay, Texas. Manuscript on File, Texas Historical Commission.
2006 *The Glass Beads and Sundry Other Beads from Fort St. Louis (41VT4), Victoria County, Texas*. Report submitted to the Texas Historical Commission.

Pfaffenberger, Bryan
1992 Social Anthropology of Technology. *Annual Review of Anthropology* 21:491-516.

Pleger, Thomas C.
1992 A Functional and Temporal Analysis of Copper Implements from the Chautaugua Grounds Site (47-MT-71), a Multi-Component Site Near the Mouth of the Menominee River. *The Wisconsin Archeologist* 73(3&4):160-176.
1998 *Social Complexity, Trade, and Subsistence During the Archaic/Woodland Transition in the Western Great Lakes (4000-400 B.C.): A Diachronic Study of Copper Using Cultures at the Oconto and Riverside Cemeteries.* Ph.D. Dissertation, Department of Anthropology, University of Wisconsin, Madison, Wisconsin.
2000 Old Copper and Red Ocher Social Complexity. *Midcontinental Journal of Archaeology* 25:169-190.

Pleger, T.C. and J. Stoltman
2009 The Archaic Tradition in Wisconsin. In *Archaic Societies: Diversity and Complexity across the Midwest*, edited by T. E. Emerson, D. L. McElrath and A. C. Fortier, pp. 697-723. State University of New York Press, Albany, NY.

Purowski, T., P. Dzierzanowski, E. Bulska, B. Wagner and A. Nowak
2012 A Study of Glass Beads from the Hallstatt C-D From Southwestern Poland: Implications for Glass Technology and Provenance. *Archaeometry* 54 (1):144-166

Quimby, G. I.
1963 The Gros Cap Cemetery Site in Mackinac County, Michigan. *The Michigan Archaeologist* 9(4):50-57.
1966 *Indian Culture and European Trade Goods*. The University of Wisconsin Press, Madison, WI.

Quimby, G. I. and James B. Griffin
1961 *Various Finds of Copper and Stone artifacts in the Lake Superior Basin.* Anthropological Papers, Number 17. Museum of Anthropology, University of Michigan, Ann Arbor, Michigan.

Radin, Paul
1923 [1970] *The Winnebago Tribe*. University of Nebraska Press, Lincoln.

Rapp, George R., James Allert, Vanda Vitali, Zhichun Jing and Eiler Henrickson
2000 *Determining Geologic Sources of Artifact Copper: Source Characterization Using Trace Element Patterns.* University Press of America, New York.

Reck, Todd Michael
2004 Reexcavating Michilimackinac: Use of Harris Matrices to Analyze Stratigraphy for the Purpose of Studying French Canadians living in the South Southwest Rowhouse of Fort Michilimackinac. Ph.D. Dissertation, Department of Archaeology, Boston University, Boston, Massachusetts.

Redfield, R., Ralph Linton and J. Herskovits
1935 *A Memorandum for the Study of Acculturation*. *American Anthropologist* 38:149-152.

Reetz, Elizabeth, Rodney Riggs, Charles Egeland, Jason Kennedy and Norman Meinholz
2008 *Life Near the Ledge: Additional Archaeological Investigations of Native American and Euroamerican Sites Located along S.T.H. 15 Hortonville Bypass in Outagamie County, WI*. Report on File, Museum Archaeology Program. Wisconsin Historical Society, Madison, WI.

Resano, Martín, Esperanza García-Ruiz and Frank Vanhaecke
2010 Laser Ablation-Inductively Coupled Plasma Mass-Spectrometry in Archaeometric Research. *Mass Spectrometry Reviews* 29(1):55-78.

Richards, John D., Patricia B. Richards and Brian D. Nicholls
1998 *Archaeological Investigations in the Carcajou Point Locale, Sumner Township, Jefferson County, Wisconsin.* Report on File, University of Wisconsin-Milwaukee.

Richards, Patricia B.
2003 I Should Have Dug Red Banks: Winnebago and Menominee Ethnicity, Identity, and Homelands. *The Wisconsin Archeologist* 84:243-249.

Richter, Daniel K.
2001 *Facing East from Indian Country: a Native History of Early America*. Harvard University Press, Cambridge, Mass.

Risjord, Norman K.
2001 Jean Nicolet's Search for the South Sea. *Wisconsin Magazine of History* 84(3):34-43.

Rizvi, Uzma Z.
2008 Decolonizing Methodologies as Strategies of Practice: Operationalizing the Postcolonial Critique in the Archaeology of Rajasthan. In *Archaeology and the Postcolonial Critique*, edited by M. Liebmann and U. Z. Rizvi, pp. 109-127. AltaMira Press, Walnut Creek.

Rohrbaugh, Charles L., Lenville J. Stelle, Thomas E. Emerson, Gregory R. Walz and John T. Penman
1999 *The Archaeology of the Grand Village of the Illinois. Report of the Grand Village Research Project, 1991-1996; Grand Village of the Illinois State Historic Site (11LS13), LaSalle County, Illinois.* Illinois Transportation Archaeology Research Program, University of Illinois-Urbana.

Rosebrough, Amy L., John H. Broihahn, Leslie Eisenberg and Heather Walder
2012 On the Edge of History: The Hanson Site (47-DR-0185), Clay Banks Township, Door County, Wisconsin. In *State Archaeology and Maritime Preservation Program Technical Report Series #12-001*. Wisconsin Historical Society, Madison, Wisconsin.

Roper, Donna, C.
1991 A Comparison of Contexts of Red Ochre Use in Paleoindian and Upper Paleolithic Sites. *North American Archaeologist* 12(4):-.

Sahlins, Marshall
1993 Goodby to Tristes Tropes: Ethnography in the Context of Modern World History. *The Journal of Modern History* 65(1):1-25.
1972 *Stone Age Economics*. Aldine-Atherton, Chicago.
1972 [2000] The Original Affluent Society. In *The Politics of Egalitarianism: Theory and Practice*, edited by J. Solway, pp. 79-98. Berghahn Books, New York.
1988 Cosmologies of Capitalism: the Trans-Pacific Sector of the World System. *Proceedings of the British Academy* 74:1-51.

Said, E.W.
1979 [2014] *Orientalism*. Knopf Doubleday Publishing Group.

Salkin, Philip H. (editor)
1989 *Archaeological Mitigation Excavations at Fox Lake, Dodge County, WI*. No. 50. Archaeological Consulting and Services.

Sanson, Guillaume, A. Peyrouin, Pierre-Jean Mariette and Plans Historic Urban
1976 *Amerique Septentrionale*. Historic Urban Plans, Paris; Ithaca, N.Y.

Sassaman, KennethE
2005 Poverty Point as Structure, Event, Process. *Journal of Archaeological Method and Theory* 12(4):335-364.

Sasso, R. F.
1993 La Crosse Region Oneota Adaptations: Changing Late Prehistoric Subsistence and Settlement Patterns in the Upper Mississippi Valley. *The Wisconsin Archeologist* 74:324-369.

Scheiber, Laura L. and Mark D. Mitchell (editors)
2010 *Across a Great Divide: Continuity and Change in Native North American Societies, 1400-1900.* University of Arizona Press, Tucson.

Schiffer, M. B.
2001 Toward an Anthropology of Technology. In *Anthropological Perspectives on Technology,* edited by M. B. Schiffer, pp. 1-16. University of New Mexico Press, Albuquerque.

Schortman, Edward M. and Patricia A. Urban
1998 Culture Contact Structure and Process. In *Studies in Culture Contact: Interaction, Culture Change, and Archaeology*, edited by J. G. Cusick, pp. 102-125. vol. Occasional Paper No. 25. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Schortman, Edward M., Patricia A. Urban and Marne Ausec
2001 Politics with Style: Identity Formation in Prehispanic Southeastern Mesoamerica. *American Anthropologist* 103(2):312-330.

Schroeder, David L. and Katharine C. Ruhl
1968 Metallurgical Characteristics of North American Prehistoric Copper Work. *American Antiquity* 33(2):162-169.

Schroeder, Sissel
2004 Current Research on Late Precontact Societies of the Midcontinental United States. *Journal of Archaeological Research* 12(4):311-372.

Sciama, Lidia D.
1998 Gender in the Making, Trading and Uses of Beads: An introductory Essay. In *Beads and Bead Makers: Gender, Material Culture and Meaning*, edited by L. D. Sciama and J. Eicher, B., pp. 1-45. New York, Oxford University Press.

Scott, Elizabeth
2008 Historical Archaeology of France in the New World. *International Journal of Historical Archaeology* 12(4):275-276.

Sempowski, M. L., A. W. Nohe, R. G. V. Hancock, J. F. Moreau, F. Kwok, S. Aufreiter, K. Karklins, J. Baart, C. Garrad and I. Kenyon
2001 Chemical Analysis of 17th-century Red Glass Trade Beads from Northeastern North America and Amsterdam. *Archaeometry* 43(4):503-515.

Sempowski, M. L., A. W. Nohe, J. F. Moreau, I. Kenyon, K. Karklins, S. Aufreiter and R. G. V. Hancock

2000 On the Transition from Tin-Rich to Antimony-Rich European White Soda-Glass Trade Beads for the Senecas of Northeastern North America. *Journal of Radioanalytical and Nuclear Chemistry* 244(3):559-566.

Shackelford, Alan G.

2007 The Frontier in Pre-Columbian Illinois. *Journal of the Illinois State Historical Society*. 100(3):182-206.

Shott, Michael J., Joseph A. Tiffany, John F. Doershuk and Titcomb Jason

2002 The Reliability of Surface Assemblages: Recent Results from the Gillett Grove Site, Clay County, Iowa. *Plains Anthropologist* 47(181):165-182.

Shugar, Aaron and Ariel O'Connor

2008 The Analysis of the 18th Century Glass Trade Beads from Fort Niagara: Insight into Compositional Variation and Manufacturing Techniques. Northeast *Historical Archaeology* 37(1):58-68.

Silliman, Stephen

2005 Culture Contact or Colonialism? Challenges in the Archaeology of Native North America. *American Antiquity* 70(1):55-74.

2009 Change and Continuity, Practice and Memory: Native American Persistence in Colonial New England. *American Antiquity* 74(2):211-230.

2010 Indigenous Traces in Colonial Spaces. *Journal of Social Archaeology* 10(1):28-58.

2013 What, Where, and When is Hybridity. In *The Archaeology of Hybrid Matierial Culture*, edited by J. J. Card, pp. 486-500. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

2015 A requiem for hybridity? The Problem with Frankensteins, Purées, and Mules. *Journal of Social Archaeology.* In Press.

Skinner, Alanson

1926 *Ethnology of the Ioway Indians*. Bulletin of the Public Museum of the City of Milwaukee 5(4):181-352.

Skrivseth, Janet

1950 University Scientists Study Indian Relics on Bay Shore. *Green Bay Press Gazette*, 29 May. Green Bay, Wisconsin.

Sleeper-Smith, Susan

2001 *Indian Women and French Men: Rethinking Cultural Encounter in the Western Great Lakes*. University of Massachusetts Press, Amherst.

2009 *Rethinking the Fur Trade: Cultures of Exchange in an Atlantic World*. University of Nebraska Press, Lincoln.

Šmit, Ž

2013 Ion–Beam Analysis Methods. In *Modern Methods for Analysing Archaeological and Historical Glass*, pp. 155-183. John Wiley & Sons Ltd.

Sommer, Jeffery D.

2013 *Report on the Archaeology of the Shiawassee National Wildlife Refuge: the 2012 Field Season.* Report on File, Historical Society of Saginaw County, Inc., Saginaw, Michigan.

Speakman, Robert, J., D. Glascock Michael, H. Tykot Robert, Christophe Descantes, J. Thatcher Jennifer, E. Skinner Craig and M. Lienhop Kyra

2007 Selected Applications of Laser Ablation - Inductively Coupled Plasma - Mass Spectrometry to Archaeological Research. In *Archaeological Chemistry*, pp. 275-296. ACS Symposium Series Vol. 968. American Chemical Society.

Speakman, Robert J., Hector Neff, D. Glascock Michael and J. Higgins Barry

2002 Characterization of Archaeological Materials by Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry. In *Archaeological Chemistry*, pp. 48-63. ACS Symposium Series Vol. 831. American Chemical Society.

Spector, Janet D.

1975 Crabapple Point (Je 93): an Historic Winnebago Indian Site in Jefferson County, Wisconsin. *The Wisconsin Archeologist* 56(4):270-345.

Speth, Janet M.

2000 *The Site Complex at Red Banks (47-Br-4/Br-31), Brown County, Wisconsin, as Seen Through Collections at the Neville Public Museum.* Neville Public Museum of Brown County, Report on File.

Speth, Janet M. and Seth A. Schneider

2004 *Testing at the Brown County Historical Soceity Gazebo and Parking Lot, Red Banks, Brown County, Wisconsin*. Report on File at the Neville Public Museum.

Staeck, John P.

2000 Echoing the Past: Reconciling Ethnohistorical and Archaeological Views of Ho-Chunk (Winnebago) Ethnogenesis. In Interpretations of Native North American Life: Material Contributions to Ethnohistory, edited by M. Nassaney and E. S. Johnson, pp. 88-117. The University Press of Florida, Gainesville.

Stein, Gil (editor)

2005 *The Archaeology of Colonial Encounters: Comparative Perspectives.* School of American Research Press ; James Currey, Santa Fe; Oxford.

Stelle, Lenville J.

1992 History and Archaeology: The 1730 Mesquakie Fort. In *Calumet and Fleur-de-Lys: Archaeology of Indian and French Contact in the Midcontinent*, edited by J. A. Walthall and T. E. Emerson, pp. 265-307. Smithsonian Institution Press, Washington DC.

2008 The 1730 Fox Fort: Historical Debate and Archaeological Endeavor. *The Wisconsin Archeologist* 89(1 & 2):86-97.

Stelle, Lenville J. and Michael L. Hargrave

2013 Messages in a Map: French Depictions of the 1730 Meskwaki Fort. *Historical Archaeology* 47(4):23-44.

Stevenson, Katherine

1985 Oneota Subsistence-Related Behavior in the Driftless Area: A Study of the Valley View Site near La Crosse, Wisconsin. Ph.D Dissertation, Department of Anthropology, The University of Wisconsin, Madison, Wisconsin.

1994 Chronological and Settlement Aspects of the Valley View site (47 Lc 34). *The Wisconsin Archeologist* 75(3-4):237-294.

Stojanowski, Christopher M.

2005 The Bioarchaeology of Identity in Spanish Colonial Florida: Social and Evolutionary Transformation before, during, and after Demographic Collapse. *American Anthropologist* 107(3):417-431.

Stone, Lyle M.

1974 *Fort Michilimackinac, 1715-1781: an Archaeological Perspective on the Revolutionary Frontier*. The Museum, Michigan State University, East Lansing.

Tanner, Helen Hornbeck

1987 *Atlas of Great Lakes Indian History.* Published for the Newberry Library by the University of Oklahoma Press, Norman.

Thwaites, Reuben Gold (editor)

1890 [2000] *Jesuit Relations.* 42 vols. Pawtucket, R.I.:, Quintin Publications.

1905 *Original Kournals of the Lewis and Clark Expedition, 1804-1806*. 7 vols. Dodd, Mead & Company, New York.

Tiffany, Joseph A. and Duane Anderson

1993 The Milford Site (13 DK1): A Postcontact Oneota Village in Northwest Iowa. *Plains Anthropologist* 38(145):283-306.

Tigerman, K.

2006 *Wisconsin Indian Literature: Anthology of Native Voices*. University of Wisconsin Press.

Titcomb, J.M.

2000 *The Gillett Grove Site (13CY2): A Postcontact Oneota Village in the Little Sioux Valley*. Iowa State University.

Trigger, Bruce G.

1978 *Handbook of North American Indians* 15, Volume 15, Northeast. Smithsonian Institution.

1987 *The Children of Aataentsic a History of the Huron People to 1660.* McGill-Queen's University Press, Kingston ; Montreal.

2006 *A History of Archaeological Thought*. 2nd Edition ed. Cambridge University Press, Cambridge.

Tronchetti, Carlo and Peter van Dommelen

2007 Entangled Objects and Hybrid Practices: Colonial Contacts and Elite Connections at Monte Prama, Sardinia. *Journal of Mediterranean Archaeology* 18(2):183-208.

Trudel, M.

1968 [1997] *Introduction to New France*. Holt, Rinehart and Winston of Canada.

Turgeon, Laurier

1997 The Tale of the Kettle: Odyssey of an Intercultural Object. *Ethnohistory* 44(1):1-29.

1998 French Fishers, Fur Traders, and Amerindians during the Sixteenth Century: History and Archaeology. *The William and Mary Quarterly* 55(4):585-610.

2001a French Beads in France and Northeastern North America during the Sixteenth Century. *Historical Archaeology* 35(4):58-82.

2001b Material Culture and Cross Cultural Consumption: French Beads in North America 1500-1700. *Studies in the Decorative Arts* 9:85-107.

2004 Beads, Bodies, and Regimes of Value: From France to North America c. 1500 - c.1650. In *The Archaeology of Contact in Settler Societies*, edited by T. Murray, pp. 19-47. Cambridge University Press, Cambridge.

Tyler, K. and H.B. Willmott

2005 *John Baker's Late 17th-Century Glasshouse at Vauxhall.* Museum of London Archaeology Service.

Ubelaker, Douglas H. and William M. Bass

1970 Arikara Glassworking Techniques at Leavenworth and Sully Sites. *American Antiquity* 35(4):467-475.

Van der Linden, V., E. Bultinck, J. De Ruytter, O. Schalm, K. Janssens, W. Devos and W. Tiri

2005 Compositional Analysis of 17–18th century Archaeological Glass Fragments, Excavated in Mechelen, Belgium: Comparison with Data from Neighboring Cities in the Low Countries. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 239(1–2):100-106.

van Dommelen, Peter

1997 Colonial Constructs: Colonialism and Archaeology in the Mediterranean. *World Archaeology* 28(3):305-323.

Van Dyke, Allen P. and Rodney E. Riggs

2003 *Archaeological Excavations at 47FD13 along Camp Shaginappi Road, Fond du Lac County, Wisconsin SHSW #91-0556*. Report prepared for Commissioners, Town of Calument Sanitary District No. 1.

Vanhaeren, Marian and Francesco d'Errico

2006 Aurignacian Ethno-linguistic Geography of Europe Revealed by Personal Ornaments. *Journal of Archaeological Science* 33(8):1105-1128.

Vidale, M., J. M. Kenoyer and Kuldeep Bhan

1992 A Discussion of the Concept of "Chaîne Opératoire" in the Study of Stratified Societies: Evidence from Ethnoarchaeology and Archaeology. In *Ethnoarcheologie: Justification, Problèmes, Limites,* edited by A. Gallay, pp. 181-194. Centre De Recherches Archéologiques, Juan-Le-Pins, France.

Voss, Barbara L.

2005 From Casta to Californio: Social Identity and the Archaeology of Culture Contact. *American Anthropologist* 107(3):461-474.

2008 `Poor People in Silk Shirts'. *Journal of Social Archaeology* 8(3):404-432.

Walder, Heather

2012 Compositional Analysis of Archaeological Materials from the Hanson Site. In *On the Edge of History: The Hanson Site (47-DR-0185), Clay Banks Township, Door County, Wisconsin*, edited by A. L. Rosebrough, pp. 103-122. State Archaeology and Maritime Preservation Program Technical Report Series #12-001. Wisconsin Historical Society, Madison, Wisconsin.

2013a Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) Analysis of Refired Glass Pendants from the North American Upper Great Lakes. In *Archaeological Chemistry VIII*, edited by R. A. Armitage and J. H. Burton, pp. 365-396. vol. 1147. American Chemical Society Symposioum Series.

2013b Stylistic and Chemical Investigation of Turquoise-Blue Glass Artifacts from the Contact Era of Wisconsin. *Midcontinental Journal of Archaeology, MCJA* 38(1):119-142.

2014 Appendix: LA-ICP-MS Analysis of Blue Glass Beads from Peshtigo Point. *The Wisconsin Archeologist* 95(1):62-64.

Walder, Heather, Yolona Ngandali and Jeffery A. Behm

2015 Revising the Community Plan of the Bell Site (47 WN 009): Processes and Outcomes of GIS Spatial Analysis. *Wisconsin Archeologist* In Press.

Walthall, John A. and Thomas E. Emerson

1992 Indians and French in the Midcontinent. In *Calumet and Fleur-de-Lys: Archaeology of Indian and French Contact in the Midcontinent*, edited by J. A. Walthall and T. E. Emerson, pp. 1-16. Smithsonian Institution Press, Washington DC.

Wanatee, Donald

2008 Effects of Euroamerican Incursions on the Social, Linguistic, Economic, and Religious Aspects of the Meskwaki Tradition throughout the Great Lakes Region. *The Wisconsin Archeologist* 89(1&2):200-202.

Webb, Clarence H.

1968 The Extent and Content of Poverty Point Culture. *American Antiquity* 33(3):297-321.

Webster, Jane

1997 Necessary Comparisons: A Post-Colonial Approach to Religious Syncretism in the Roman Provinces. *World Archaeology* 28(3):324-338.

Wedel, Mildred Mott

1981 The Ioway, Oto, and Omaha Indians in 1700. *Journal of the Iowa Archeological Society* 28: 1-13

1986 Peering at the Ioway Indians through the Mist of Time: 1650-circa 1700. *Journal of the Iowa Archeological Society* 33:1-74.

Wedepohl, Karl Hans and Klaus Simon

2010 The Chemical Composition of Medieval Wood Ash Glass from Central Europe. *Chemie der Erde - Geochemistry* 70(1):89-97.

Wedepohl, Karl Hans, Klaus Simon and Andreas Kronz

2011 Data on 61 Chemical Elements for the Characterization of Three Major Glass Compositions in Late Antiquity and the Middle Ages. *Archaeometry* 53(1):81-102.

Weeks, William Rex, Jr.

2009 *Antiquity of the Midewiwin: an Examination of Early Documents, Origin Stories, Archaeological Remains, and Rock Paintings from the Northern Woodlands of North America*, Ph.D. Dissertation, Department of Anthropology, Arizona State University, Arizona.

Weik, T.M.

2014 The Archaeology of Ethnogenesis. *Annual Review of Anthropology* 43(1):291-305.

Weisman, Brent R.

1989 *Like Beads on a String: a Cultural History of the Seminole Indians in North Peninsular Florida*. University of Alabama Press, Tuscaloosa, Ala.; London.

2007 Nativism, Resistance, and Ethnogenesis of the Florida Seminole Indian Identity. *Historical Archaeology* 41(4):198-212.

2012 Chipco's House and the Role of the Individual in Shaping Seminole Indian Cultural Responses to the Modern World. *Historical Archaeology* 46(1):161-171.

Wesson, Cameron B.

2010 When Moral Economies and Capitalism Meet: Creek Factionalism and the Colonial Southeastern Frontier. In *Across a Great Divide*, edited by L. Scheiber and M. Mitchell, pp. 61-78. The University of Arizona Press, Tucson.

Wheeler, Robert C.

1975 *Voices from the Rapids: an Underwater Search for Fur Trade Artifacts, 1960-73.* Minnesota Historical Society, St. Paul.

White, Carolyn L.

2005 *American artifacts of personal adornment, 1680-1820: a guide to identification and interpretation*. AltaMira Press, Lanham, MD.

2008 Personal Adornment and Interlaced Identities at the Sherburne Site, Portsmouth, New Hampshire. *Historical Archaeology* 42(2):17-37.

White, Richard

1991 *The Middle Ground: Indians, Empires, and Republics in the Great Lakes Region, 1650-1815.* Cambridge University Press, Cambridge.

Whittaker, William E.

2015 Determining the Age of GLO-mapped Trail Networks: A GIS Analysis of Northern Iowa. *Midcontinental Journal of Archaeology* 40(2):134-148.

Whittaker, William E. and Mark L. Anderson

2007 Note on Site: the Wanampito Site, 13BM16, A Prehistoric and Protohistoric Oneota Site Near Wavery, Iowa. Report on File, Office of the State Archaeologist, University of Iowa.

2008 Wanampito: An Early Ioway Site? *Newsletter of the Iowa Archaeology Society* 58(1)(205):4-5.

Wied, M., H.E. Lloyd and K. Bodmer

1843 *Travels in the Interior of North America*. Ackermann and Company.

Wilford, Lloyd A. and John W. Brink

1974 Hogback: A Proto-historic Oneota Burial Site. *The Minnesota Archaeologist* 33(1 & 2):1-79.

Wilson, Curtis L. and Melville Sayre

1935 A Brief Metallographic Study of Primitive Copper work. *American Antiquity* 1(2):109-112.

Winchell, N. H.
1881 Ancient Copper Mines of Isle Royale. *Engineering and Mining Journal* 32:184-186, 201-202.

Winsor, Justin
1894 *Cartier to Frontenac; Geographical Discovery in the Interior of North America in its Historical Relations, 1534-1700*. Cooper Square Publishers, New York.

Wisconsin Cartographers, Guild
2002 *Wisconsin's Past and Present: a Historical Atlas*. University of Wisconsin Press, Madison, Wisconsin.

Witgen, Michael J.
2012 *An Infinity of Nations: how the Native New World Shaped Early North America.* University of Pennsylvania Press, Philadelphia.

Wittry, Warren
1957 A Preliminary Study of the Old Copper Complex. *The Wisconsin Archeologist* 38(4):204-221.
1963 The Bell Site, Wn9, an Early Historic Fox Village. *The Wisconsin Archeologist* 44(1):1-57.

Wobst, H. Martin
1977 Stylistic Behavior and Information Exchange. In *For The Director: Research Essays in Honor of James B. Griffin*, edited by C. Cleland, pp. 317-342. Anthropological Papers, Number 61. Museum of Anthropology, University of Michigan, Ann Arbor, Michigan.

Wolf, Eric R.
1982 *Europe and the People without History*. University of California Press, Berkeley.

Woolf, Greg
1997 Beyond Romans and Natives. *World Archaeology* 28(3):339-350.

Wroth, Lawrence C.
1954 An Unknown Champlain Map of 1616. *Imago Mundi* 11: 85-94.

Appendix A: Extended Site Excavation Histories

For each archaeological assemblage fully or partially investigated in this project, this appendix presents technical excavation details, extended historical background, and information about related or nearby sites. Sites directly related to this project that were unavailable for complete study are also discussed and marked with an asterisk (*). Some sites are represented by only a handful of artifacts, while others produced enough materials to fill an entire storeroom, so the presentation of relevant artifacts varies according to the contents of each assemblage. Because many sites have been investigated numerous times, I review the previous excavation or collection history of assemblages examined, focusing on methods of investigations and conclusions of the original excavators. Whenever possible, the original principal investigator or other crew members have been consulted. I also note how each locale came to be part of the study sample.

A.1 The Lower Peninsula of Michigan and Straits of Mackinac

A.1.1 Marquette Mission (20 MK 82 and 20 MK 99)

The Marquette Mission site has a long history of investigation that produced vast quantities of cultural materials dated to the late seventeenth century. During the early excavations, archaeologists recognized that both Native habitation areas and French-style architecture were present, so the site was given two numbers: 20 MK 82 would refer to the actual "Mission" structure attributed to the Jesuit Father Marquette, while 20 MK 99 would designate the Huron village component, *Te Oshinchiae* (Branstner 1984); however, in practice, the site numbers refer to the same general area. The site was first excavated intensively in 1972 and 1973 during the prolific early career of James E. Fitting, who also summarizes previous preliminary investigations of Lyle Stone, and earlier avocational investigations at this locale (Fitting 1976a:105-108). Excavated materials from early investigations (Lyle Stone's preliminary work in 1971 and Fitting's 1972 season) could not be located at the Michigan Office of the State Archaeologist (MOSA), and some correspondence on file there indicates that these items may have been donated to the Mackinac Historical Society c. 1975, though this could not be confirmed. Fitting's second season of fieldwork went largely unreported, but a draft copy of his unpublished report on 1973 excavations and an unpublished map of all sites identified in Fitting's 1972 survey season remain on file at MOSA.

Charles Cleland and Susan Branstner of the Museum and Department of Anthropology, Michigan State University (MSU) conducted four field school seasons of excavation at the site from 1983 to 1986, which were reported in four successive volumes of interim reports (Branstner 1984; 1985; 1986; 1987). Branstner synthesized the historic records and findings of these archaeological projects as they related to Tionontate Huron acculturation and cultural contact theories in her dissertation (1991) but a final report on this series of archaeological excavations at the Marquette Mission site was never completed. Jodie O'Gorman returned to the site for one field season in 2001, and her findings are on file at the MSU archaeology laboratory. All of these excavation seasons recovered a diverse variety of trade items typical of late seventeenth century occupations. O'Gorman also compiled all of the artifact inventories and available spatial data from prior excavations, developing extensive spreadsheets and GIS mapping of the site in an effort to rehabilitate these research collections and better understand spatial relationships and activity areas at the site (O'Gorman 2007b). This research made it possible to access the materials that I needed to locate for my project as well as devise a sampling strategy to deal with the thousands of glass and copper-based metal artifacts in the MSU collections from this site.\

The St. Ignace locale has a rich history long-predating European contact, and this has been a strategic geographic location for thousands of years; the whole of the Straits area is virtually covered with archaeological sites. In the present study, Marquette Mission, Gros Cap, Norge Villiage, Lasanen (now repatriated), and Fort Michilimackinac are all in extremely close proximity with overlapping occupation periods. It can be difficult to determine if one is examining separate archaeological sites or simply different activity areas within a broader inhabited landscape. The relatively few materials from Norge Village will be considered separately from Marquette Mission. I added the Marquette Mission site to the regional project as an early comparative sample from an occupation contemporary with Rock Island and the Bell Site; contact with Michigan archaeologists that resulted from working with the Marquette Mission collections allowed me to find out about many more sites in the study sample, as addressed in other areas of this chapter.

Some artifacts from the Marquette Mission collection are listed in the site reports but could not be located during the metals analysis. Furthermore, there are differences between Branstner's counts and the MSU inventories (e.g. 60 pieces of copper mail listed in in the inventory for feature 121, but only 58 segments listed in Branstner 1984:172). Unique pieces, such as a "brass bowl" described from feature 154 as a "cup shaped brass dish, bowl, or spoon? Edges folded over" (Branstner 1985:104) and a brass harpoon fragment from feature 202 with "1 flat edge, 1 with one barb, perforated" (Branstner 1987:168), among other unique pieces, could not be located either. This confusion is a common pitfall of working with older collections.

A.1.2 Norge Village (20 MK 53)

James E. Fitting and his survey crew identified and preliminary excavated the site in 1972, beginning with two 5x10' test pits, which revealed nineteenth century historic European trash deposits above the earlier campsite. They returned in 1973 to excavate a small undisturbed area of the site before work began at the Marquette Mission site (Fitting and Lynott 1974:196).

They excavated four 10x10’ units and two 5x10’ units, excavating in arbitrary 6” levels and screening through ¼ inch mesh. No water-screening or flotation sampling was conducted, which may account for the lack of seed beads recovered during the project. The excavators did obtain a radiocarbon date from one feature attributed to the seventeenth century campsite component; this date was A.D. 1640 +/- 85 years (Fitting and Lynott 1974:225), which fits with the excavators’ interpretations of the small amount of material culture associated with this level. The nearby Marquette Mission site is a comparable and contemporary assemblage. I added the Norge Village site to my dissertation project at the suggestion of Dean Anderson while I was working at the MOSA on the Marquette Mission collections there.

A.1.3 Gros Cap (20 MK 6)

The Gros Cap site has a long history of informal and survey investigation. The spot was recognized by artifact collectors as a productive location to gather trade items for at least the last 70 years, and the most complete assemblages of artifacts likely now remain in private collections. G.I. Quimby both surveyed the site and met with private collectors to gain more information about materials recovered there, but he did not conducted subsurface excavations (Quimby 1963; 1966:125-133). Nern and Cleland catalogued additional avocational collections and expanded on Quimby’s work with collectors in this area, but they were unable to retain the artifacts for curation (1974). Artifacts known to be in these private collections tend to be much more complete than those recovered in later salvage excavations. Materials collected from the Gros Cap site include: iconographic rings, brass bracelets, glass beads, copper and brass projectile points, disks, tinklers and scrap, iron trade knives and axes, gun parts, iron nails, and assorted other unique trade items as enumerated in the above publications. Bone tools and marine shell personal adornments are also present. A far greater variety and quantity of glass beads were recovered by collectors than in excavations; examples are illustrated in Nern and Cleland's Figure 17 (1974:35).

The 1979 Michigan Technological University excavations were conducted as a test-pit survey of the area; pits were approximately 1.5 foot squares excavated predominantly by troweling and screened through ¼ in mesh. Cheesecloth wet-screening was used in instances of fishbone concentrations, but not as a general process. There were almost no beads of <¼ in diameter in the collection, and it seems likely that some seed beads were probably present in excavated deposits and may have fallen through the mesh in some cases. A great deal of the archaeological site may remain unexcavated and undisturbed by the highway at the location, though the extent of damage done by the extensive looting and collecting activities that have taken place there remains unknown. An original map of shovel test pits at the site is included here (Figure A.1)

The MTU collections from this work include several glass trade beads, though twelve white beads sent out for analysis at the SLOWPOKE reactor facility were lost after the sudden death of Ian Kenyon in 1997 (S. Martin personal communication and records on file at MTU). The results of the NAA analysis of these beads were never published, but they are available on file at MTU and continue to exist in a database compiled by Ron Hancock. The white beads are generally all antimony-opacified types, which consistently appear at the end of the seventeenth century on North American sites. I included the Gros Cap materials in my project at the suggestion of Dean L. Anderson of the MOSA.

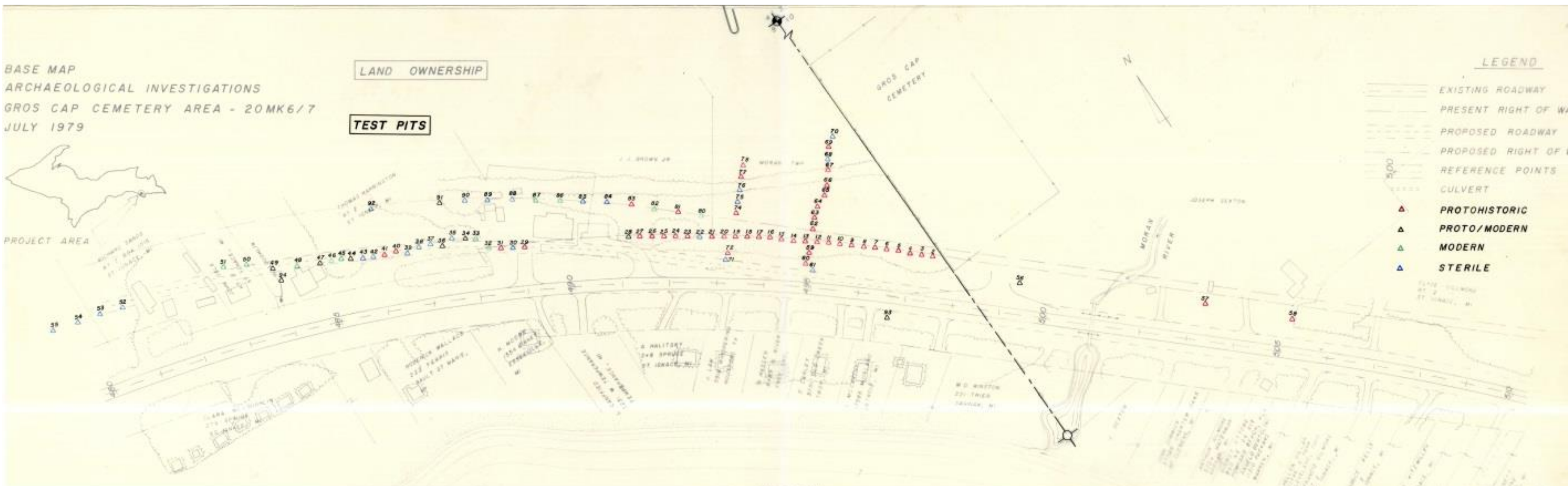


Figure A.1 Map of Test Pits from Gros Cap survey (Figure reproduced with permission from Susan and Patrick Martin, MTU)

A.1. 4 Fort Michilimackinac (20 EM 52)

Fort Michilimackinac has an extensive excavation history, with professional excavations sponsored by the Mackinac Island State Park Commission beginning in 1959. Lyle Stone's dissertation research synthesized the early years of work, and his site-specific typological system is used for nearly all artifact categories recovered on the site, including glass beads, tinkling cones, gun parts, crafting materials, religious artifacts, trade items, and other material culture of a French colonial fortification (Stone 1974). Foodways of colonial Michilimackinac have also been intensively investigated (see Scott 1985), and a recent study focused on the creolized and hybridized aspects of cooking during the French occupation of the site (Carlson 2012).

Fort Michilimackinac is unique in the study sample because it comes with documentary records of maps and personal accounts that identify particular individual inhabitants of many of the structures excavated over the years. Southeast Rowhouse, House D was originally occupied by Gabriel Bolon, a French soldier who married Suzanne Menard, a Metis woman. The couple was involved in the fur trade, and four of their children appear in French baptismal records (Evans 2001:6). The historical record is less clear about the specific occupants of the house during the era of British rule. However, the documentary evidence for the French occupation makes this locale a critical archaeological context for inclusion in the study because it provides an opportunity to compare material culture early eighteenth century French colonial contexts with that from explicitly Indigenous habitation contexts at the nearby Marquette Mission, which would have been occupied immediately prior to the founding of the Fort. Southeast Rowhouse House D is also one of the more recently excavated houses of the site, excavated in from 1989-1997 (Evans 2001), and based on the field records, I am confident of the French and Metis affiliation of artifacts selected for analysis from this context. Because no master list exists outlining any contexts that are strictly from French-affiliated contexts, I spent several days identifying additional individual metal artifacts from the inventory log books. This site was included in the dissertation research for the sake of its comparative value, and for the purposes of investigating possible material evidence of Suzanne Menard's Metis-community affiliations.

A.1.5 (20 CN 51)

20 CN 51 consists of a single deposit of trade-items disturbed during construction activities on South Huron St. in Mackinaw City, Michigan in 1992. A memo dated to Dec. 1st, 1992 to John R. Halsey from Dean Anderson documents the materials and remains on file at Michigan Office of the State Archaeologist (MOSA) (Anderson 1992). The trade items were noticed in a watermain trench backdirt pile after archaeologists were called to investigate a burial disturbed by the same construction activities. According to the memo, no artifacts were associated with the burial, and the trade items came from a localized part of the backdirt at least 30 feet from the burial pit. The trade items of 20 CN 51 therefore may or may not have been contemporary with the burial. Salvage excavation consisted of "combing" the backdirt with the teeth of a backhoe bucket and screening some of the backdirt through ¼ inch wire mesh. The Straits of Mackinaw have many contemporary historic sites, including Fort Michilimackinac, Marquette Mission, Gros Cap, and Norge Village. 20 CN 51 was included in the dissertation data set upon recommendation from State Archaeologist Dean Anderson of MOSA while I was investigating materials from Marquette Mission in their collections.

A.1.6 Cloudman (20 CH 6)

The Cloudman site on Drummond Island has a relatively long history of investigation, beginning in the 1930s; this history is summarized in the site report (Branstner 1995: 19-20). Several initial surveys recognized the historic trade items on the site (Franzen 1974; Demers

1991:110-118). These early investigations employed shovel tests along transects as well as investigations of the Cloudman family artifact collections as part of broader surveys of Chippewa County, MI. A burial area nearby was also located, and is listed within site 20CH15, the Cloudman site boundaries. Cloudman was formally excavated in 1992 and 1994 by Christine N. Branstner (now Stephenson), who was then a Graduate Research Assistant in Michigan State University's Department of Anthropology under the direction of Charles Cleland. During the MSU project the habitation area was excavated according to standard archaeological practices including the establishment of a grid system, shovel testing, and excavation in metric units conducted in arbitrary 5 cm levels with different soil colors and textures kept separated (Branstner 1995:15). All soils were screened through ¼ in mesh, with window screen used to collect smaller materials when deemed necessary, and flotation samples were collected from features and from each level.

Cleland's assertion that a copper knife recovered from the Cloudman family garden was made "using indigenous cold hammer technology but an exact replica of a French clasp knife" (Cleland 1999:280) could not be verified. An object matching the description of a cold-worked copper knife was located in the MSU collections, labeled as a "kettle brass knife" (HW-00349). The artifact comes from the Cloudman Garden Collection and has not been published before; working methods do appear to be cold-working of native copper, but the uncertain provenience of this piece does not rule out a strictly prehistoric origin of the piece. With assistance from Jessica Yann of the MOSA, I was able to consult further with Chris Stephenson about her excavations of the site and the provenience of the native copper "clasp knife" artifact. No further provenience information about the clasp knife could be identified.

The Cloudman site should be compared to other early sites in Michigan, especially the Goose Lake Outlet #3 site as well as those near the Straits of Mackinac. Cloudman was included in the dissertation data set because Cleland (1999) suggests that it is probably the oldest known historic site in Michigan; numerous other Michigan archaeologists also recommended that I investigate this site.

A.1.7 Mormon Print Shop (20 CX 59)

Nothing further to report.

A.1.8 O'Neill (20 CX 18)

The historic-era component of the O'Neill site was investigated as part of a larger project examining Late Woodland cultures in the Northern Lower Peninsula of Michigan (Lovis 1973). Crews from the Michigan State University Museum excavated the site in 1969 and 1971, using standard excavation methods of the time, which included screening through ¼ inch mesh and removal of feature material for flotation samples. While I was visiting MSU to examine the Marquette Mission collection, Lovis suggested that I examine the O'Neill collection.

A.1.9 Clunie (20 SA 722)

The Clunie site is named after Saginaw-area avocational archaeologist Robert R. Clunie, who drew attention to archaeological sites being destroyed by river erosion within the Shihiawassee National Wildlife Refuge. Professional investigations began in 1999 under the supervision of the Saginaw County Historical Society. To date, fifteen seasons of investigation have been conducted in the Wildlife Refuge, with Clunie being one of most intensively investigated sites in the survey. The goal of the survey is to document and salvage archaeological materials being exposed through erosion processes, and test excavations were conducted at Clunie to better understand the site occupants and their role in regional culture-history. Field methods employed at Clunie have included surface collection, shovel testing, standard 1x1 meter block excavations, as well as ¼ inch and 1/8 inch mesh screening and flotation of feature-fill (Sommer 2012:1-2).

The Clunie site beads and metal assemblage were included in the dissertation data set at the suggestion of Dean Anderson and Jessica Yann, who noticed the blue bead of the type being examined in the present study. Other early historic trade beads were recovered in the Saginaw area by James Payne of the University of Michigan in 1995 and 1996 from the Tobico Marsh State Game Area, near Saginaw Bay (20BY192) (Yann personal communication 2013). An undated newspaper clipping of an article reporting on the Tobico beads by Dave Wilkins, possibly from an Ann Arbor newspaper, is on file at MOSA. Beads from the Tobico Marsh site were not available for analysis during the study period, should be prioritized for future research.

A.1.10 Fort St. Joseph (20 BE 23)

A Western Michigan University (WMU) field survey re-located this French colonial fortification in 1998, basing their search on locations depicted on historic-era maps and using clues from other contemporary texts. Although the locale of 20 BE 23 has been listed as an archaeological site for years prior to the survey, this project was the first to explicitly seek to confirm the location of the fort through intensive survey and testing. The site itself is sandwiched between an old city landfill and bank of the St. Joseph River, which is higher today than in the past because of a damming project. The high water table and landfill overburden complicate the excavation of the site, but successive field schools have progressively revealed more artifacts and features that positively link this location to the historically documented Fort.

The nearby Lynn site terrace (20BE10) has yielded materials consistent with Native American occupation activities near a colonial fort, including earthernware ceramics, lithic debris, fire-cracked rock, and lead shot. Field school students are generally trained on excavation techniques on the Lynn terrace before moving down to the Fort site area itself. The 11th WMU field school at the site (conducted during summer of 2013) investigated architectural features, mainly fireplaces and structural materials, which had been identified in previous seasons (Nassaney and Brand 2013). Despite continuing work, it is not yet possible to internally distinguish French from British levels at the site, nor have the outer walls of the fort been located.

A.1.11 Lasanen* (20 MA 21)

The Lasanen cemetery site in St. Ignace Michigan appears to have been a Huron or possibly Huron and Odawa ossuary resulting from the celebration of a "Feast of the Dead" ritual sometime between 1670 to 1715, on the basis of material remains and skeletal elements from at least 137 individuals recovered there (Cleland 1971). Cleland speculated that the remains could have been interred during a particular ceremony recorded by Cadillac occurring at St. Ignace sometime between 1697 and 1697 (1971:93). Salvage excavations were conducted by archaeologists from the Mackinac Island State Park Commission and Michigan State University Museum in 1966. According to the repatriation report, burial artifacts included a wide range late of seventeenth century trade items including "knives, awls, harpoons, scissors, strike-a-lites, projectile points, finger rings, bracelets, a box, a sword pommel, buttons, bells, tinkling cones, saw parts, a trade silver cross, a pail, iron mail, Jesuit rings, and medallions; shell items including beads, pendants, runtees, effigies, and a gorget; catlinite pendants and beads; antler, bone, and ivory harpoons, points, fakes, containers, a comb, and buttons; chipped stone items including gunflints, scrapers, and projectile points; textiles; glass beads; and wood, charcoal, fabric remnants, ochre, vermillion, and animal bone fragments" (National Parks Service 1998)

The National Parks Service NAGPRA report of inventory completion dated to September 18th, 1998 notes that the Little Traverse Bay Band of Odawa Indians were identified as a likely descendant community of the individuals interred at Lasanen, and repatriation of the human remains and all artifacts proceeded following that notice. According to Marla Buckmaster, who participated in the original excavations as a student, the Lasanen family may have retained some of the human remains and artifacts (Buckmaster personal communication 2013). Cleland's original report also notes that "The recovered cultural material was loaned to the [MSU] Museum by [landowner] Dr. Lasanen, analyzed during the winter while this report was prepared, and was returned to Dr. Lasanen" (Cleland 1971:1). The 1998 repatriation report states that the human remains were donated to the Museum, and seems to imply that the associated funerary objects were also received at the same time. I attempted to contact the descendants of this family, and Buckmaster contacted Cleland to confirm her recollection, but the Lasanen family could not be reached for comment. It is possible, and perhaps likely, that some Lasanen site materials remain in a private collection.

Although the artifacts were no longer available for study during the course of this project, Cleland's report is well illustrated and it is possible to examine particular working styles of tinkling cones, a C-shaped bracelet, and "copper mail", the latter of which commonly appears in burials at the site. The small rolled "mail" beads are fastened around leather strips and used to decorate the surface (see Cleland 1971: Figure 17A and 21B). The rolled metal beads are very similar in appearance to those beads recovered by collectors at the nearby Gros Cap cemetery. Adornments decorated with "copper mail" seem to be a very distinctive burial item for individuals interred in the late seventeenth century at the Straits of Mackinac, and possibly in other regions. During my research at the Illinois State Museum, I noted the presence of a similar object in a collection from Starved Rock, Illinois, excavated by Robert L. Hall. The object appears to be a necklace or other adornment made using small rolled copper beads deposited intact. Kathleen Ehrhardt has examined the object in preparation for its reconstruction. Such objects are also present at the Zimmerman and Iliniwek village sites, as well as from the second Potawatomi occupation of Rock Island, and several other sites in this dissertation. Based on their widespread regional distribution but relatively limited chronological span copper mail may be more of a temporal rather than a social marker. Notably, the Lasanen burial assemblage contains only finished artifacts made of copper-based metal; there is no mention of the presence of any partially worked objects or "scrap." In this case, metal "scrap" may not have been a culturally appropriate burial item.

A.1.12 Summer Island* (20 DE 4)

Summer Island is located in the Garden Peninsula of Michigan, adjacent to the north and west from the Door Pensinsula and Rock Island site of Wisconsin. Davis S. Brose excavated the Summer Island site in 1967 and reports Middle and Late Woodland, and Oneota or Upper Mississippian materials (1970a), as well as a protohistoric component (1970a:199-223; 1970b). The site has long been recognized as an inhabited Native site, and Brose recounts this history beginning with a reference from Schoolcraft in 1851. Quimby surveyed the site in 1959 (Binford and Quimby 1963:227-307), and throughout the 1960s, various crews from the University of Michigan conducted additional surface collections, site survey, and test trenches. Brose's formal work on the site in summer of 1967 was his dissertation project under the direction of James E. Fitting, and Brose's publications on the site are revisions of his thesis.

Brose describes the protohistoric component as severely plow-disturbed in many places, but Area B of the site yielded undisturbed midden deposits and architectural postmolds interpreted as a structure surrounding two hearths. Nine undisturbed protohistoric features were excavated. Bay de Noc Notched Lip ceramics constitute majority of the assemblage, with additional examples of the Potawatomi-associated Bell Type II (Algoma Modified Lip), Garden Incised, and Summer Island Cordmarked, and a Lake Winnebago Trailed vessel. (1970a:201-207). Both native copper materials such as awls and Middle-Woodland style rolled beads, and European smelted copper-based metal objects are recorded, including tinkling cones and kettle rims. A total of 49 glass trade beads were recovered from features and units, including two dark blue opaque beads, nine barrel shaped opaque to translucent dark blue beads, and sixteen small dark blue opaque "seed" beads, for a total of 27 beads that would have been suitable for LA-ICP-MS, based on Brose's published description alone (1970a: 212). Brose classifies the trade items as nearly 80% related to the activity of personal adornment (1970a: 213). He is unable to assign a narrow date range based on the limited quantity of trade items present, suggesting AD 1625 to AD 1730 as the outside dates.

The Summer Island materials are now curated at the University of Michigan in Ann Arbor, but this institution was unable to facilitate my research requests, as the materials were under a research moratorium during the period of my dissertation data collection. The Summer Island collection should be prioritized for further research if at all possible, as this is a very rare instance of European trade items in direct and apparently undisturbed association with ceramic types associated with the early-mid seventeenth century.

A.2 Green Bay and Door Peninsula of Wisconsin

A.2.1 Rock Island (47 DR 128)

Nothing further to report.

A.2.2 Chautauqua Grounds (47 MT 71)

T. Pleger (1992) reports that George Fox and Harvey Younger first reported the Chautauqua Grounds site in the survey of Marinette County in 1918 (Fox and Younger 1918). Most archaeological materials from the site are dated to prehistoric periods, from the Early Archaic to the Late Woodland, based on projectile point typologies as well as a radiocarbon date from wooden material preserved inside a copper harpoon head. Chautauqua Grounds was placed on the National Register of Historic Places in 1997. It provides a data point along the Green Bay shoreline, north of Peshtigo Point, Red Banks, Point Sauble and other heavily surface-collected sites in the same area. The site was included in the dissertation data set at the suggestion of Thomas Pleger, who facilitated access to the Ernest Pleger surface collections.

A.2.3 Peshtigo Point (47 MT 165)

A long history of avocational surface collecting at Peshtigo Point, along with limited subsurface testing conducted by David Overstreet in 2010 and 2011 have produced a sizeable assemblage of historic materials. Overstreet has documented the surface collections as well as the results of his own investigations, which are compiled in a report on file at the College of the Menominee Nation (Overstreet 2011) and published in summary form (Overstreet 2014). Overstreet also conducted surveys determined that the site extended beyond the boundaries originally defined for site 47 MT 164, and much of the site is now located in wetlands inundated by the waters of Green Bay. Phase I shovel testing and surface survey at the site and collaboration with local avocational collectors Ron Strojny and Robert “Cubby” Couvillion helped Overstreet to identify the areas of the site that were most productive. Many artifacts that seem to be of early-mid seventeenth century origin have been recovered from the portions of the site that now are under shallow water. The lakeshore bottom is currently inaccessible as a result of encroachment from “Asian Phragmites,” an invasive species that thrives in this wetland environment (Overstreet 2014). Other sites in this immediate vicinity with comparable materials have been discussed in detail in Overstreet’s synthesis of Mero complex sites (2009). Sites in the same region that are relevant to this dissertation research include Chautauqua Grounds, Point Sauble, McCauley, Astor, and Red Banks. Peshtigo Point’s relationships to other sites in the area, especially the very nearby Chautauqua Grounds site, have yet to be determined

A.2.4 Hanson (47 DR 185)

Sites related to Hanson discussed elsewhere in Appendix A include surface collections from several other archaeological sites in the Door Pensinsula region: Clay Banks, La Salle Park, and Horn’s Pier. These nearby locales offer additional archaeological evidence that Eastern Great Lakes Peoples were becoming a presence on the landscape of Wisconsin during the mid-seventeenth century(Rosebrough et al. 2012:9). Red Banks and Point Sauble are also relatively close in proximity and time to the Hanson site and should be considered contemporary habitation areas. Hanson was the first site in my dissertation data set and the necessity to compare it with other regional early-contact locales provided the initial impetus for this project.

A.2.5 Red Banks (47 BR 437)

Materials surface-collected from Red Banks are curated in the collections of the Neville Public Museum as well as the Milwaukee Public Museum. Speth examined these collections and discussed the historic landownership and collecting activities at the site in a widely circulated but yet unpublished report (2000), which still is the best reference for researchers interested in working with the Red Banks materials curated by the Neville Public Museum. Speth notes that most artifacts in the Neville collections came from two donors: Frank J. B. Duchateau's 1927 donation, and John P. Schumacher's collections sold to the museum in the 1930s. Both of these men and their families collected in the general area of Red Banks during the late nineteenth and early twentieth centuries. Speth reports that a wide variety of prehistoric materials were recovered from Red Banks along with trade items and other artifacts that may come from later activities there. Trade items and material culture possibly associated with seventeenth century activities include stone projectile points metal artifacts, ceramic sherds, pipes, gunflints, shell artifacts, iron implements, an iconographic ring, glass beads, and copper-based metal scrap.

Limited subsurface testing on the Brown County Historical Society grounds at Red Banks, conducted by Janet Speth and Seth Schneider in 2004 (Speth and Schneider 2004), revealed nothing but disturbed ground and gravel fill. Local residents confirmed that an "Indian fort" had once existed in the nearby woods, but the fort was bulldozed years ago, with the spoil pile from the mound pushed over the embankment into Green Bay. By all accounts, it now appears that the Red Banks site has been completely destroyed.

Lurie and Jung's recent review of the evidence for Nicolet's landing devotes an entire chapter to tracing the historical references and archaeological investigations that took place at Red Banks (2009:71-94). Lurie recounts her own futile attempts to generate archaeological interest in the site in the 1970s before construction activities obliterated the archaeological deposits there. Patricia Richards expressed similar sentiments in her article, "I Should Have Dug

Red Banks" (2003), where she suggests that this site might have provided the most solid evidence linking Menominee and Winnebago groups of the historic period to prehistoric occupations in this region. Lurie and Jung do not support a Red Banks landing for Nicolet, but rather a landfall miles to the north, near the Menominee River (2009:113-124). They maintain that Red Banks was an important Ho-Chunk village of the seventeenth century and they argue that now-destroyed earthen mounds recorded in the Red Banks vicinity by Wisconsin scholars Morgan Martin (in 1851) and Charles E. Brown (in 1909) represent an ancestral Ho-Chunk link to prehistoric Aztalan, and that the earthworks arose as a defensive village to mitigate mid-seventeenth century inter-tribal conflicts exacerbated and to some extent recorded by the French explorer Nicolas Perrot (Lurie and Jung 2009). This argument is probably not testable given the remaining archaeological record in this region, but nevertheless, existing collections from the Red Banks vicinity can provide information about some of the earliest European explorations into Wisconsin.

A.2.6 Point Sauble (47 BR 101)

Joan Freeman reported on Point Sauble (or Sable) and the nearby Beaumier Farm sites in her master's thesis (1956). Freeman listed the former site as being about 8 miles north and east of Green Bay, in Brown Co. WI. (1956:7). Both locales were avocationally surface-collected for many years, and the surface collected materials that Freeman examined come from collections made from 1939 to 1950 by Robert L. Hall and Warren L. Wittry. Additional Point Sauble and Beaumier Farm collections may be present at the Neville Public Museum in Green Bay, but because these likely come from late nineteenth or early twentieth century surface collecting activities, not excavations, I did not prioritize them for analysis during this project. I added Point Sauble to my dissertation data set at the suggestion of Janet Speth.

A.2.7 Astor* (47 BR 243)

The Astor site is a small site on South Adams Street in a Green Bay, Wisconsin neighborhood that seems to have been an important locale of interaction during the seventeenth century and afterward in the history of this area. Overstreet discusses Astor as being a possible link between Oneota and protohistoric groups, along with the McCauley and Hanson sites (1993:142-156). Overstreet (working with the GLARC) conducted survey and testing at Astor in 1988. In these excavations, Feature 3, a historic refuse pit, contained a rectangular copper-based metal scrap, possibly with rivets, and a white glass seed bead along with Bell Type I and Oneota (Lake Winnebago Trailed) ceramic fragments. The two trade items are illustrated in Overstreet's Figure 15 (1993:150), and he has interpreted their presence in this pit as evidence of a possible protohistoric link between the Oneota and the Potawatomi. However, because the pit appears to be the result of historic (perhaps eighteenth century) trash disposal activities and since it is a disturbed context, this interpretation remains one of several possible depositional scenarios

The GLARC-excavated materials from the Astor site are presently curated at UW-Milwaukee, while the Grignon-house materials are currently at Lawrence University. The single piece of scrap metal and the white bead from the GLARC excavations were not analyzed in the course of this dissertation research, since their comparative value would be minimal to the overall dissertation project. Intact features likely remain on the Astor site property, and future investigations of a protohistoric component seem like the best way to expand on Overstreet's interpretation. James Yingst also excavated at the Astor site with support from the Neville Public Museum in 1992. He focused his publication efforts on the nineteenth century privy, attributed to the Grignon family (Yingst 1993), and although some protohistoric materials were apparently excavated during Yingst's investigations, these were never published (Behm 2008:63-64; Sasso pers. communication 2012). The materials that Yingst independently excavated appear to remain in his possession and could not be retrieved for analysis.

A.2.8 Beaumier Farm* (47 BR 60)

This site is located along the eastern shore of Green Bay, about two miles north of the Point Sauble site (Freeman 1956:8). Joan Freeman discussed Beaumier Farm as another locale in the Green Bay area where surface collectors and avocational archaeologists collected materials during the late nineteenth and most of the twentieth centuries. Freeman did not excavate at the site but summarized some of the avocational collections in her MA thesis (1956). Some materials from Beaumier Farm remain in the collections of the Neville Public Museum, while others are curated at the WHS. Because no materials come from excavated contexts, and no suitable beads were identified in my reviews of the surface collected materials, no artifacts from the Beaumier Farm site were included in this dissertation research. Beaumier Farm and Point Sauble are listed as "non-Mero" associated sites in Overstreet's 2009 summary, suggesting that these are not locales affiliated with the Menominee tribe. The cultural assignment of Lake Winnebago Focus Oneota proposed for Beaumier Farm (Freeman 1956) should stand, unless new excavations at the site demonstrate otherwise.

The early historic component of Beaumier Farm is also represented by a unique artifact in the possession of Kathleen Ehrhardt, given to her by the late Robert L. Hall. The artifact is piece of deer hide decorated with 68 rolled metal beads bent in a U-shape around the leather, with all closures on the same side. Ehrhardt documented the beads as being approximately 2.1 mm long and 2.7 mm in diameter (Ehrhardt 2005:111). Hall seems likely to have collected the piece while doing surface collections at the Point Sauble and Beaumier Farm sites with Warren Wittry sporadically from 1939 to 1950 (Ehrhardt 2005).

A.2.9 Clay Banks* (47 DR 005)

Clay Banks is a protohistoric locale in Door County, WI, which Robert L. Hall documented as part of a group of sites in a preliminary report on the "Iroquois Aspect" of ceramics in eastern Wisconsin (1947). He examined materials from Clay Banks, Horn's Pier (47 DR 006), La Salle Park (47 DR 0088) along with Point Sable (Sauble) (47 BR 0101) and Dykesville. On the basis of similarity to Eastern Great Lakes assemblages, Hall attributed the Clay Banks materials of the Neville Public Museum (NPM) to Huron peoples who were living in this region in the mid-seventeenth century. No known professional excavations were ever carried out at Clay Banks. The eastern shore of the Door Peninsula continues to be an important but relatively poorly investigated locale of protohistoric interaction in Wisconsin.

Some artifacts from Clay Banks were preliminarily examined in the course of this project. The Milwaukee Public Museum (MPM) curates surface-collected materials from the Thomson Archaeological Collection, Accession No. 25576. M.S. Thomson was an avocational collector in the Door County area, and museum accession records state that Mr. M.S. Thomson's materials were donated by his wife, Lucille Thomson, to the MPM in 1979. The collection includes Late Woodland and protohistoric-Huron style ceramics, as well as European trade items. The 25-piece copper-based metal assemblage (Thomson ID #1390) was not included in the dissertation data set because it did not have clear provenience information, and it possibly represents a biased surface sample biased toward recognizable ornaments or preforms over scrap (Figure A.2). Thomson recovered 48 glass trade beads (Thomson ID #1389) and what appears to be a fragment from the perforated end of a refired glass pendant (Figure A.3). In addition to his work at Clay Banks, Thomson also collected at the nearby Horn's Pier site. The Horn's Pier assemblage (also curated at the MPM) contains probable Late Woodland-style ceramics and miscellaneous bone and antler implements, but no trade goods. Requests to the MPM for permission to use LA-ICP-MS to analyze the glass beads from the Clay Banks site were not granted. I examined the Thomson collection materials from Clay Banks and Horn's Pier while visiting the MPM to research the McCauley collection, and was directed to Thomson's collections on the recommendation of Ms. Dawn Scher Thomae.

Figure A.2 Clay Banks copper-based metal assemblage from the Thomson collection, MPM

Figure A.3 String of blue glass trade beads from the Clay Banks site (above), and a close-up of the probable refired glass pendant fragment (below).

The nearby La Salle Park site assemblage is curated at the Neville Public Museum, Green Bay, WI. Rosebrough et al. recently revisited the La Salle park assemblage in a comparison with the Hanson-site burial materials (2012:9-11). This assemblage does include flattened B-shaped copper-based metal tubing, but no other trade items. However, the La Salle Park metals were not included in the present study because of their relatively unclear context, which Hall documented as eroding from the surface of a feature "immediately north of La Salle Park" (Hall 1947:35) along with protohistoric ceramics, a marine shell fragment, and pipe fragments. For further review of the historic ceramics from the MPM (Thomson collection) and NPM (Red Banks and La Salle Park), see Naunapper's dissertation research (2007:306-310).

A.3 Lake Superior Area (Ojibwe sites)

A.3.1 Goose Lake Outlet #3 (20 MQ 140)

This site was excavated with volunteer labor using standard 1x1 meter squares laid out in a grid system. However, without access to flotation equipment, the excavators devised a different method of recovering small items such as glass beads. The majority of cultural materials were recovered very near the surface of the site, so the artifact-bearing sod-layer was initially removed from each unit in small 20x20 cm chunks. Volunteers then screened the chunks through ¼ in mesh using trowels and hand-sorting to remove soil and artifacts from the dense root-mass of surface vegetation. All screened material then went through 1/16 in mesh (window screen), which is where the great majority of glass beads were found. A benefit of this method is that most beads found in screening are provenienced to the 20x20 cm portion of the unit and layer where they were recovered, rather than just to unit and level. Amazingly, two refitting halves of a single bead were recovered from different excavation units during the 2012 season, indicating that the recovery method was very effective. Most excavated material was screened in this way, though soil samples for flotation were collected from feature contexts.

I added this site to my dissertation site sample after Dean Anderson and Jessica Yann of the Michigan Office of the State Archaeologist initially brought it to my attention, and at the suggestion of Carol I. Mason, who has been assisting the excavators with artifact identification and dating of the site, as well as a more formal analysis of the iconographic rings (Mason and Paquette 2009).

A.3.2 Cadotte (Winston-Cadotte) (47 AS 13)

The Cadotte or Winston-Cadotte site on Madeline Island, WI was investigated in 1961 by Leeland Cooper of Minnesota's Hamline University. Cooper passed away before publishing the results of the investigation, but his materials and notes are curated at the Wisconsin Historical Society, and they were reanalyzed by Robert Mazrim in 2005 and 2006. Beloit College surveyed the site in 1974, and the Wisconsin Office of the State Archaeologist also conducted extensive survey at the site from 2003 to 2005 to clarify the site boundaries (Birmingham 2005). The site was placed on the National Register of Historic Places in December of 2005. In my project, I investigated the Cooper collection, which is now housed at the Wisconsin Historical Society. Surface finds are also present in the Madeline Island Museum collections, and they include materials collected by Al Galazen, who spend much of his life on the island collecting artifacts and researching local history. Galazen's collection included at least three refired glass pendants as well as blue glass beads, some of which also were analyzed in the course of this project.

Leeland Cooper's project was conducted using early 1960s methods of large block and trench excavations, covering more than 1300 square feet (Birmingham 2005). Post molds and other features were identified, but it is unknown (and unlikely) that the feature fill was preserved for further analysis. I presume that matrix was screened through ¼ inch hardware mesh, as all beads recovered are larger than this size. It also seems unlikely that the material was subjected to flotation, as no beads smaller than ¼ inch were present in the recovered sample. Mazrim (2011) presents additional details about Cooper's methods and total numbers of artifacts recovered.

Cooper identified a "clay floor" that probably separates later seventeenth century activities from earlier levels below, and it extends beyond the boundaries of Cooper's investigations (Birmingham 2005). Although Cooper did not publish at the time of his investigations, Quimby records a brief discussion of initial findings (Quimby 1966:115-116). The part of Cooper's assemblage coming from below the clay floor is minimal, and both metal and glass samples included in my dissertation project come from both below and immediately above the clay floor. Birmingham interpreted the clay floor itself as possibly related to the c. 1690s French fort, but notes that no artifacts specifically link the levels below the floor to a 1690s date. Birmingham argued that the floor is more likely to be related to the British-era occupation of the site associated with nineteenth century fur trader Michel Cadotte (Birmingham 2005, Section 7 pg. 3). Mazrim disagrees with the antiquity of material below the clay floor, stating that although "is thought to predate 1670, and has been traditionally interpreted as a post-1650 Huron refugee encampment," (2011:35) some of it may actually date to as early as the 1620s. He lists no citation for the "traditional" interpretation, although earlier in the article Mazrim does reference Quimby's brief statement about Cooper's initial impression of the sub-floor context as related to a Huron longhouse (Quimby 1966:116). Mazrim concurred with Birmingham that the clay floor itself probably is associated with Cadotte's activities (2011:33).

Mazrim published the results of his findings in *MCJA*, but an earlier technical report includes a critical data table that links artifacts identified to earlier and later components (2009: Table 1). Mazrim's method of distinguishing between Components 1 and 2 is unclear. To determine whether or not I thought a copper-based metal artifact should be included in my dissertation data set, I worked backwards through Mazrim's 2009 data table. If he published an artifact as coming from his Component 1, I also included the rest of the materials coming from that context, even when Mazrim (for reasons unknown) did not. I then systematically read through Cooper's original inventory cards, which are photocopied and bound on file at the WHS. When a metal fragment was present in one of the lower levels (Level 4 and below), I checked it against Mazrim's inventory to see if the artifact in the inventory matched the Component 1 assemblage listed in his article.

I do not agree with Mazrim's delineation of materials that belong to an "Isolated Component 1" sample. For example, Square 104SE was not included in his component 1 sample, but it is listed in Cooper's inventory as coming from below the red clay floor. It yielded 2 pottery sherds, 1 piece of glass, and a copper-based metal fragment (HW-00686). It is unclear why Mazrim excluded this context. In addition, the iron awl (WHS catalog # C2018) pictured in his image of the "Isolated Component 1" trade goods (2011: Figure 11f) comes from Trench 2, Square 124 SE, level 2, according to the inventory cards. This context also yielded window glass, blue transfer print pottery, and a square nail. Nothing in this level strikes me as indicative of a pre-1650s occupation, and the context is mixed at best and probably includes materials from at least the post-1690s. Level 2 is the level is generally associated with the clay floor itself.

Most problematically, two tinklers are illustrated and identified as coming from the "Isolated Component 1" sample in Mazrim's 2011 Figure 11c, C-654 and C567, with their catalog numbers clearly visible in the color image in his 2009 report (Figure 16). This is the same image as the MCJA article's Figure 11 (2011), but the catalog numbers are more clearly visible in color. These contexts do not seem to match actual contexts that are likely to come from Component 1, both according to the card catalog and Mazrim's own data table. C-654 is listed in the card catalog as Trench 2, Square 88 SE, level 2. Other materials listed in the card catalog for this context include: charcoal, faunal remains, a clay pipe stem, worked red stone, brass button, and china fragments. Square 88SE is not listed in Mazrim's 2009 table 1 as either yielding probable or possible Component 1 materials.

C-567 refers to Trench 3, Square 4 (North ½) Level 5. This context is also not listed in Mazrim's Table 1 (2009). It is more likely to be in an early context based on its depth and location below the clay floor, but the materials listed again are indicative of stratigraphic mixing even in the low levels. Materials listed as in association with this tinkler include: china fragments, square nails, tin scrap, glass fragments, clay pipe fragments, Native-made pottery, flint flakes, chert flakes, glass beads, and a silver ear bob. The presence of the silver ear bob is especially indicative of probably mid-late eighteenth or nineteenth century admixture in this context.

In Table 1 (2009), Mazrim lists 3 brass tinklers as coming from "Possible C1" contexts. Presumably, the two tinklers illustrated in Figure 11 are meant to be two of the three artifacts listed in the table, but as demonstrated above, they are not. Therefore, I attempted to identify tinklers in the WHS collections coming from the contexts listed in the table. One tinkler should come from 123SE L5-8, while two are listed from 186SE L4-6. I identified a tinkler (WHS ID C1957; HW-00693) from 123 SE L6. This square contained charcoal, another copper fragment (HW-00694), aboriginal ceramic rim and body sherds, and an iron fragment. The catalog describes 123 SE level 6 as an undisturbed layer 3-4" below the clay floor, a seemingly "possible" context for component 1 materials. Likewise, I found one tinkler from SE186 L5 (WHS C2884; HW-00696), which comes from below an undisturbed clay floor in level 4. The tinkler was associated with charcoal, bone fragments, rim and body ceramic sherts and a square nail. This again is a “possible” C1 context. A second tinkler from SE186 (as listed in Mazrim’s 2009 Table 1) could not be located in the collection. Neither of these two tinklers are illustrated in his report.

In short, Mazrim seems to have identified potential early historic contexts properly in Table 1 (2009), but incorrectly illustrated many non-C1 artifacts in his Figure 16 (2011) and Figure 11 (2011). This confusion does not lend credibility to tenuous arguments about the antiquity of historic trade items at the Cadotte site c. 1620. There is no material evidence to support (or falsify) this hypothesis, and some materials that Mazrim identified and illustrated as coming from Component 1 clearly do not seem to belong in this context.

This site was identified for inclusion in my study sample through initial investigations conducted at the WHS and by recommendation from Carol I. Mason. The Marina site, also located on Madeline Island, is a comparable habitation locale with clearly defined occupations beginning in the very late seventeenth century (Birmingham and Salzer 1984)

A.3.3 Marina (47 AS 24)

Working under extreme time pressure to excavate a large and culturally-rich area endangered by sewer line construction, the Marina site project documented four distinct occupation layers, including a small prehistoric activity concentration and extensive eighteenth century habitation deposits and cemetery areas (summarized in Birmingham and Salzer 1984:457-458). Archaeologists were recruited from all major archaeological programs and institutions in the region, and the report’s acknowledgments and crew rosters now read like a “who’s who” list of at least two generations of Wisconsin archaeologists. Because of the limited time frame, several different methods of excavation were applied in 1975. The site was divided into four areas, labeled by letter from south to north. Hand-removal of an overlaying road bed followed by complete excavation with matrix screened through ¼ in mesh was only used in area B, while power equipment removed the overburden followed by feature-targeted excavations using trowels was conducted in C and D. The southernmost portion of the site, Area A, was sampled with a series of 2x2m units. Soil samples from features were taken to the Beloit College laboratories to speed excavation and to ensure the recovery of small artifacts; many of the glass beads in my project's sample of this site come from these flotation samples. A field school from Beloit College returned to the site in 1977 to apply the more careful methods used in area B to parts of area D outside the sewer-line right-of-way on private properties. This allowed the excavators to gain a better understanding of stratigraphic relationships at the site. See Birmingham and Salzer (1984: 46-52) for a more detailed overview of excavation methods.

Trade items are abundant from the habitation areas as well as from mortuary contexts; in the course of my project I examined the Madeline Island Museum's collections, which come from the habitation areas only. All human remains and associated funerary objects are curated at the designated burials facility of the Wisconsin State Historical Society in Madison, Wisconsin, and I did not examine these materials in the course of this project. Of the twelve burials excavated during the project to prevent their destruction during the impending installation of the new sewer line, four may date to Quimby's "Middle Historic" Period (c. 1670 to 1760) and are relevant to the present dissertation research. According to Birmingham and Salzer, Burials 1, 3, 6, and 9 are the likely earliest interments at Marina, dated on the basis of artifacts interred with these individuals. Burial 3 is a male aged 18-20, and the excavators estimate estimated the date of burial to be c. 1715 to 1730, based on the presence a French clasp knife that is similar to one found on the Bell Site and five “engraved brass” iconographic rings (1984:407). Three of those rings are of the L-Heart variety, though no published images of them are available, and it is uncertain where they fit into Carol I. Mason’s recent reassessment of the iconographic ring chronology (see Mason and Ehrhardt 2009). Burial 9’s mortuary assemblage included a re-fired glass pendant and several blue glass beads, which the excavators interpret as evidence of a Middle Historic date for this individual (1984:403). No skeletal material was preserved in Burial 9, but the orientation and fill of this pit strongly suggested that it was burial feature. If permission were granted from descendant communities, LA-ICP-MS analysis of glass beads from the burials might shed some light on the chronological relationships among mortuary areas of this site.

A.4 Lake Winnebago Area and Arrowsmith Site (Meskwaki sites)

A.4.1 Bell (47 WN 9)

The Bell Site’s excavation history begins with avocational investigations and looting, documented in newspaper articles dating to the 1910s and 1920s (Behm 1999). Bell was systematically excavated for the first time in the 1950s to mitigate damage by quarrying operations, first by amateur archaeologist Neil Ostberg, and then by Warren Wittry (Wittry 1963), and Jeffery Behm conducted further research in the 1990s (Behm 1993, 1998, 2008). These excavations have allowed for the investigation of many aspects of Meskwaki life and activities on the site, particularly architectural patterns, ceramic usage, and mortuary practices (summarized in Alex 2008). A full review of these investigations has been published (Behm 2008: 32 -51).

This location has been described as a rare instance in Wisconsin of “site-unit ethnicity” (C. I. Mason 1997), meeting four criteria designed to match an archaeological locale to a site attributed to a particular ethnic group, as documented in historical records. These criteria include 1) physical evidence of European influence, particularly trade goods; 2) diagnostic indigenous artifacts, most likely ceramics, that allows for the attribution of a particular ethnic group to the site; 3) a historical document discussing the locality and inhabitants; 4) no serious incompatibility between any two of the previous criteria (R. J. Mason 1976). According to R. J. Mason, these are the stringent qualifications that must be used to link a modern ethnic group or tribe with an archaeological site. Cast iron grenade fragments and shrapnel were recovered at the site. This kind of weapon was only documented to have been used during the 1716 French attack on the Meskwaki village, positively linking documents and material culture to this location (Behm 1993b). For the current state of Wisconsin, R. J. Mason determined that only the Bell Site and the Rock Island Site and the Bell site meet all four of these criteria for a positive assignment of archaeoethnicity. However, Mason conceded that a more general term, "territorial ethnicity" may well be applied when some but not all of the criteria are met (see also Overstreet 2009).

Warren Wittry conducted three weeks of investigation at the Bell site in 1959, excavating large trenches and screening using ¼ in mesh. The excavator admits that they "would have been likely to have missed seed beads," (Wittry 1963:30), but he adds that none were noted during the project. Larger glass trade beads were recovered from these excavations, but none were sampled in the current project. I systematically recorded all copper-based metal artifacts from the Wittry collection, which is now curated at the Wisconsin Historical Society, including those artifacts from Wittry's investigations which are on display at the Wisconsin State Historical Museum. Wittry's original feature inventories have been compiled (Behm 1993b), and these were consulted to determine associated artifacts for all metal objects. Regretfully, some artifacts listed in these inventories were not located at the WHS or the museum, and should be considered lost.

The second sample of metal and glass artifacts comes exclusively from the surface collecting. In the 1960s and 1970s, an Oshkosh resident, James Peterson, visited the Bell site property both with other known avocational collectors and independently. He utilized a metal detector in some instances, amassing a collection of more than 200 cupric metal artifacts from the surface of the Bell site. 1n 1990, Peterson donated his entire collection of Bell site artifacts (including a full range of trade goods and ceramic fragments) to the UW-Oshkosh archaeology laboratory. While Petersen recorded some limited intra-site provenience information, such as “Upper Field West End” for some of the artifacts, most have no further context. The copper-based metal artifacts from the Peterson collection offer an opportunity to compare systematic excavation to less-systematic surface collection recovery methods at the Bell site. While other collectors, including Paul Koeppler, James Reed, and Neil Ostberg, and Richard P. Mason all amassed additional surface assemblages from the Bell Site and vicinity (Behm 1993b), Petersen’s was the most accessible for this project. Private collections retain archaeological value when they are tied to a particular site, especially a site as well-understood as Bell. Therefore, it was important to at least include a sample of one of the many known collections from the site.

The 1990-1998 investigations of the Bell site conducted by Behm and his UW-Oshkosh field school students have resulted in extensive publications and detailed lists and enumerations of the artifacts from the site. To investigate the metal artifacts, Behm generously provided complete access (in digital form) to reams of original field notes, excavation logs, artifact inventories, feature maps and photographs, and all of the original reports of investigations. In this way, I was able to connect particular artifacts to other materials recovered from the same feature or site area and investigate the metal processing techniques practiced at the Bell site in a very detailed way. Behm's interest in the site began when the Bell property became available for residential development in 1989. Efforts first focused on preserving intact portions of the site, and Behm's 1990-1993 field seasons worked to determine the site boundaries and the extent of undisturbed areas at the site, but preservation attempts were unsuccessful. Therefore, from 1996-1998, Behm conducted intensive salvage excavations before the construction of a residential neighborhood on the premises (Behm 2008: 35). The neighborhood plan was never fully completed, but there are unlikely to be significant intact deposits remaining there today.

All excavated material from the UW-O excavations was screened through ¼ inch mesh, which might have detracted from the recovery of seed beads, but samples of feature fill were recovered for flotation. This method should have recovered any seed beads, if they were present in great quantity. The relative paucity of seed beads in the assemblage (only approximately 150) at the site has been noted as anomalous (Lorenzini 1995). According to Lorenzini's masters research, more of the expensive and individually-produced would beads were recovered (67.6% of the total assemblage), in contrast with the cheaper, more easily mass-produced drawn beads (32.4% of the assemblage). The diversity of wound beads and relative paucity of seed beads in the Bell Site Bead assemblage continue to be puzzling aspects of this site.

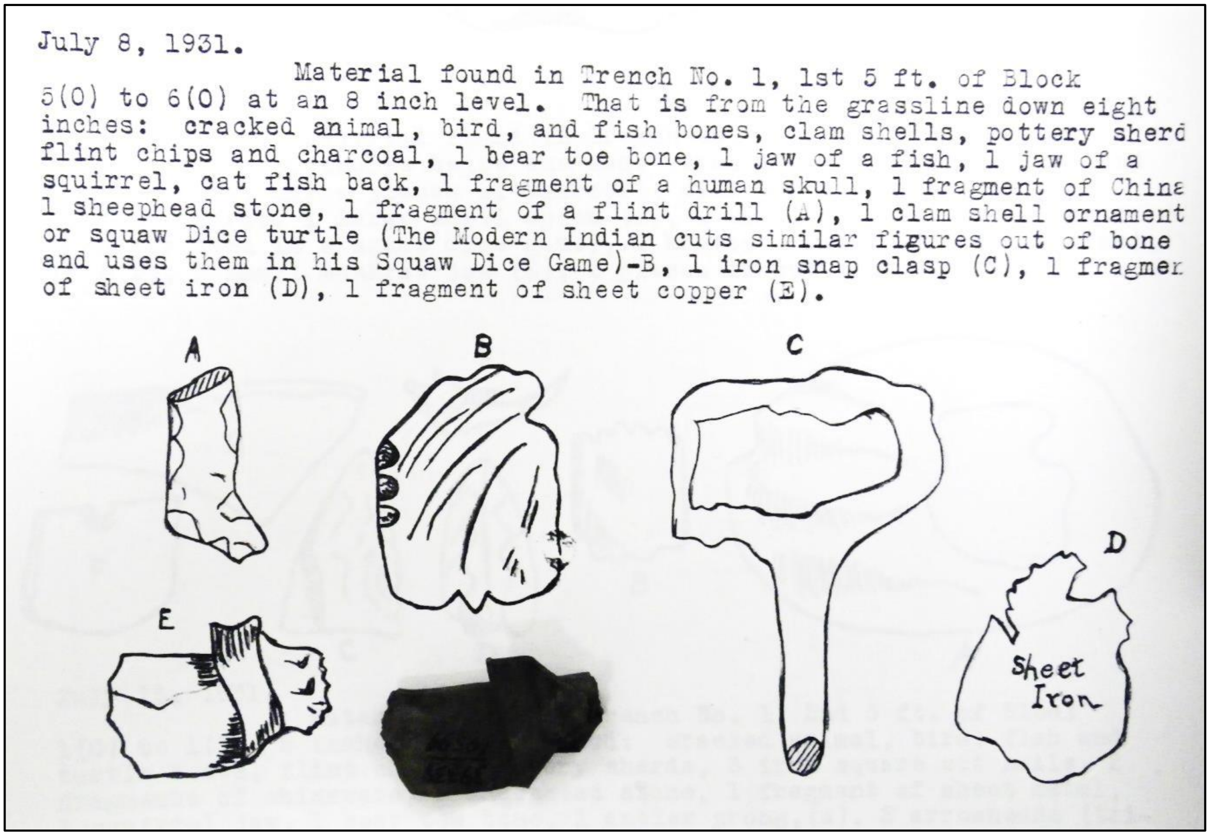
Because the Bell site offers the opportunity to study materials positively attributed to the Meskwaki, I chose to conduct a complete survey of all available copper-based metal artifacts from the site, including those from surface collections. This methodology has allowed me to compare the assemblages obtained through controlled excavations with those assemblages amassed by a collector in a less scientific way. Such a comparison is useful for understanding other assemblages or collections, and how they might differ from excavated materials.

Three distinct collections of artifacts from three very different programs of investigation at the Bell site constitute the site sample. By systematically examining artifacts collected using these different methods, I was able to discuss the effects of differential recovery practices at the site; these findings are discussed in the "Results" chapter of the dissertation.

Behm has extensively investigated the Meskwaki presence in Wisconsin, and in this research project, the Bell Site is comparable with other sites of possible Meskwaki influence, including Doty Island, Markman, Marina, Arrowsmith, and Mukwa in this research project. Other possible locales of Meskwaki habitation or presence in the seventeenth and eighteenth century are identified in Behm (2008). Future research on the migration of the Meskwaki could extend this sample to their nineteenth century residences in Iowa; an archaeological record of the Meskwaki once they leave Wisconsin is almost continuous and extends up to their present area of residence in Tama, Iowa.

A.4.2 McCauley (47 WN 222)

Excavations of this site took place in the early 1930s, and project director Arthur Kannenburg and his team dug in arbitrary levels of 6" and screened all their backdirt through ¼ inch mesh, and the field notes express the excavators' desire to locate small finds. Therefore, glass beads larger than ¼ inch were recovered. Excavations moved quickly, opening 5' blocks and progressing forward in trenches. Since the site was not excavated using natural levels, I believe that there was significant mixing of distinct cultural components in the arbitrary levels. However, Kannenburg's record-keeping was meticulous and improved as the project went on, and his daily notes include inventories and sketches of artifacts recovered in each level, so it is at least possible to determine which levels certainly contain admixture of materials from different time periods (Figure A.4).


July 8, 1931.

Material found in Trench No. 1, 1st 5 ft. of Block 5(0) to 6(0) at an 8 inch level. That is from the grassline down eight inches: cracked animal, bird, and fish bones, clam shells, pottery sherd flint chips and charcoal, 1 bear toe bone, 1 jaw of a fish, 1 jaw of a squirrel, cat fish back, 1 fragment of a human skull, 1 fragment of China 1 sheephead stone, 1 fragment of a flint drill (A), 1 clam shell ornament or squaw Dice turtle (The Modern Indian cuts similar figures out of bone and uses them in his Squaw Dice Game)-B, 1 iron snap clasp (C), 1 fragmen of sheet iron (D), 1 fragment of sheet copper (E).

Figure A.4 example of a reproduced copy of Kannenburg's notes, photographed with an artifact labeled "1 fragment of sheet copper (E)" placed to the right of to its sketch.

These detailed notes made it relatively simple, albeit time-consuming, to identify the provenience of copper-based metal artifacts and glass beads present in the collection and then to determine at least some of the other materials recovered in association with them. I approached the McCauley collection with the goal of locating any materials that might come from levels unquestionably attributable to a "protohistoric" situation.

To deal with the collection, I began with the lists of artifacts in Overstreet's 1993 article. These include: Table 1, Kettle Scrap; Table 2, Miscellaneous Metal; and Table 4, Brass

Tinklers/Cones. I requested artifacts matching the listed catalog numbers, and museum staff members retrieved these artifacts. I found that many of the accession numbers were difficult to read on the metal artifacts, and that they did not always match the numbers published in the report, or that provenience information would not match the information available in the report, or additional information could be found in the ledgers.

For example, artifact 39419/10594 is a possible lug or other kettle part, although it is not a "bail" or handle (Figure A.5). Overstreet lists no specimen number or provenience for this artifact. When I visited the collection, the object was curated in a labeled bag.

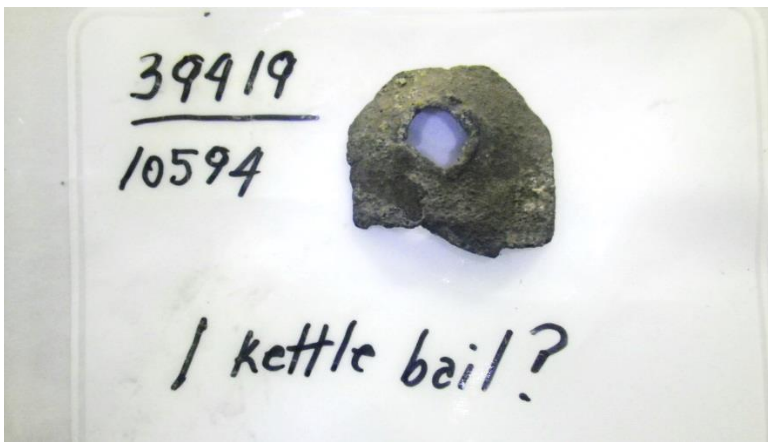


Figure A.5 Object identified as a kettle bail

I was able to locate the artifact in Kannenburg's notes, where its context is listed as coming from 12 in" below the surface of the 2nd 5ft of block 6 to 7. Figure A.6 shows this artifact and another copper-based metal fragment placed on a white piece of paper above their drawings (covering a drawing of a "Jew's harp, trade implement"). The cataloging ledger of the museum indicates these materials come from a 12-18 inch arbitrary level that contained ceramic sherds (likely Oneota) but also square cut nails, among other materials. Neither the possible "lug" nor the perforated piece of sheet copper from this mixed context can be considered definitively from the seventeenth century. The perforated square piece was curated in the same bag as the possible lug, accurately representing the fact that they came from the same context.

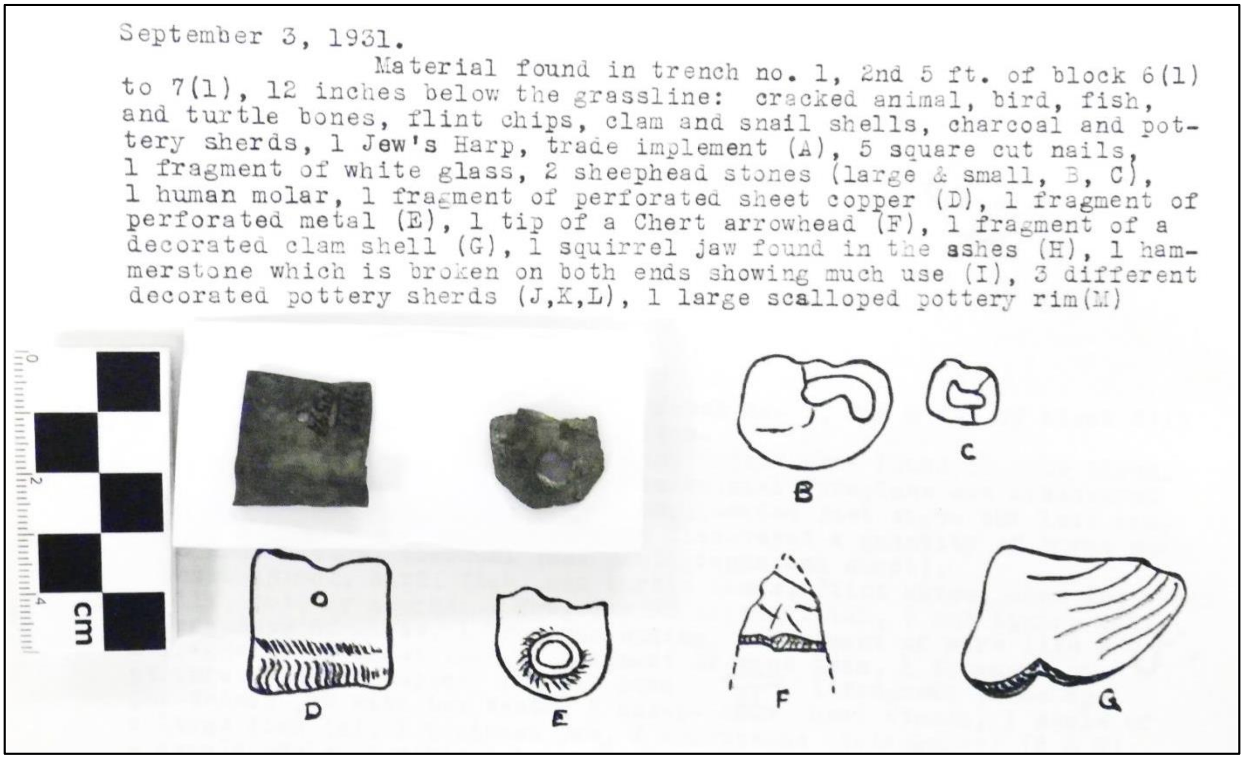
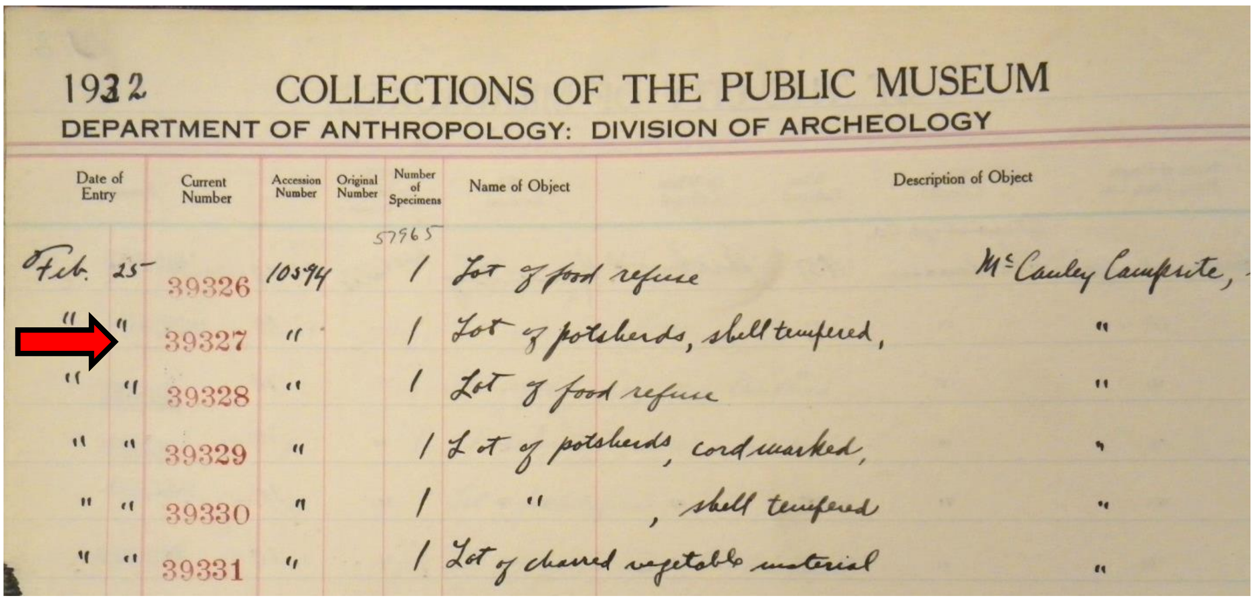

September 3, 1931.
Material found in trench no. 1, 2nd 5 ft. of block 6(1) to 7(1), 12 inches below the grassline: cracked animal, bird, fish, and turtle bones, flint chips, clam and snail shells, charcoal and pottery sherds, 1 Jew's Harp, trade implement (A), 5 square cut nails, 1 fragment of white glass, 2 sheephead stones (large & small, B, C), 1 human molar, 1 fragment of perforated sheet copper (D), 1 fragment of perforated metal (E), 1 tip of a Chert arrowhead (F), 1 fragment of a decorated clam shell (G), 1 squirrel jaw found in the ashes (H), 1 hammerstone which is broken on both ends showing much use (I), 3 different decorated pottery sherds (J,K,L), 1 large scalloped pottery rim(M)

Figure A.6: "Kettle lug" and perforated metal object photographed next to their drawings in the Kannenberg report

I proceeded to check every copper-based metal artifact listed in Overstreet's report against the original notes (Figure A.7). Some metal scraps do come from contexts that could be "protohistoric," but it is difficult to be certain, for example artifact 38721 (HW-00514) is a metal strip from a depth of 32" recovered with a lithic point, end scrapers, and chert fragments, according to the ledger. I found that some catalog numbers reported in Overstreet's tables did not match the number on the artifacts described. For example, artifact 39279/10594 is a bent rectangular metal piece. Overstreet lists this piece as 39327 and reports this context as listed in the museum's ledgers: "1 lot of potsherds, shell tempered, Square 14, level 15 in" (1993:131:Table 1, row 9). This would then seem to be a reworked piece of copper-based metal in a “protohistoric” context. However, the piece is clearly labeled 39279, and I located it along with a drawing in the found it in the original notes (Figure A.8 and Figure A.9). This piece does not come from a distinctly seventeenth century context, as a later historic “carving knife” was found in this layer as well as other materials.



1932 COLLECTIONS OF THE PUBLIC MUSEUM

DEPARTMENT OF ANTHROPOLOGY: DIVISION OF ARCHEOLOGY

Date of Entry	Current Number	Accession Number	Original Number	Number of Specimens	Name of Object	Description of Object
				57965		
Feb. 25	39326	10594		1	Lot of food refuse	McCauley Campsite,
" "	39327	"		1	Lot of potsherds, shell tempered,	"
" "	39328	"		1	Lot of food refuse	"
" "	39329	"		1	Lot of potsherds, cord marked,	"
" "	39330	"		1	" , shell tempered	"
" "	39331	"		1	Lot of charred vegetable material	"

Figure A.7: Original field notes from the McCauley site, arrow pointing to Catalog Number 39327 to indicate how confusion in catalog numbers can lead to incorrect assignment of provenience data

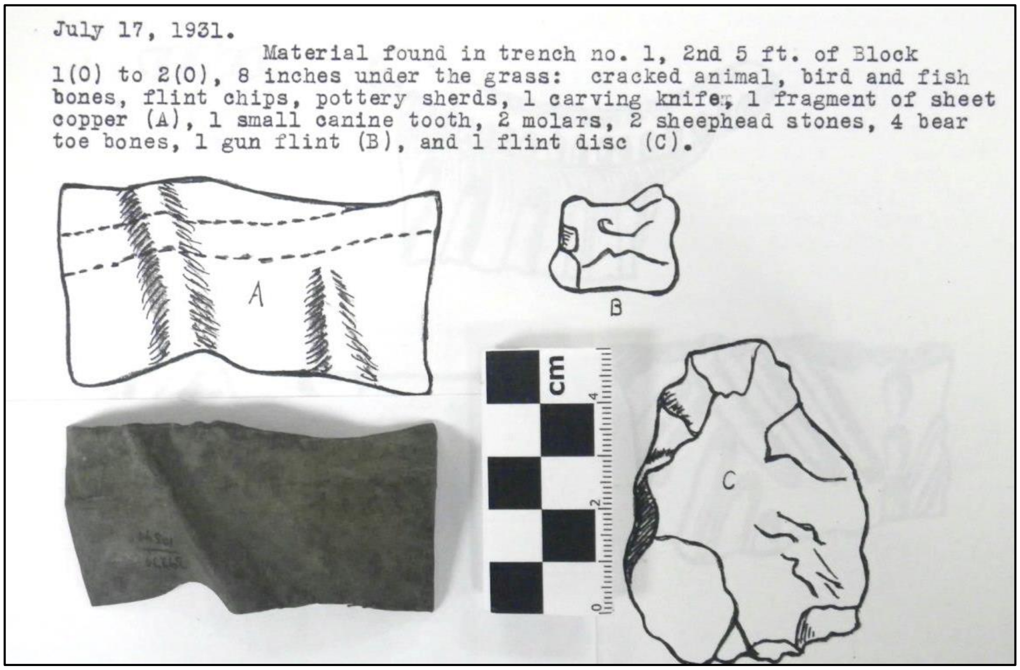


Figure A.8 Rectangular blank, artifact 39279, photographed with its drawing in the original field notes

Figure A.9 Artifact 39279 color-enhanced and rotated to show the catalog number

I followed this same procedure of backchecking the contexts of all the tinkling cones. By systematically reading the ledger, beginning with entries attributed to the first day of excavation in 1931, I tried to match individual metal artifacts to their contexts. This was a slow process, and I found that I needed to re-organize the tinkling cone collection in order to being to make sense of these artifacts. Their catalog numbers were difficult to read and some were wearing off, so I re-bagged them and double-checked each artifact to ensure that the number I assigned it matched records of tinklers in the catalog. Nine of the 12 tinklers cataloged in Overstreet's report are listed as having "uncertain" proveniences. Some of these issues may stem from Overstreet's reading of the catalog numbers; he lists two of the artifacts as coming from lots 90658 and 90597, however catalog numbers for the 1932 season only extended into the 40000s and were assigned sequentially, so lot numbers in the 90000s are impossible. I was able to identify provenience information for all of the tinkling cones and correct the error (Table A.1).

This table demonstrates that the provenience recording system that Kannenburg used was not internally consistent, making it difficult to understand spatial relationships at the site. While there do seem to be some tinkling cones in direct association with material culture attributed to the Oneota, such as Lake Winnebago Trailed ceramics at this site, I have not confirmed this with an examination of the McCauley ceramics themselves but infer this from descriptions in the ledger and drawings in the field notes. Additional re-analysis of the ledgers, maps, and fieldnotes might permit the identification of specific squares and excavation layers that produced only Native-made materials and seventeenth century trade items without admixture, and the collections could then be reviewed to see if this is the case. This detailed research was far beyond the possible scope of my project, but it seems that it could be done. There do seem to be intact levels of deposits below the upper layers that do not have eighteenth and nineteenth century material culture mixed in with them, and most of the historic materials seem to come from the first 6" level. Continued research with this collection would be necessary to quantify my qualitative and speculative assessments.

Table A.1: Table of verified catalog numbers, in order of the original publication (Overstreet 1993)

Overstreet Specimen #	**Verified catalog #**	**Provenience**	**Database ID**	Associated materials (limited) & justification for re-numbering
41087b/10903	41087b/10903	Trench 2, Section 7, Layer 4	HW-00499	2 other tinklers and a rolled bead (41087a)
40748/10903	40748/10903	Block 5 1X2-X1-X12, 2nd 6" layer	HW-00500	potsherds and brass trade pieces and a "copper piece, probably native" (40747)
40780/10903	40780/10903	Block 2, new diggings, 2nd 6" layer	HW-00501	potsherds, shell, and one other tinkler (40781)
90658/10903	40658/10903	Section 6, No. 2, Layer 2 and 3	HW-00502	pottery sherds, projectile points; in ledger as "trade piece"
40525/10903	40625/10903	Section 4, Trench 2, Pit 8 1x2 – 1x2	HW-00503	potsherds; 40525 is a ceramic rim sherd in the ledger, but 40625 is a "brass trade piece"
90658/10903	40607/10903	Block 1 and 2, 2" – 6"?	HW-00504	'German' incised trade piece, 40608 TC, lot of potsherds, chert projectile point. Re-numbered – matches DO piece measurements
41987c/10903	41087c/10903	Trench 2, Section 7, Layer 4	HW-00505	2 other tinklers and a rolled bead (41087a)
41087d/10903	41087d/10903	Trench 2, Section 7, Layer 4	HW-00506	2 other tinklers and a rolled bead (41087a)
40632/10903	40632/10903	Block 6, pits 3 and 4, 2nd 6" layer	HW-00507	Round incised metal "trade piece" and trade ring, metal button of wood covered with copper??
90597/10903	40697/10903	Trench 2, Section 6, Layer 1	HW-00508	Projectile point and potsherds
40781/10803	40781/10903	Block 2 new diggings, 2nd 6" layer	HW-00509	TC 40780, piece of shell and potsherds
40608/10903	40608/10903	Block 1 and 2, 2" -6"?	HW-00510	'German' incised trade piece, 40607 TC, lot of potsherds, chert projectile point
NONE, not reported	41073/10903	Block 9, 2nd 6" layer	HW-00498	"other prehistoric – copper ring and rim sherd"
NONE, not reported	41087a/10903	Trench 2, Section 7, Layer 4	HW-00512	3 tinklers

The daily field notes do not contain the catalog numbers that were used when the artifacts were added to the museum accessions, so the only way to link the ledgers and notes is to match the square and level information. For example, in the ledger (Figure A.10), tinkling cone 40632 is labeled as trade piece coming from Block 6 – Pits 3 & 4 2nd 6" layer, along with a round trade piece and trade ring. This allows me to match the piece to the fieldnotes (Figure A.11), which provide more information about all artifacts found in that layer: It is possible to connect these two documents in some but not all cases, and I did not have enough time to complete this task; however, it should be possible if a future re-analysis were undertaken.

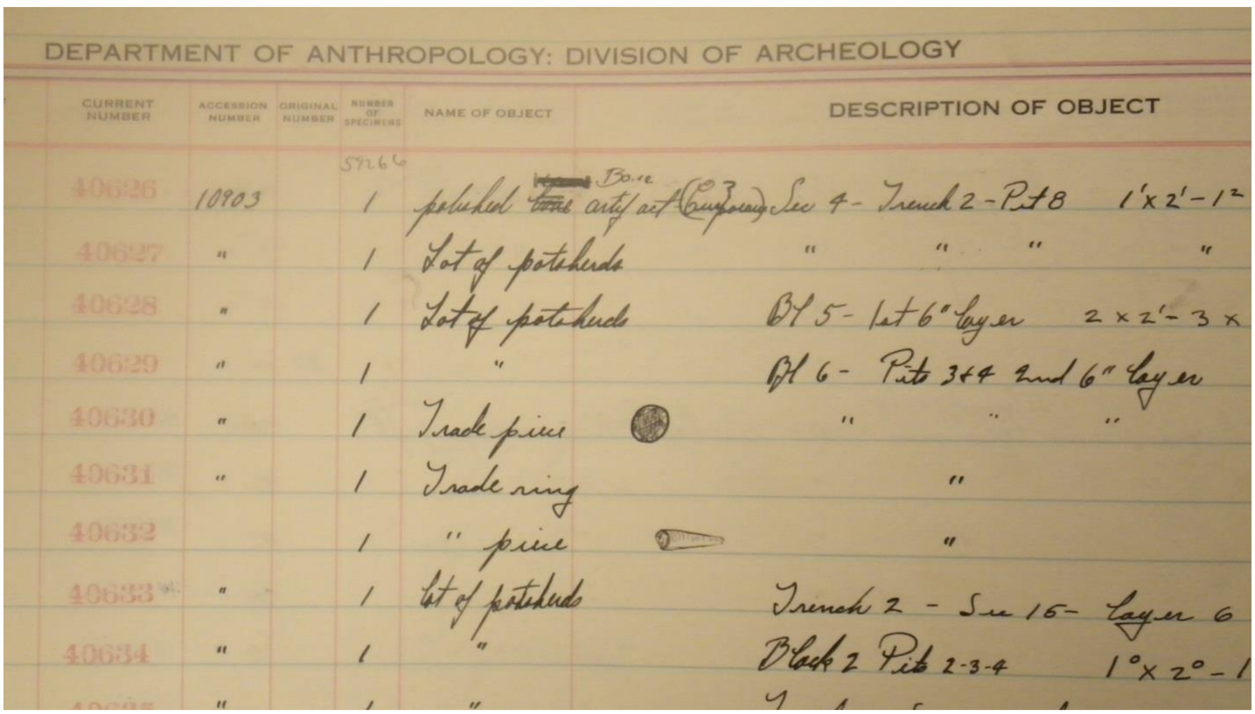
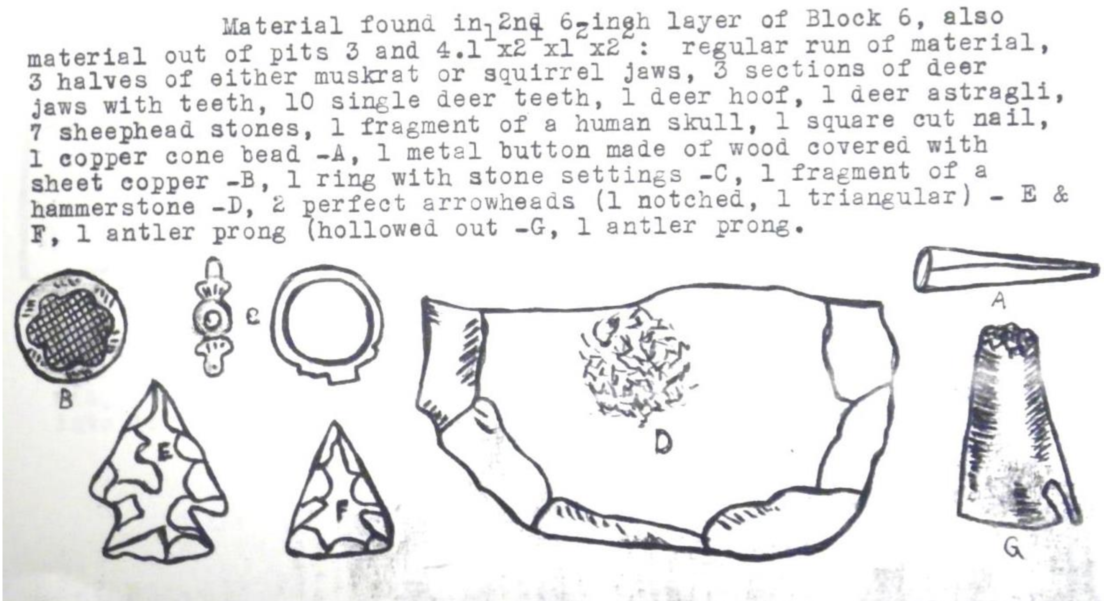


Figure A.10: Photograph of ledger, showing the provenience information for tinkling cone 40632



Material found in 2nd 6-inch layer of Block 6, also material out of pits 3 and 4.1'x2'x1'x2': regular run of material, 3 halves of either muskrat or squirrel jaws, 3 sections of deer jaws with teeth, 10 single deer teeth, 1 deer hoof, 1 deer astragli, 7 sheephead stones, 1 fragment of a human skull, 1 square cut nail, 1 copper cone bead -A, 1 metal button made of wood covered with sheet copper -B, 1 ring with stone settings -C, 1 fragment of a hammerstone -D, 2 perfect arrowheads (1 notched, 1 triangular) - E & F, 1 antler prong (hollowed out -G, 1 antler prong.

Figure A.11: Field notes with associated artifacts for tinkling cone 40632, showing that later historic buttons and rings came from same context

In his re-analysis of the collection, Overstreet stated, “During the cleaning and cataloging of each lot which consisted primarily of well-preserved faunal remains and shell tempered body sherds a considerable number of items manufactured from kettle brass or kettle brass scraps, iron scrap fragments, a kettle lug, seven gun flints, a few scraps of copper, some clay (kaolin) pipe fragments, and six glass trade beads were found. Assuming the contexts to be valid…” Overstreet accepted the artifacts as evidence the Lake Winnebago phase of Oneota occupation at the site extended into historic times (1993:125). Unfortunately, it is difficult to accept that all of the “protohistoric” materials come from single-component activity areas. There are many pieces of late historic refuse such as cut nails, screws, wire, bottle glass, buttons, buckles, pieces of trade silver and European-made ceramics, and other debris that reflect much later occupations incorporated with Oneota ceramics and historic-era trade items. Several of the glass bead types present in the assemblage continue in use well into the eighteenth century, and none of them fit into categories exclusively attributed to the seventeenth century. Because tinkling cones and other copper-based metal objects are found on Indigenous sites that extend much later in time, these artifacts are not temporally diagnostic and do not by themselves suggest an early historic date for layers in which they are recovered. Significant admixture of all of these materials appears to be occurring in the upper layers of the site, probably from plowing and from non-stratigraphic excavation methods used at the site in the 1930s.

In 1993, Carol L. Mason of the UW-Oshkosh Archaeology Laboratory surveyed the site and located the areas that Kannenberg had excavated in an effort to clarify the relationship between the trade items and the Oneota deposits (C.L. Mason 1994:46-47). She shovel tested on 5 meter intervals and collected flotation samples in an attempt to recover seed beads; flotation was negative for these artifacts. In a review of Kannenberg's notes on file at the Oshkosh Public Museum, Mason determined that none of the historic artifacts came from Oneota features; rather, all historic material came from the midden and burial contexts (1993:46). The midden and burials seemed to be those contexts closest to the surface and seem to have been largely disturbed contexts, and Mason suggested that "It seems [Kannenburg] was excavating a prehistoric Oneota cemetery with possible historic intrusive burials" (1994:47). Mason also assembled inventories from the McCauley site, which correspond well with the typed field notes present at the Milwaukee Public Museum. Mason appears to have complied her inventory from a duplicate copy of these notes on file at the Oshkosh Public Museum. C.L. Mason's report independently concurs with Overstreet that significant portions the site remained relatively undisturbed on private properties.

The blue glass beads from McCauley were photographed using the dinolite in preparation for LA-ICP-MS, but they all appear to be wound beads of types not generally recovered on sites clearly dated to the seventeenth century. The two intact blue beads are listed as types IIa46/47 and IIa55/56 respectively (Overstreet 1993). These are drawn types, generally small seed beads. However, the beads from McCauley in the Milwaukee Public Museum are wound and do not fit these categories.

McCauley is located in a regional landscape that could include Oneota villages with access to trade items at a “constellation” of sites in the Green Bay and Lake Winnebago areas that might also include unconfirmed contexts at Red Banks, Point Sauble, Doemel’s Point, Karow, and Butte de Morts (1993:182). Overstreet stresses that the presence of European-made items on these sites, and the trade connections among them connections are tentative and hypothetical but supportive of W.C. McKern’s hypothesized link between the Oneota and the historic Ho-Chunk or Winnebago (McKern 1945). My re-examination of the McCauley collection seems to support the possibility of Lake Winnebago Trailed Oneota pottery identifiable in relatively undisturbed contexts with European trade items now in the collections of the Milwaukee Public Museum. Despite the challenges of working with conflicting field notes, bound paper ledgers, and fading catalog numbers, the excavated materials are in good condition, and further work with the collections could be profitable. Investigating the McCauley collection revealed the pitfalls and potential rewards of utilizing existing collections, even those that are more than 80 years old.

A.4.3 (47 WN 853) (Lake Winneconne Park)

After a tree-tip event in 2001, Jeffery Behm of UW-Oshkosh salvaged a disturbed midden deposit before the Village of Winneconne removed the tree and refilled the hole. Initial recovery involved dry-screening the disturbed cultural deposits through ¼ inch mesh, but this was shifted to bulk sampling and transportation to the UW-Oshkosh campus for waterscreening through 1/16 inch mesh for the sake of recovery of smaller artifacts.

A.4.4 Markman (47 WP 85)

UW-Oshkosh field school investigations by shovel testing and several 1x1 meter units recovered significant quantities of cultural material dated to as early as the Middle Archaic period, but historic items from the site generally come from surface collections of highly eroded plowzone. According to Behm, few pit features remain below the plowzone and those that extend below the plowzone appear to have been heavily disturbed by rodent burrowing. It seems unlikely that further archaeological research at the Markman site would produce intact deposits.

A.4.5 Chickadee (47 OU 251)

Chickadee was first recognized through positive shovel tests conducted in a Phase I survey of the U.S. 45 highway corridor near New London, Wisconsin, while feature excavation was conducted by hand after mechanical removal of the plowzone conducted using a small backhoe monitored by the Museum Archaeology Program archaeologists. Soil samples of approximately 5 to 10 liters were retained for flotation from each feature contexts (see Reetz et al 2008:29 for an overview of field methods used). The excavators report that they excavated approximately 20 percent of the total site area, and that the remainder of the site left in situ would be undisturbed by further highway expansion in this area.

Other associated sites in this area that should be compared to Chickadee are the Markman site, the Mukwa avocational collections, and the more widely published Doty Island and Bell Sites. The Chickadee site was suggested for inclusion in the dissertation project by Marlin F.

Hawley while I was investigating collections from Warren Wittry's investigations at the Bell site curated at the WHS.

A.4.6 Doty Island (47 WN 30 and 47 WN 671)

Located at the north end of Lake Winnebago between present-day Neenah and Menasha, WI, Doty Island has a long history of archaeological investigation, with reports of historic artifacts documented by Increase Lapham, Publius Lawson, and Charles E. Brown (summarized in Mason and Mason 1993). The excavated areas of the Doty Island site are located on two adjacent parcels, both privately owned. Carol L. and Richard P. Mason attempted to identify the boundaries of historic occupations using shovel tests in 1990 (Mason and Mason 1993:210), but the outer boundaries of the habitation area are not well documented because it extends onto additional private parcels that could not be investigated. During excavations at the Village and Mahler portions, standard block 1x1 meter block excavation methods were employed, as well as screening of soils through ¼ in mesh and water screening through window screen to recover small finds. Undisturbed portions of the Doty Island site likely remain intact though neither landowner is amenable to further archaeological investigations at this time.

The Doty Island materials were included in this project early on, at the suggestion of Richard P. Mason and Jeffery Behm. R. P. Mason also provided access to the materials as well as to the original field notes, photographs, and color slides taken during the excavation of the site. Related sites is in the Lake Winnebago and Fox Valley region include Bell, Markman, and Chickadee. The eighteenth century temporal components of the Doty Island site and possible admixture made it difficult to delineate the earlier habitation activities in the lowest excavation levels, and comparative discussion with other sites in the region should clarify these temporal relationships.

A.4.7 Camp Shaginappi (47 FD 13)

This site was identified as a possible protohistoric site for further investigation during initial database searches of the BAR computer database in Madison, WI. Camp Shaginappi is relatively unknown and unpublished, except for the contract report by Van Dyke and Riggs (2003). Van Dyke and Riggs conducted standard CRM investigations, excavating 15 3x3 meter pits, screening most soils through ¼ in mesh, and screening feature fill through 1/16 in mesh to recover smaller artifacts. The collection of artifacts is now housed at UW-Stevens Point, but no further field notes or paperwork were present, and efforts to locate these documents failed. However, because of the completeness and excellent quality of the contract report, provided by the Wisconsin OSA, all necessary information was available during my work at UW-SP. It should be noted here that the excavations took place in sometimes below-freezing conditions from October to mid-November in Wisconsin but remained on-schedule due to diligent work from the excavators (Van Dyke and Riggs 2003:6). Of the many CRM-investigated sites examined in this dissertation research, this site probably best demonstrates the importance of synthesizing CRM contributions a regional scale.

A comparable Middle Historic archaeological site in the area of Camp Shaginappi is the Bell Site, although no definitively Meskwaki ceramics were identified at the former site. According to the contract report, Camp Shaginappi was included in the nomination of the Pipe Site (47 FD 10) for the National Register of Historic Places in 1978, but areas investigated in several 1991-1997 intermittent CRM projects were omitted from the NRHP nomination on the grounds that they were likely highly disturbed (Van Dyke and Riggs 2003). The actual relationship between Pipe and the expanded Camp Shaginappi sites remains unknown.

A.4.8 Arrowsmith (11 ML 6)

Arrowsmith is located in McLean county Illinois, positioned at the headlands of the Sangamon River, between Champaign and Bloomington-Normal. The site was investigated through field school surveys and excavations of Lenville J. Stelle and the students Parkland College during the 1980s and early 1990s (Stelle 2008). Artifacts were recovered from this site through surface collection, metal detecting surveys, shovel testing, and controlled excavations. Based on an extensive historic record of maps, journals, and other French documents, Stelle has identified the site as the probable location where, on September 9th, 1730, more than 500 Meskwakis were killed in conflict with French troops (Stelle 2008:87). Despite the relatively thorough period of archaeological investigations at the site, the assemblage recovered is small and probably reflects the limited time that the site was occupied. The site was included in the project as a comparative sample for other Meskwaki locales, including Bell, probably Doty Island, and other smaller sites where Meskwaki-style pottery has sometimes been identified.

A.5 Fox Lake and Koshkonong area

A.5.1 Elmwood Island (47 DO 47)

The Fox Lake sites of Elmwood Island and North Shore Village were investigated by the Archaeological Consulting and Services (ACS) firm in the 1980s and 1990s, but archaeological evidence of habitation on the island was first identified by Charles E. Brown and Leopold Drexel in a survey of the Fox Lake area (Brown and Drexel 1921:142-143). Brown and Drexel were the first surveyors to identify the Fox Lake locale as historically associated with the Winnebago (Ho-Chunk) during the early 1830s (1921:115), a sentiment echoed by later excavators (Salkin 1989:419). This initial survey also yielded trade items, including kettle scraps, firearm parts, iron trade axes, and some glass beads. ACS conducted several surveys and mitigation projects in the

Fox Lake area ahead of the construction of a wastewater treatment plant facility. Sewer line construction on Elmwood Island required the excavation of a trench covering approximately 1800 square meters, which was conducted entirely by hand-dug 1x1 meter units, since heavy equipment could not be brought to the location.

The glass pendant in the historic artifacts inventory (Salkin 1989: 214-215) is later described as a “cuff-link half” (Salkin 1989:227) and ultimately could not be located in the massive artifact collection; however, its description in the site report as transparent green faceted glass makes it clear that it is not a re-fired pendant produced from trade beads. The brass bead, identified as 55A-4, could not be located in the Madison collections. The bead is described in Salkin’s report as “tubular, with slightly tapered ends, and a round, raised thickening in the center. Length: 3.4cm, Diameter of raised center: .7cm, Diameter next to raised area: .5cm, Bore: 2mm, irregular” (1989:227).

The Elmwood Island site, along with North Shore Village was identified as a possible protohistoric locale to be included in dissertation research through my initial searches of the BAR computer at the Wisconsin OSA. Staff of the OSA provided a copy of the relevant contract report (Salkin 1989), and Danielle Benden facilitated the investigation of historic materials in the collections of UW-Madison.

A.5.2 North Shore Village (47 DO 39)

This site on the northern shore of Fox Lake was excavated during the ACS mitigation and surveys of this area in the 1980s (Salkin 1989). The historic habitation component is thought to be larger than that on nearby Elmwood Island, but more disturbed by modern driveways, utility trenches, and other activities. Unlike on Elmwood Island, it was feasible to bring in a grader to remove the plow zone and disturbed surface of the site. Soils were screened through ¼ in mesh, and a sample of 1x1 meter units excavated in the area of the proposed pipe line. Soil samples were taken for flotation.

As noted in Chapter 3, many of the historic copper-based metal artifacts that Salkin listed in his report could not be located in the site collection, despite extensive searches. It is unclear at what point the majority of copper-based kettle metal artifacts were lost, or why some but not all of the artifacts are missing. The collection was not re-bagged or inventoried when it was initially turned over to UW-Madison in the early 1990s, so it is unclear if the missing pieces were lost before or after this exchange. I have reproduced some portions of the contract report to provide further information about the missing artifacts. Salkin's report describes the "brass kettle fragments" as follows:

> "Seventy pieces of sheet brass or copper, most of which are probably from brass or copper trade kettles were recovered from the site. These are typically irregularly shaped small fragments, varying in thickness from .25mm to . Smm, sometimes perforated. Also included is a portion of rectangular handle attachment or lug, a fragment of kettle foot, and seven rolled, conical 'tinkling cones' made from copper or brass fragments." (Salkin 1989:473)

Although none of the tinklers described in this passage, nor the lug, were identified at UW-Madison, fifteen pieces of copper-based metal scrap, some of them with rivets, and one piece classified as a clip were located. Salkin described the tinklers in greater detail, this time listing eight, not seven artifacts:

> "Eight tinkling cones made from kettle brass were recovered...These cones vary in size (Plate 60), but appear to cluster in two groups, distinguished by their overall length:"

Artifact Number	Length (cm)	Diameter at Large End of Cone (cm)
24-4-6	1.6	.55 (flattened)
19-4-6	2.2	.5
12-3-3	2.0	.7 (flattened)
17-6-4	2.1	.75
17-6-4	2.0	.65
14-2-2	2.85	.7
17-4-2	2.8	.7
9-4-3	2.75	1.0 (flattened)

(Text and table from Salkin 1989:475)

Plate 60 of the report illustrated some of the more diagnostic pieces of copper-based metal scrap and tinkling cones, but the image reproduced in the report available to me (a photocopy copied several times over) is indecipherable. The caption of the image includes artifact ID numbers, some of which are not otherwise listed in the report. It reads as follows:

"Plate 60 47DO39 a.-e. Awls, 9-2-2, 4-4-13, 44-3-3, 36-3-3, 1-7-2 f. File Tail 16-4-7 g. Iron Fragment 14-4-4 h. Unidentified Iron Artifact 4-2-2 i. Stamped Decorative Iron Sheet F2 j. Brass Kettle with Handle Attachment 107-3-2 k. Brass Kettle with Foot Attachment 9-4-3 1. Perforated Brass Fragment 43-3-3 m. Perforated Brass with Repair 15-5-5 n. Perforated Brass 10-4-6 o -u. Tinklers, 9-4-3, 14-2-2, 19-4-6, 17-6-4, 17-4-2, 12-3-3, 24-4-6 v. Brass Ring 11-4-3 w. Brass Ring 110-2-3 x. Brass Ring 11-2-2"

(Salkin 1989:673).

Although the majority of the North Shore Village items could not be located in the course of this dissertation research, they may yet resurface at some point in the future.

A.5.3 Carcajou Point (47 JE 2)

Hall excavated Carcajou Point according to standard retrieval practices of the early 1960s (see discussion in Hall 1962:14-17). The disturbed plowzone was removed and presumably not screened, and excavations focused on the retrieval of artifacts from soil stains recognizable as cultural features, usually storage or refuse pits. Hall noted that looting was common on-site while excavations were taking place, and it seems possible that some materials were lost to this practice, possibly skewing the sample significantly. As was customary, he excavated in large 5 x 5 foot blocks, removing the plowzone from a total area of 2,670 square feet. These excavation practices differ significantly from the shovel testing, surface survey, and test excavations conducted by UW-Milwaukee at this site in later years.

Carcajou Point is directly related to the nearby Crabapple Point, an eighteenth and nineteenth century Winnebago village, and the Lake Koshkonong area in general is an important locale for continued investigation of possible early to middle historic activities. In 1975, Crabapple Point and Carcajou Point along with Rock Island, which was at that time unpublished and still being investigated (Spector 1975:275), and Old Birch Island, a Late Historic Burial site represented the only four known and excavated possible historic-era Native American sites in Wisconsin, demonstrating the significant progress made in 35 years of historic archaeological research in Wisconsin. Identifying possible seventeenth or early eighteenth century activities at Crabapple Point and Carcajou Point could be an important future direction for research in WI.

A.6 Western Neighbors (Ioway sites)

A.6.1 Farley Village (21 HU 2)

Archaeologists and collectors have been investigating this area since the early twentieth century, as summarized in Gallagher's report (1990:7-9). Excavation methods at the Farley Village site began with shovel testing along the highway easement, and proceeded through Phase 2 and Phase three unit excavations. Below the plowzone, soils were screened through ¼ inch mesh. Some of the overburden was removed by shovel skimming, while in other places, a backhoe was used to remove the disturbed upper layer. The area impacted by road re-grading was completely excavated. This process identified some intact features, and feature fill was removed for flotation, which ultimately led to the recovery of glass trade beads analyzed in this project. Farley Village was included in the dissertation sample at the suggestions of Kathy Stevenson and Connie Arzigian of the Mississippi Valley Archaeology Center, which was an easily accessible curation facility during the data collection process.

While there are other likely protohistoric Orr Phase Oneota sites in the gray literature of southeastern Minnesota and northeastern Iowa, a detailed exploration of these data was outside the bounds of the dissertation but will be an important avenue of exploration in future research. For example, the Yucatan Village Site yielded Orr Phase Ceramics in association with glass beads and copper-based metal object, but these materials were not examined during the dissertation project. They are most likely curated at the University of Minnesota's Department of Anthropology, which I did not have the opportunity to visit in the course of research. Also of note are materials from the now-repatriated Hogback Village Cemetery, which was excavated in 1947 and 1953 .There, archaeologists excavated the remains of 23 individuals who were interpreted as seventeenth century "protohistoric" Ioway peoples on the basis of the presence Orr Phase Oneota ceramics in concert with European trade items as grave goods (Wilford and Brink 1974). Items of European manufacture included: a turquoise "stone" bead that may very well have been a glass trade bead (see Wilford and Brink 1974: Plate 12d). Yucatan village and Hogback sites appear to be contemporary to Farley Village and probably represent places that were known to the latter village's inhabitants.

A.6.2 Wanampito (13 BM 16)

There is possible blue glass pendant fragment from the Wanampito site (Whittaker and Anderson 2007: 4). I did not have the opportunity to examine this particular artifact or include it in my study, but it is on display at the Heery Woods State Park Nature Center in Clarksville, Iowa, along with other blue glass beads from the site (Figure A.12). The pendant appears to be a re-fired glass object similar to others examined in my research project and should be prioritized for further analyses.

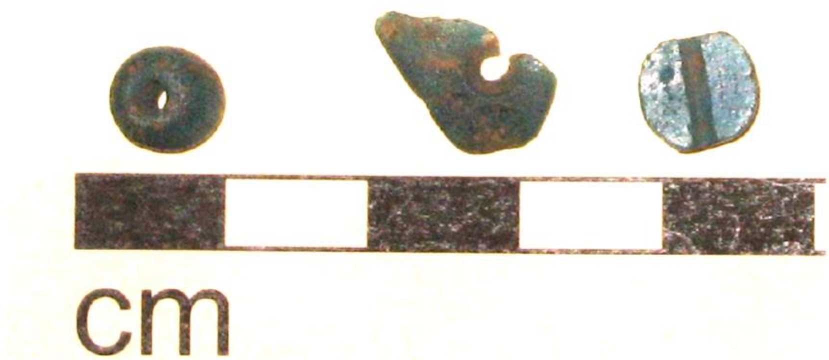


Figure A.12 Glass beads and pendant fragment from surface collections at Wanampito, on display at Heery Woods State Park Nature Center; not analyzed with LA-ICP-MS (Reproduced from Whittaker and Anderson 2007: Figure 15).

.

A.6.3 Milford (13 DK 1)

A 1978 field school was conducted on the site by the University of Iowa and the Office of the State Archaeologist of Iowa in cooperation with the Iowa Archeological Society, and investigation methods included surface collection, soil probing, augering, shovel testing, and eventually the designation of units to be investigated in three concentrations: North, East, and South. Material from excavated unites was excavated in 10 cm arbitrary levels, with flotation samples collected from each level and other soils screen through ¼ in mesh. The North Concentration was the least dense in features and artifacts recovered, while the South and East concentrations produced very similar assemblages of European-made trade items and Oneota cultural material (Tiffany and Anderson 1993).

A.6.4 Gillette Grove (13 CY 2)

Nothing further to report.

A.6.5 Valley View site* (47 LC 34)

The Valley View site is an Oneota site near present-day La Crosse, Wisconsin excavated by MVAC in 1979. The site lends its name to the latest phase of Oneota habitation in this locale, dated to the late sixteen century on the basis of radiocarbon dates and the known ceramic chronology for the region. See Boszhardt (1998) for a summary of the Oneota ceramic and radiocarbon chronology in the La Crosse area. Although some European trade items were recovered, including two purple glass beads, they seem to be nineteenth century material related to a later Winnebago component on the site. Field school students excavated a total of 91 features and water-screened feature fill through ¼, 1/8, and 1/16 inch mesh, and some samples were saved for later laboratory flotation (Stevenson 1994; 1985). Despite these methods, only a total of three trade beads were recovered, and all come from uncertain contexts not directly associated with any Oneota material. The excavator reported one "aqua colored seed bead" was recovered from an uncertain context within Feature 97 (1994:247) and this artifact could be prioritized for future analyses.

Local collectors routinely surveyed the site for decades prior to its commercial development, and they report European trade items consistent with seventeenth and eighteenth century exchange (A.J. Moore, personal communication, 2014). However, no definitively "protohistoric" materials were recovered during the professional excavation, although Stevenson reported 163 pieces of copper, though 128 of these are small copper flecks (1994:252). Such flecks could be the result of cold-working native copper or simply the degradation of larger copper objects. The collection also includes “9 fragments of coils made from rolled copper wire” (1994:252). These materials could be prioritized for future pXRF testing to determine if they are European-made copper. If so, they would constitute the only European trade items from this otherwise distinctly Oneota component.

The Valley View site materials were not included in the course of the dissertation research for the sake of consistency. The excavators consider the site to be a pre-contact Oneota site, and since there are hundreds of late pre-contact Oneota sites in the Midwest, it seemed outside of the bounds of this project. Although my dissertation research has developed the means to test this assertion, I did not recognize this site as having suitable materials for further analysis until after I had completed data-collection phase. Likewise, efforts to work with local collectors to facilitate loans of European trade items in their collections were unsuccessful during the period of dissertation data collection. However, in the future, I plan to test the single glass bead to see if it falls into a pre-1700 chemical subgroup and to test the rolled copper using pXRF to determine whether or not it is made of native or smelted copper.

A.7 Southern Neighbors (Illinois sites)

A.7.1 New Lenox (11 WI 213)

I included the blue glass beads from New Lenox in my dissertation’s LA-ICP-MS sample at the suggestions of Kathy Ehrhardt and of MARS founder and site investigator Rochelle Lurie. Ehrhardt conducted attribute analysis of the copper-based metal assemblage, so the metals were not included in my investigation.

A.7.2 Iliniwek Village (23 CK 116)

No comprehensive final report of excavations exists for the Iliniwek Site, but Ehrhardt summarized the discovery and excavation history of the site in her volume on metal-reworking practices (2005:96-104). Although this locale was probably well-known to collectors for much longer, it was only documented in state archaeological records in 1984. Early investigators immediately recognized the importance of the site as the possible village of "Peouarea" and extensive archaeological research at the site was carried out during the 1990s by the Missouri Department of Natural Resources, the Upper Mississippi Valley Archaeological Foundation/Western Illinois University, and the University of Illinois (Ehrhardt 2005:98). The presence of domestic architecture including longhouses and a stockade provide valuable information about the community plan of the site, and refuse or storage pits offer opportunities to study the spatial layout of trade items in spatial context with one another. The site was excavated using standard modern excavation methods of controlled level excavations within units and flotation of soil samples, with good recovery of archaeobotanical and faunal remains and small artifacts including seed beads. Other materials recovered on the site include Danner style shell-tempered ceramics, triangular projectile points and other stone tools; red stone pipe fragments; iconographic rings; glass trade beads; tinkling cones and other materials made from copper-based metals; iron awls, knives, and axes; and both French and native-made gunflints (Grantham 1993).

A.7.3 Zimmerman (11 LS 13)

This site has a long history of professional excavation, beginning with James A. Brown (1961) and Margaret K. Brown (1975). Additional work in the 1990s expanded on their findings, and they recognize Zimmerman site as the "Grand Village of the Illinois (Rohrbaugh et al 1999).

Mazrim's recently published volume on his re-analysis of Margaret K. Brown's investigations at Zimmerman (Mazrim 2015) include a discussion and some photographs of the glass trade beads and metal artifacts recovered. Archaeologists working in Illinois have continued investigate the peoples of protohistoric period of this region and their possible relationships to material culture recovered archaeologically. Ehrhardt reviewed earlier literature (e.g. Brown and Sasso 2001; Walthall and Emerson 1992; Mazrim and Esarey 2007) and argued that while significant progress has been made in linking proto-historic groups of the historically documented Illinois to Danner-style ceramics, the timing of interactions with Europeans, the spatial distribution of ceramic styles, and their probable ethnic affiliations are "far from resolved" (Ehrhardt 2010:266).

In the course of my project, I analyzed materials from Rohrbaugh's excavations, using the original site report to identify contexts where Danner-style ceramics were in clear and undisturbed association with trade items to select my glass bead sample. Extensive screening of the plowzone resulted in a large collection of artifacts that could not be directly attributed to a particular social or ethnic group, and these surface-collected materials were not included in my sample. I added Zimmerman to my dissertation data set at the early suggestion of James A. Brown and after further discussion with Charles L. Rohrbaugh and Kathleen Ehrhardt. The site should be considered in comparison with the Iliniwek Village site as well as possibly New Lenox as representative of Illinois habitation sites during proto-historic and early historic times. Nearby Starved Rock has also yielded historic artifacts, but no materials from this collection were available for analysis during the period of dissertation research.

Appendix B: Glass Bead Descriptions by Provenience

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
AR_01	Arrowsmith	91A-138	cobalt blue, tubular, large	translucent	Ia19	ISM
AR_02	Arrowsmith	N88-2	turquoise blue seed bead	opaque	IIa31	ISM
AR_03	Arrowsmith	Lot 128	cobalt blue, round, large	opaque	IIa48?	ISM
B_026	Bell	Lot #2785, N27-28 E120-121, Level 17, Quad IV	cobalt blue, seed	opaque	IIa55/56	UWO
B_027	Bell	Lot #2790, N27-28 E120-121, Level 19, Quad I	turquoise blue, seed	opaque	IIa31	UWO
B_028	Bell	Lot #632A_1of6, Feature 106 SE 1/3 1 of 6	cobalt blue, seed	translucent	IIa55/56	UWO
B_029	Bell	Lot #632A_2of6, Feature 106 SE 1/3 2 of 6	cobalt blue, seed	translucent	IIa55/56	UWO
B_030	Bell	Lot #632A_3of6, Feature 106 SE 1/3 3 of 6	cobalt blue, seed	translucent	IIa55/56	UWO
B_031	Bell	Lot #632A_4of6, Feature 106 SE 1/3 4 of 6	cobalt blue, seed	translucent	IIa55/56	UWO
B_032	Bell	Lot #632A_5of6, Feature 106 SE 1/3 5 of 6	cobalt blue, seed	translucent	IIa55/56	UWO
B_033	Bell	Lot #632A_6of6, Feature 106 SE 1/3 6 of 6	cobalt blue, seed	translucent	IIa55/56	UWO
B_P251	Bell	Lot #1990-10-251, Peterson collection	turquoise blue, round, medium	opaque	IIa40	UWO
B_P286	Bell	Lot #1990-10-286, Peterson collection	turquoise blue, medium	translucent	IIa32	UWO
B_P295	Bell	Lot #1990-10-295, Peterson collection	turquoise blue, round, medium	translucent	IIa44	UWO
B1428	Bell	Lot #1428, Feature 106B, Zone B, Section 5	cobalt blue, seed	translucent	IIa55/56	UWO
B163	Bell	Lot #163, N95-96 / E132-133 Level 5	turquoise blue, round, medium	translucent	WIc (?) frag	UWO
B177	Bell	Lot #177, N120-121 E191-192 Level 4	cobalt blue, seed	translucent	IIa55/56	UWO
B1832	Bell	Lot #1832, Feature 190, Zone A S1/2	cobalt blue, tubular, large	translucent	Ia19/20	UWO
B1956	Bell	Lot #1956, Feature 202, Zone A S1/2	cobalt blue, seed	translucent	IIa55/56	UWO
B1990	Bell	Lot #1990, Feature 223, Zone A N1/2	cobalt blue, seed	translucent	IIa55/56	UWO
B2040	Bell	Lot #2040, Feature 252, Zone B S1/2	turquoise blue, seed	opaque	IIa31	UWO
B2041	Bell	Lot #2041, Feature 252, Zone C S1/2	cobalt blue, seed	translucent	IIa55/56	UWO
B2065	Bell	Lot #2065, Area G: N29-30 E119-120, Level 25, Quad I, NE corner	cobalt blue, seed	translucent	IIa55/56	UWO
B2125	Bell	Lot #2125, Upper Field West End	cobalt blue, seed	translucent	IIa55/56	UWO
B2128	Bell	Lot #2128, S65/E74 scraped surface	cobalt blue, seed	translucent	IIa55/56	UWO
B2445	Bell	Lot #2445, Feature 340, Zone A SE 1/2	cobalt blue, seed	translucent	IIa55/56	UWO
B411	Bell	Lot #411, N98-99 E223-224 Level 2	cobalt blue, tubular, large	translucent	Ia19/20	UWO
B425	Bell	Lot #425, S81-82 E68-69 Level 1 Plowzone	cobalt blue, seed	translucent	IIa55/56	UWO
B632	Bell	Lot #632, Feature 106 SE 1/3	cobalt blue, seed	translucent	IIa55/56	UWO
B643	Bell	Lot #643, N30-31 E120-121 Level 11	cobalt blue, seed	translucent	IIa55/56	UWO
B649	Bell	Lot #649, Feature 105: Area H	turquoise blue, seed	opaque	IIa31	UWO
B701	Bell	Lot #701, Feature 107 Zone C, S 1/2	cobalt blue, seed	translucent	IIa55/56	UWO
B738	Bell	Lot #738, Area K N117-118 / E59-60 Level 1	cobalt blue, seed	translucent	IIa55/56	UWO
B872	Bell	Lot #872, Upper Field West End	cobalt blue, seed	translucent	IIa55/56	UWO

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
B932	Bell	Lot #932, Upper Field Central Portion surface	cobalt blue, medium, fragment	translucent	IIa45	UWO
B956	Bell	Lot #956, Feature 122 Zone A - backfill	cobalt blue, seed	translucent	IIa55/56	UWO
BR_01	Bell Ridge	Richard P. Mason collection	turquoise blue, round, medium	opaque	IIa40	private
BR_02	Bell Ridge	Richard P. Mason collection	turquoise blue, round, medium	opaque	IIa40	private
BR_03	Bell Ridge	Richard P. Mason collection	turquoise blue, round, medium	opaque	IIa40	private
CAD_1_1	Cadotte	2009.35.AS13 C1452.1	turquoise blue, v. small	opaque	IIa31	WHS
CAD_2_1	Cadotte	C3346	turquoise blue, round	opaque	IIa40	WHS
CAD_3_1	Cadotte	C1790	turquoise blue, round	opaque	IIa40	WHS
CAD_4_1	Cadotte	C2399	turquoise blue, round	opaque	IIa40	WHS
CAD_5_1	Cadotte	C2905.1	turquoise blue, round	opaque	IIa40	WHS
CAD_6_1	Cadotte	C3383	cobalt blue, tubular	translucent	Ia19/20	WHS
CAD_7_1	Cadotte	C3222	turquoise blue, tubular	opaque	Ia14	WHS
CAD_8_1	Cadotte	C2638	turquoise blue, tubular	opaque	Ia14	WHS
CAD_9_1	Cadotte	ASI3.25	cobalt blue, round	translucent	IIa55	WHS
CAD_10_1	Cadotte	C2334A	cobalt blue, round	translucent	IIa55	WHS
CAR_1_1	Carcajou Pt.	1955.4224	cobalt blue, tubular	translucent	Ia19/20	WHS
CG_01_1	Chautauqua Grounds	Ernest Pleger collection	turquoise blue, round	opaque	IIa40	private
CG_02_1	Chautauqua Grounds	Ernest Pleger collection	turquoise blue, round	opaque	IIa40	private
CG_03_1	Chautauqua Grounds	Ernest Pleger collection	turquoise blue, round	opaque	IIa40	private
CG_04_1	Chautauqua Grounds	Ernest Pleger collection	turquoise blue, round	opaque	IIa40	private
CHK_1_1	Chickadee	F7, 2008.139.180	turquoise blue	opaque	IIa31	WHS
CHK_2_1	Chickadee	F4, Z2, 2008.139.165.2	turquoise blue, v. small	opaque	IIa31	WHS
CHK_3_1	Chickadee	F4, Z2, 2008.139.165.3	cobalt blue	opaque	IIa55/56	WHS
CHK_4_1	Chickadee	F4, Z2, 2008.139.165.4	turquoise blue	opaque	IIa31	WHS
CHK_5_1	Chickadee	F4, Z2, 2008.139.165.5	cobalt blue	opaque	IIa55/56	WHS
CHK_6_1	Chickadee	F4, S, Z2, 2008.139.176	turquoise blue	opaque	IIa31	WHS
CHK_7_1	Chickadee	F6, E, Z1 2008.139.178.2	turquoise blue, v. small	opaque	IIa31	WHS
CHK_8_1	Chickadee	F6, W, 2008.139.152.1	turquoise blue, v. small	opaque	IIa31	WHS
CHK_9_1	Chickadee	F6, W, 2008.139.152.2	cobalt blue	translucent	IIa55/56	WHS
CL_01_1	Cloudman	Accession # 7282.993.03.01 (1 of 4 beads), S18E102 L3 10-15 cm SW1/2	navy blue seed bead	translucent	IIa55/56	MSU
CL_02_1	Cloudman	Accession # 7282.993.03.01 (2 of 4 beads), S18E102 L3 10-15 cm SW1/2	navy blue seed bead	translucent	IIa55/56	MSU
CL_03_1	Cloudman	Accession # 7282.993.03.01 (3 of 4 beads), S18E102 L3 10-15 cm SW1/2	navy blue seed bead	translucent	IIa55/56	MSU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
CL_04_1	Cloudman	Accession # 7282.993.03.01 (4 of 4 beads), S18E102 L3 10-15 cm SW1/2	navy blue seed bead	translucent	IIa55/56	MSU
CL_05_1	Cloudman	Accession # 7282.939.04.01 (1 of 2 beads), water screen (?)	navy blue seed bead	translucent	IIa55/56	MSU
CL_06_1	Cloudman	Accession # 7282.939.04.01 (2 of 2 beads), water screen (?)	navy blue seed bead	translucent	IIa55/56	MSU
CL_07_1	Cloudman	Accession # 7282.880.03.03, S16E98 L3 10-15cm NE1/4	navy blue seed bead	translucent	IIa55/56	MSU
CL_08_1	Cloudman	Accession # 7282.939.02.04, water screen (?)	navy blue seed bead	translucent	IIa55/56	MSU
CL_09_1	Cloudman	Accession # 7282.993.04.02, S18E102 L4 15-20cm NW1/4 10L Flot	navy blue seed bead	translucent	IIa55/56	MSU
CL_10_1	Cloudman	Accession # 7282.939.03.01, water screen (?)	navy blue seed bead	translucent	IIa55/56	MSU
CL_11_1	Cloudman	Accession # 7282.888.02.04.1, S18E100 L3 10-15cm SE1/4 (fish & lithic concentration) 15.5 L flot	navy blue seed bead	translucent	IIa55/56	MSU
CL_12_1	Cloudman	Accession # 7282.888.02.01, S18E100 L2 5-10 cm SW1/4 9L Flot	navy blue seed bead	translucent	IIa55/56	MSU
CL_13_1	Cloudman	Accession # 7282.932.04.2, S16E102 L3 10-15cm SE1/4 (fish concentration #2)	navy blue seed bead	translucent	IIa55/56	MSU
CL_14_1	Cloudman	Accession # 7282.888.03.04.1, S18E100 L3 10-15cm SE1/4 (fish & lithic concentration) 15.5 L flot	navy blue seed bead	translucent	IIa55/56	MSU
CL_15_1	Cloudman	Accession # 7282.939.03.04, water screen (?)	navy blue seed bead	translucent	IIa55/56	MSU
CL_16_1	Cloudman	Accession # 7282.888.03.03, S16 E98	navy blue oval, large	translucent	IIa57	MSU
CLU_01	Clunie	F06-4-40	turquoise blue, round, medium	opaque	IIa40	SHM
DI_1	Doty Island (V)	T12 SDE 1 12-22 L2	elongate, dark blue, medium	translucent	Wic	UWO
DI_2	Doty Island (V)	T12 SDE 1 12-22 L2	elongate, dark blue, medium	translucent	Wic	UWO
DI_3	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_4	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_5	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_6	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_7	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_8	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_9	Doty Island (V)	T12 SDE 1 12-22 L2	turquoise blue, seed	opaque	IIa31	UWO
DI_10	Doty Island (V)	T12 SDE 1 12-22 L2	turquoise blue, seed	opaque	IIa31	UWO
DI_11	Doty Island (V)	T12 SDE 1 12-22 L2	turquoise blue, seed	opaque	IIa31	UWO

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
DI_12	Doty Island (V)	T12 SDE 1 12-22 L2	turquoise blue, seed	opaque	IIa31	UWO
DI_13	Doty Island (V)	T12 SDE 1 12-22 L2	light blue, seed	opaque	IIa46/47	UWO
DI_14	Doty Island (V)	T12 SDE 1 12-22 L2	light blue, seed	opaque	IIa46/47	UWO
DI_15	Doty Island (V)	T12 SDE 1 12-22 L2	light blue, seed	opaque	IIa46/47	UWO
DI_16	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_17	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_18	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_19	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_20	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_21	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_22	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_23	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_24	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_25	Doty Island (V)	T12 SDE 1 12-22 L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_26	Doty Island (V)	T13 32-42 SW 1/2 F12 WS	cobalt blue, seed	translucent	IIa55/56	UWO
DI_27	Doty Island (V)	T13 32-42 SW 1/2 F12 WS	cobalt blue, seed	translucent	IIa55/56	UWO
DI_28	Doty Island (V)	T13 32-42 SW 1/2 F12 WS	cobalt blue, seed	translucent	IIa55/56	UWO
DI_29	Doty Island (V)	T13 32-42 SW 1/2 F12 WS	cobalt blue, seed	translucent	IIa55/56	UWO
DI_30	Doty Island (V)	T13 32-42 SW 1/2 F12 WS	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_31	Doty Island (V)	T13 32-42 SW 1/2 F12 WS	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_32	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_33	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_34	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_35	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_36	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_37	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_38	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_39	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, tubular, small	translucent	Ia19/20	UWO
DI_40	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_41	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_42	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_43	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_44	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_45	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_46	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_47	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
DI_48	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_49	Doty Island (V)	T14 SD W2 12-22cm, L2	cobalt blue, seed	translucent	IIa55/56	UWO
DI_50	Doty Island (V)	T14 SD W2 12-22cm, L2	turquoise blue, seed	opaque	IIa31	UWO
DI_51	Doty Island (V)	T14 SD W2 12-22cm, L2	turquoise blue, seed	opaque	IIa31	UWO
DI_52	Doty Island (V)	T14 SD W2 12-22cm, L2	light blue, seed	opaque	IIa46/47	UWO
DI_53	Doty Island (V)	T14 SD W2 12-22cm, L2	light blue, seed	opaque	IIa46/47	UWO
DI_54	Doty Island (V)	T14 SD W2 12-22cm, L2	light blue, seed	opaque	IIa46/47	UWO
DI_55	Doty Island (V)	T14 SD W2 12-22cm, L2	light blue, seed	opaque	IIa46/47	UWO
M_01	Doty Island (M)	F2 T2 33-38	cobalt blue, seed	translucent	IIa55/56	UWO
M_02	Doty Island (M)	F2 T2 33-38	dark blue, tubular, small, patina	translucent	Ia19/20	UWO
M_03	Doty Island (M)	F2 T2 33-38	dark blue, tubular, small, patina	translucent	Ia19/20	UWO
M_04	Doty Island (M)	T3 13-18	cobalt blue, tubular, small	translucent	Ia19/20	UWO
M_05	Doty Island (M)	T3 13-18	cobalt blue, tubular, small	translucent	Ia19/20	UWO
M_06	Doty Island (M)	T3 13-18	cobalt blue, tubular, small	translucent	Ia19/20	UWO
M_07	Doty Island (M)	T3 13-18	cobalt blue, tubular, small	translucent	Ia19/20	UWO
M_08	Doty Island (M)	T3 13-18	turquoise blue, seed	opaque	IIa31	UWO
M_09	Doty Island (M)	T3 13-18	turquoise blue, seed	opaque	IIa31	UWO
M_10	Doty Island (M)	T3 13-18	turquoise blue, seed	opaque	IIa31	UWO
M_11	Doty Island (M)	T3 13-18	turquoise blue, seed	opaque	IIa31	UWO
M_12	Doty Island (M)	T3 13-18	turquoise blue, seed	opaque	IIa31	UWO
M_13	Doty Island (M)	T3 13-18	cobalt blue, seed	translucent	IIa55/56	UWO
M_14	Doty Island (M)	T3 13-18	cobalt blue, seed	translucent	IIa55/56	UWO
M_15	Doty Island (M)	T3 13-18	cobalt blue, seed	translucent	IIa55/56	UWO
M_16	Doty Island (M)	T3 13-18	cobalt blue, seed	translucent	IIa55/56	UWO
M_17	Doty Island (M)	T3 13-18	cobalt blue, seed	translucent	IIa55/56	UWO
M_18	Doty Island (M)	T3 13-18	light blue, seed	opaque	IIa46/47	UWO
M_19	Doty Island (M)	T3 13-18	light blue, seed	opaque	IIa46/47	UWO
M_20	Doty Island (M)	T3 13-18	light blue, seed	opaque	IIa46/47	UWO
M_21	Doty Island (M)	T3 13-18	light blue, seed	opaque	IIa46/47	UWO
M_22	Doty Island (M)	T4 13 - 18	turquoise blue, seed bead	opaque	IIa31	UWO
M_23	Doty Island (M)	T4 13 - 18	turquoise blue, seed bead	opaque	IIa31	UWO
M_24	Doty Island (M)	T4 13 - 18	remelted glass fragment	opaque	N/A	UWO
FV_01	Farley Village	89.247.67 F19 S1/2 L3	cobalt, seed	translucent	IIa55/56	UWL
FV_02	Farley Village	89.161.107 F2 E1/2 ZE	cobalt, seed	translucent	IIa55/56	UWL
FV_03	Farley Village	89.131.20 F2 W1/2 L10	cobalt, oval or barleycorn	translucent	IIa57	UWL
CM_01	Fort Michilimackinac	MS2.11426.3	cobalt blue, round, medium	translucent	IIa55/56	MHP

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
CM_02	Fort Michilimackinac	MS2.9605.3	cobalt blue, seed	translucent	IIa55/56	MHP
CM_03	Fort Michilimackinac	MS2.11425.4	cobalt blue, seed	translucent	IIa55/56	MHP
CM_04	Fort Michilimackinac	MS2.11431.9	cobalt blue, seed	translucent	IIa55/56	MHP
CM_05	Fort Michilimackinac	MS2.11746.4	cobalt blue, seed	translucent	IIa55/56	MHP
CM_06	Fort Michilimackinac	MS2.11833.8	cobalt blue, seed	translucent	IIa55/56	MHP
CM_07	Fort Michilimackinac	MS2.11944.2	cobalt blue, seed	translucent	IIa55/56	MHP
CM_08	Fort Michilimackinac	MS2.8264.1	cobalt blue, seed	translucent	IIa55/56	MHP
CM_09	Fort Michilimackinac	MS2.8266.6	cobalt blue, seed	translucent	IIa55/56	MHP
CM_10	Fort Michilimackinac	MS2.8272B.39	cobalt blue, seed	translucent	IIa55/56	MHP
CM_11	Fort Michilimackinac	MS2.8502.6	cobalt blue, seed	translucent	IIa55/56	MHP
CM_12	Fort Michilimackinac	MS2.9040.5	cobalt blue, seed	translucent	IIa55/56	MHP
CM_13	Fort Michilimackinac	MS2.10316.2	cobalt blue, seed	translucent	IIa55/56	MHP
CM_14	Fort Michilimackinac	MS2.12106.12	cobalt blue, seed	translucent	IIa55/56	MHP
CM_15	Fort Michilimackinac	MS2.12106.12	cobalt blue, seed	translucent	IIa55/56	MHP
CM_16	Fort Michilimackinac	MS2.8863.9	blue, seed	opaque	IIa55/56?	MHP
CM_17	Fort Michilimackinac	MS2.11347.6	cobalt blue, seed	translucent	IIa55/56	MHP
CM_18	Fort Michilimackinac	MS2.11354.1	cobalt blue, seed	translucent	IIa55/56	MHP
CM_19	Fort Michilimackinac	MS2.11378.5	cobalt blue, seed	translucent	IIa55/56	MHP
CM_20	Fort Michilimackinac	MS2.11601.4	cobalt blue, seed	translucent	IIa55/56	MHP
CM_21	Fort Michilimackinac	MS2.11899.12	cobalt blue, seed	translucent	IIa55/56	MHP
CM_22	Fort Michilimackinac	MS2.12113.14	cobalt blue, seed	translucent	IIa55/56	MHP
CM_23	Fort Michilimackinac	MS2.8430.6	cobalt blue, seed	translucent	IIa55/56	MHP
CM_24	Fort Michilimackinac	MS2.12113.14	cobalt blue, seed	translucent	IIa55/56	MHP
CM_25	Fort Michilimackinac	MS2.11793.4	cobalt blue, tubular, small	translucent	Ia19	MHP
CM_26	Fort Michilimackinac	MS2.12106.12	turquoise, seed	opaque	IIa31	MHP
CM_27	Fort Michilimackinac	MS2.12106.12	turquoise, seed	opaque	IIa31	MHP
CM_28	Fort Michilimackinac	MS2.11672.17	turquoise, seed	opaque	IIa31	MHP
CM_29	Fort Michilimackinac	MS2.11867.16	turquoise, seed	opaque	IIa31	MHP
CM_30	Fort Michilimackinac	MS2.12113.14	turquoise, seed	opaque	IIa31	MHP
CM_31	Fort Michilimackinac	MS2.9040.5	turquoise, seed	opaque	IIa31	MHP
CM_32	Fort Michilimackinac	MS2.11868.13	turquoise, seed	opaque	IIa31	MHP
CM_33	Fort Michilimackinac	MS2.11868.13	turquoise, seed	opaque	IIa31	MHP
CM_34	Fort Michilimackinac	MS2.11868.13	turquoise, seed	opaque	IIa31	MHP
CM_35	Fort Michilimackinac	MS2.8796.6	turquoise, seed	opaque	IIa31	MHP
CM_36	Fort Michilimackinac	MS2.8796.6	turquoise, seed	opaque	IIa31	MHP

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
CM_37	Fort Michilimackinac	MS2.11794.2	turquoise, seed	opaque	IIa31	MHP
CM_38	Fort Michilimackinac	MS2.8757.2	turquoise, seed	opaque	IIa31	MHP
CM_39	Fort Michilimackinac	MS2.8515.3	turquoise, seed	opaque	IIa31	MHP
CM_40	Fort Michilimackinac	MS2.8862.4	turquoise, seed	opaque	IIa31	MHP
CM_41	Fort Michilimackinac	MS2.8862.4	turquoise, seed	opaque	IIa31	MHP
CM_42	Fort Michilimackinac	MS2.9040.5	turquoise, seed	opaque	IIa31	MHP
CM_43	Fort Michilimackinac	MS2.11672.17	turquoise, seed	opaque	IIa31	MHP
CM_44	Fort Michilimackinac	MS2.8862.4	light blue seed bead, patinated	translucent	IIa31?	MHP
CM_45	Fort Michilimackinac	MS2.8796.6	turquoise seed bead	translucent	IIa31?	MHP
CM_46	Fort Michilimackinac	MS2.8863.9	iridescent light blue seed or short	translucent	IIa31?	MHP
CM_47	Fort Michilimackinac	MS2.8502.6	turquoise seed bead	translucent	IIa31?	MHP
CM_48	Fort Michilimackinac	MS2.11868.13	turquoise seed bead	translucent	IIa31?	MHP
CM_49	Fort Michilimackinac	MS2.11672.16	iridescent cobalt blue, round	translucent	IIa48?	MHP
CM_50	Fort Michilimackinac	MS2.11601.4	iridescent turquoise blue seed	translucent	IIa31?	MHP
CM_51	Fort Michilimackinac	MS2.11429.7	light blue, seed	opaque	IIa46/47	MHP
CM_52	Fort Michilimackinac	MS2.8441.3	light blue, seed	opaque	IIa46/47	MHP
CM_53	Fort Michilimackinac	MS2.8862.4	light blue, seed	opaque	IIa46/47	MHP
CM_54	Fort Michilimackinac	MS2.11868.13	light blue, seed	opaque	IIa46/47	MHP
CM_55	Fort Michilimackinac	MS2.11795.1	turquoise or blue, seed	opaque	IIa46/47	MHP
CM_56	Fort Michilimackinac	MS2.11376.12	opaque light blue seed bead	opaque	IIa46/47	MHP
CM_57	Fort Michilimackinac	MS2.11347.6	opaque blue seed bead	opaque	IIa46/47?	MHP
CM_58	Fort Michilimackinac	MS2.8530.2	opaque light blue seed bead	opaque	IIa46/47?	MHP
CM_59	Fort Michilimackinac	MS2.11867.16	black "barleycorn" bead	opaque	IIa8	MHP
CM_60	Fort Michilimackinac	MS2.9605.3	white, seed, "cored"	opaque	IIa14	MHP
CM_61	Fort Michilimackinac	MS2.11429.7	white, seed, "cored"	opaque	IIa14	MHP
CM_62	Fort Michilimackinac	MS2.11429.7	white, seed, "cored"	opaque	IIa14	MHP
CM_63	Fort Michilimackinac	MS2.11429.7	white, seed, "cored"	opaque	IIa14	MHP
CM_64	Fort Michilimackinac	MS2.11429.7	white, seed (not visibly cored)	opaque	IIa14	MHP
CM_65	Fort Michilimackinac	MS2.11429.7	white, seed (not visibly cored)	opaque	IIa14	MHP
CM_66	Fort Michilimackinac	MS2.11868.13	white, seed, "cored"	opaque	IIa14	MHP
CM_67	Fort Michilimackinac	MS2.11868.13	white, seed, "cored"	opaque	IIa14	MHP
CM_68	Fort Michilimackinac	MS2.11868.13	white, seed, "cored"	opaque	IIa14	MHP
CM_69	Fort Michilimackinac	MS2.8796.6	white, seed (not visibly cored)	opaque	IIa14	MHP
CM_70	Fort Michilimackinac	MS2.8796.6	white, seed, "cored"	opaque	IIa14	MHP
CM_71	Fort Michilimackinac	MS2.11868.14	cobalt blue and white striped	translucent	N/A	MHP

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
CM_72	Fort Michilimackinac	MS2.11868.14	cobalt blue and white striped	opaque	N/A	MHP
CM_73	Fort Michilimackinac	MS2.2521.14	turquoise blue pendant, point A	opaque	N/A	MHP
CM_74	Fort Michilimackinac	MS2.2521.14	turquoise blue pendant, point B	opaque	N/A	MHP
CM_75	Fort Michilimackinac	MS2.8796.4	turquoise blue iridescent pendant fragment	opaque	N/A	MHP
CM_76	Fort Michilimackinac	MS2.9605.4	turquoise iridescent and white striped pendant, blue	translucent	N/A	MHP
CM_77	Fort Michilimackinac	MS2.9605.4	turquoise iridescent and white striped pendant, white	opaque	N/A	MHP
SJ_01	Fort St. Joseph	2002.177 N37 E20 Feature 2, 54-64 cm bd	cobalt blue, tubular, small	translucent	Ia19	FSJ
SJ_02	Fort St. Joseph	2002.177 N37 E20 Feature 2, 54-64 cm bd	cobalt blue, tubular	translucent	Ia19	FSJ
SJ_03	Fort St. Joseph	2002.177 N37 E20 Feature 2, 54-64 cm bd	cobalt blue, tubular	translucent	Ia19	FSJ
SJ_04	Fort St. Joseph	2002.177 N37 E20 Feature 2, 54-64 cm bd	cobalt blue, tubular	translucent	Ia19	FSJ
SJ_05	Fort St. Joseph	2002.177 N37 E20 Fea 2, 54-64 cm bd	Round, translucent blue	translucent	IIa55/56	FSJ
SJ_06	Fort St. Joseph	2002.177 N37 E20 Fea 2, 54-64 cm bd	Round, translucent blue	translucent	IIa55/56	FSJ
SJ_07	Fort St. Joseph	2009.149W N27 E16 E half Feature 7, 55-60 cm bd	blue, tubular	translucent	Ia19	FSJ
SJ_08	Fort St. Joseph	2002.167 N27 E14 Feature 7, 80-90 cm bd	blue, tubular w/striations	translucent	Ia19?	FSJ
SJ_09	Fort St. Joseph	2002.167 N27 E14 Fea 7, 80-90 cm bd	Blue, tubular	translucent	IIa55/56	FSJ
SJ_10	Fort St. Joseph	2002.61 N38 E20 Feature 2, 60-70 cm bd	Blue, tubular	translucent	Ia19	FSJ
SJ_11	Fort St. Joseph	2002.61 N38 E20 Fea 2, 60-70 cm bd	Blue, round	translucent	IIa55/56	FSJ
SJ_12	Fort St. Joseph	2002.61 N38 E20 Fea 2, 60-70 cm bd	Blue, round	translucent	IIa55/56	FSJ
SJ_13	Fort St. Joseph	2002.150 N22 E2 Fea 6, 28-44 cm bd	Blue, round	translucent	IIa55/56	FSJ
SJ_14	Fort St. Joseph	2006.97W N27 E8 Feature 11, 48-53 cm bd	Blue, round	translucent	IIa55/56	FSJ
SJ_15	Fort St. Joseph	2006.97W N27 E8 Feature 11, 48-53 cm bd	Blue, round	translucent	IIa55/56	FSJ
SJ_16	Fort St. Joseph	2004.64 N39 E20 Feature 2, 50-55 cm bd	blue, cylindrical	translucent	IIa55/56	FSJ
SJ_17	Fort St. Joseph	2004.77 N24 E2 Feature 6, 54-64 cm bd	blue, cylindrical	translucent	IIa55/56	FSJ
SJ_18	Fort St. Joseph	2002.168 N27 E14 Fea 7, 110-115 cm bd	blue, round	translucent	IIa55/56	FSJ
SJ_19	Fort St. Joseph	2010.108W N35 E20 W half Feature 17, 60-65 cm bd	blue, seed	translucent	IIa55/56	FSJ
SJ_20	Fort St. Joseph	2006.83W N27 E8 Feature 11, 43-48 cm bd	round, blue	translucent	IIa55/56	FSJ
SJ_21	Fort St. Joseph	2006.104W N25 E0 Feature 14, 45-50 cm bd	round, blue	translucent	IIa55/56	FSJ
SJ_22	Fort St. Joseph	2006.109W N27 E8 Feature 11, 48-53 cm bd	round, blue	translucent	IIa55/56	FSJ
SJ_23	Fort St. Joseph	2006.109W N27 E8 Feature 11, 48-53 cm bd	round, turquoise	opaque	IIa31	FSJ
SJ_24	Fort St. Joseph	2006.104W N25 E0 Feature 14, 45-50 cm bd	round, turquoise	opaque	IIa31	FSJ
SJ_25	Fort St. Joseph	2006.83W N27 E8 Feature 11, 43-48 cm bd	round, turquoise	opaque	IIa31	FSJ

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
SJ_26	Fort St. Joseph	2010.108W N35 E20 W half Feature 17, 60-65 cm bd	light blue, seed	translucent	IIa31?	FSJ
SJ_27	Fort St. Joseph	2002.168 N27 E14 Fea 7, 110-115 cm bd	Round, turquoise	opaque	IIa31	FSJ
SJ_28	Fort St. Joseph	2008.99W N32 E12 occupational N1/2, 50-55 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_29	Fort St. Joseph	2008.99W N32 E12 occupational N1/2, 50-55 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_30	Fort St. Joseph	2010.58 N25 W1 S half occupation, 45-50 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_31	Fort St. Joseph	2010.58 N25 W1 S half occupation, 45-50 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_32	Fort St. Joseph	2009.158 N17 W7 N half occupation zone, 50-55 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_33	Fort St. Joseph	2009.139W N27 W1 N half occupation zone, 50-55 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_34	Fort St. Joseph	2009.145W N26 W3 occupation zone, 50-55 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_35	Fort St. Joseph	2009.152W N17 W7 S half occupation zone, 50-55 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_36	Fort St. Joseph	2010.117W N27 E16 W half Feature 7, 60-65 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_37	Fort St. Joseph	2009.143W N30 E11 S half occupation zone, 45-50 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_38	Fort St. Joseph	2010.114W N19 W7 N half Feature 19, 55-60 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_39	Fort St. Joseph	2010.114W N19 W7 N half Feature 19, 55-60 cm bd	turquoise, seed	opaque	IIa31	FSJ
SJ_40	Fort St. Joseph	2004.59 N26 E8 Feature 5, 44-48 cm bd	turquoise, round	opaque	IIa31	FSJ
SJ_41	Fort St. Joseph	2004.59 N26 E8 Feature 5, 44-48 cm bd	turquoise, round	opaque	IIa31	FSJ
SJ_42	Fort St. Joseph	2004.59 N26 E8 Feature 5, 44-48 cm bd	blue, round	opaque	IIa46/47	FSJ
SJ_43	Fort St. Joseph	2002.168 N27 E14 Fea 7, 110-115 cm bd	light blue, donut shaped	opaque	IIa46/47	FSJ
SJ_44	Fort St. Joseph	2010.114W N19 W7 N half Feature 19, 55-60 cm bd	light blue, seed	opaque	IIa46/47	FSJ
SJ_45	Fort St. Joseph	2010.114W N19 W7 N half Feature 19, 55-60 cm bd	light blue, seed	opaque	IIa46/47	FSJ
SL_01_1	Fort St. Louis	Lot #1082 BlockB18 N426 E781 Level2	Opaque Blue French	opaque	IIa46/47	TSHC

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
SL_02_1	Fort St. Louis	Lot #1271 BlockB18 N422 E785 Level2	Blue French	translucent	IIa55/56	TSHC
SL_03_1	Fort St. Louis	Lot #1366-1.1 BlockB18 N423 E775 Level1	Blue French	translucent	IIa55/56	TSHC
SL_04_1	Fort St. Louis	Lot #1366-1.2 BlockB18 N423 E775 Level1	Blue French	translucent	IIa55/56	TSHC
SL_05_1	Fort St. Louis	Lot #2078-1.1 BlockB18 N424 E774 Level1	Blue Variety 8 French	translucent	IIa55/56	TSHC
SL_06_1	Fort St. Louis	Lot #2078-1.2 BlockB18 N424 E774 Level1	Opaque blue french	opaque	IIa31	TSHC
SL_07_1	Fort St. Louis	Lot #2268-1.2 BlockB18, Fea. 20 N424 E773 Level2	Opaque blue French	opaque	IIa31	TSHC
SL_08_1	Fort St. Louis	Lot #2531 BlockAdd. 2 N337.96 E775.44 Level20	Blue Translucent French	opaque	IIa31	TSHC
SL_09_1	Fort St. Louis	Lot #3104 BlockB66 N385 E794 Level1	Blue Type 1 Spanish	translucent	IIa55	TSHC
SL_10_1	Fort St. Louis	Lot #3969 BlockB254 N370 E743 Level1	Dk. Blue Spanish	opaque	IIa31	TSHC
SL_11_1	Fort St. Louis	Lot #3981 BlockB66 N384 E761 Level1	Blue Type 1 Spanish	translucent	IIa55/56	TSHC
SL_12_1	Fort St. Louis	Lot #727 BlockB2 N388 E752 Level1	Lt. Blue Spanish	opaque	IIa46/47	TSHC
SL_13_1	Fort St. Louis	Lot #745 BlockB7 N377 E814 Level1	Dk. Blue Type 1 French	translucent	IIa55/56	TSHC
SL_14_1	Fort St. Louis	Lot #1272 BlockB18 N424 E775 Level1	Black Type 2 French	opaque	IIa7	TSHC
SL_15_1	Fort St. Louis	Lot #2268-1.3 BlockB18, Fea. 20 N424 E773 Level2	Black Type 2 French	opaque	IIa7	TSHC
SL_16_1	Fort St. Louis	Lot #2268-1.1 BlockB18, Fea. 20 N424 E773 Level2	White French (not cored)	opaque	IIa14	TSHC
GG_01_1	Gillett Grove	9569.220.5 Sq. 02-04, Level 2	pendant fragment, turquoise (point 1)	opaque	N/A	IOSA
GG_02_1	Gillett Grove	9569.220.5 Sq. 02-04, Level 2	pendant fragment, light blue (point 2)	opaque	N/A	IOSA
GG_03_1	Gillett Grove	9569.286.9 Sq. 02-13, Level 7	refired glass fragment, light blue	opaque	N/A	IOSA
GG_04_1	Gillett Grove	9569.211.11 Sq. 02-03, Level 2	refired glass fragment, light blue	opaque	N/A	IOSA
GG_05_1	Gillett Grove	9569.265.12 Sq. 02-10, Level 4	turquoise blue, medium, round	opaque	IIa40	IOSA
GG_06_1	Gillett Grove	9569.258.15 Sq. 02-09, Level 4	turquoise blue, seed	opaque	IIa31	IOSA
GG_07_1	Gillett Grove	10022.375.6 Sq. 46, Level 3	turquoise blue, seed	opaque	IIa31	IOSA
GG_08_1	Gillett Grove	10022.364.6 Sq. 44, Level 6	turquoise blue, seed, small	opaque	IIa31	IOSA
GG_09_1	Gillett Grove	10021.449.1 Sq. 05-2, Level 4, T.U. 2, F. 1	turquoise blue, seed, small	opaque	IIa31	IOSA
GG_10_1	Gillett Grove	6577. F8, Level 2 N100 E92	turquoise blue, medium, round	opaque	IIa40	IOSA
GG_11_1	Gillett Grove	104N 70E 20-25 cm b.s. F.S. 20 (from float?)	turquoise blue, medium, round	opaque	IIa40	IOSA
GG_12_1	Gillett Grove	181N 99-98E F1, Sect. 2 20-25 cm, from float	blue / turquoise blue, seed	opaque	IIa41?	IOSA
GG_13_1	Gillett Grove	181N 99E F.S. 17, 15-20 cm from float	white, seed, "cored" type	opaque	IIa13/14	IOSA
GG_14_1	Gillett Grove	7244.183.55 Unit 122, Level 3	turquoise blue seed, small	translucent	IIa31	IOSA

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
GG_15_1	Gillett Grove	7244.129.113 Unit 102, Level 6	turquoise blue, seed	opaque	IIa31	IOSA
GG_16_1	Gillett Grove	7244.165.142 Unit 115, Level 1	cobalt blue, oval	translucent	IIa57	IOSA
GG_17_1	Gillett Grove	7244.150.41 Unit 110, Level 1	turquoise blue, irregular, melted?	translucent	N/A	IOSA
GL_01	Goose Lake Outlet #3	Paquette ID #10	cobalt blue, oval, medium	translucent	IIa57	MCHC
GL_02	Goose Lake Outlet #3	Paquette ID #5	cobalt blue, oval, medium fragment	translucent	IIa57	MCHC
GL_03	Goose Lake Outlet #3	Paquette ID #19	cobalt blue, tubular, possibly cored (JP - IIIa12)	translucent	Ia19	MCHC
GL_04	Goose Lake Outlet #3	Paquette ID #1	turquoise blue, oval, medium	translucent	IIa38	MCHC
GL_05	Goose Lake Outlet #3	Paquette ID #3	turquoise blue, round fragment	opaque	IIa40?	MCHC
GL_06	Goose Lake Outlet #3	Paquette ID #4	turquoise blue, oval, medium	translucent	IIa38	MCHC
GL_07	Goose Lake Outlet #3	Paquette ID #6	turquoise blue, seed (JP - IIa37, but not trans.)	opaque	IIa31	MCHC
GL_08	Goose Lake Outlet #3	Paquette ID #8	turquoise blue, oval, medium	translucent	IIa42	MCHC
GL_09	Goose Lake Outlet #3	Paquette ID #12	turquoise blue, round, medium	opaque	IIa36	MCHC
GL_10	Goose Lake Outlet #3	Paquette ID #13	turquoise blue, round, medium	opaque	IIa40	MCHC
GL_11	Goose Lake Outlet #3	Paquette ID #18	turquoise blue, oval, medium	translucent	IIa42	MCHC
GL_12	Goose Lake Outlet #3	Paquette ID #21	turquoise blue, round, medium	opaque	IIa40	MCHC
GL_13	Goose Lake Outlet #3	Paquette ID #22	turquoise blue, round, medium	opaque	IIa41	MCHC
GC_01	Gros Cap	79-3-19	cobalt blue, round, large	translucent	IIa56?	MCHC
GC_02	Gros Cap	79-3-16	star or "melon" fragment	translucent	WIIe6	MCHC
GC_03	Gros Cap	79-3-66	round turquoise fragment	opaque	IIa40	MCHC
GC_04	Gros Cap	79-3-66	trapezoidal pendant fragment	opaque	n/a	MCHC
GC_05	Gros Cap	79-3-66	rounded turquoise bead or pendant frag with metal	opaque	n/a	MCHC
GC_06	Gros Cap	78-1-14	aquamarine, round, large	translucent	IIa33	MCHC
GC_07	Gros Cap	79-3-83	cobalt blue tubular fragment	translucent	Ia19	MCHC
C_5	Hanson	Lot 1, Category 5; Burial Two	pale yellow, tubular	translucent	Ia8	WHS
DB_6	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS
DB2_1	Hanson	Lot 2; Slump	dark blue, elongate	translucent	IIa57	WHS
H_C51_1	Hanson	Lot 1, Category 5; Burial Two	pale yellow, tubular	translucent	Ia8	WHS
H_C52_1	Hanson	Lot 1, Category 5; Burial Two	pale yellow, tubular	translucent	Ia8	WHS
H_C53_1	Hanson	Lot 1, Category 5; Burial Two	pale yellow, tubular	translucent	Ia8	WHS
H_C54_1	Hanson	Lot 1, Category 5; Burial Two	pale yellow, tubular	translucent	Ia8	WHS
H_C61_1	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
H_C62_1	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS
H_C63_1	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS
H_C64_1	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS
H_C65_1	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS
H_C66_1	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS
H_C67_1	Hanson	Lot 2, Category 6; Slump	cobalt blue, seed	translucent	IIa55/56	WHS
H_C71_1	Hanson	Lot 2, Category 7; Slump	turquoise blue, seed	translucent	IIa55/56	WHS
H_C72_1	Hanson	Lot 2, Category 7; Slump	turquoise blue, seed	translucent	IIa55/56	WHS
H_C73_1	Hanson	Lot 2, Category 7; Slump	turquoise blue, seed	translucent	IIa55/56	WHS
H_C74_1	Hanson	Lot 2, Category 7; Slump	turquoise blue, seed	translucent	IIa55/56	WHS
H_C75_1	Hanson	Lot 2, Category 7; Slump	turquoise blue, seed	translucent	IIa55/56	WHS
H_C76_1	Hanson	Lot 2, Category 7; Slump	turquoise blue, seed	translucent	IIa55/56	WHS
H_L2B_1	Hanson	Lot 2, Category 7; Slump	dark blue, elongate	translucent	IIa57	WHS
TB_4	Hanson	Lot 1, Category 4; Burial Two	light blue, round, medium	opaque	IIa36	WHS
TB_7	Hanson	Lot 2, Category 7; Slump	turquoise blue, seed	translucent	IIa55/56	WHS
IV_01	Iliniwek Village	F39 S1/2 1018 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_02	Iliniwek Village	F42 1027 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_03	Iliniwek Village	F43 1031 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_04	Iliniwek Village	F47 1097 House 1	cobalt blue bead, medium	translucent	IIa55/56	MDNR
IV_05	Iliniwek Village	F47 1097 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_06	Iliniwek Village	F47 S1/2 1151 House 1	cobalt blue seed, patinated	translucent	IIa55/56	MDNR
IV_07	Iliniwek Village	F72 Stratum I 1738 House 1	cobalt blue, medium	translucent	IIa55/56	MDNR
IV_08	Iliniwek Village	F74 W1/2 1818 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_09	Iliniwek Village	F74 E1/2 1839 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_10	Iliniwek Village	F90 E1/2 2162 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_11	Iliniwek Village	F90 E1/2 2162 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_12	Iliniwek Village	F121 W1/2 2391 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_13	Iliniwek Village	F107 E1/2 2399 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_14	Iliniwek Village	F123 2584 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_15	Iliniwek Village	F123 2584 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_16	Iliniwek Village	F22 N1/2 2673 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_17	Iliniwek Village	F22 S1/2 2688 House 1	cobalt blue seed	translucent	IIa55/56	MDNR
IV_18	Iliniwek Village	F146 S1/2 2874 House 2	cobalt blue seed	translucent	IIa55/56	MDNR
IV_19	Iliniwek Village	F146 S1/2 2874 House 2	cobalt blue seed	translucent	IIa55/56	MDNR
IV_20	Iliniwek Village	F151 N1/2 2941 House 2	cobalt blue seed	translucent	IIa55/56	MDNR
IV_21	Iliniwek Village	F175 E 1/2 3333 House 2	cobalt blue seed	translucent	IIa55/56	MDNR

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
IV_22	Iliniwek Village	F39 1009 House 1	turquoise, medium, patinated	translucent	IIa39?	MDNR
IV_23	Iliniwek Village	F146 S1/2 2874 House 2	turquoise blue, oval, medium	opaque	IIa38	MDNR
IV_24	Iliniwek Village	F29 796 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_25	Iliniwek Village	F39 1009 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_26	Iliniwek Village	F39 S1/2 1018 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_27	Iliniwek Village	F47 1097 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_28	Iliniwek Village	F47 1097 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_29	Iliniwek Village	F47 S1/2 1151 House 1	turquoise blue, seed, patinated	opaque	IIa31	MDNR
IV_30	Iliniwek Village	F47 S1/2 1151 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_31	Iliniwek Village	F72 E1/2 float 1748 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_32	Iliniwek Village	F90 E1/2 2162 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_33	Iliniwek Village	F90 E1/2 2162 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_34	Iliniwek Village	F90 E1/2 2162 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_35	Iliniwek Village	F90 E1/2 2162 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_36	Iliniwek Village	F121 W1/2 2391 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_37	Iliniwek Village	F121 W1/2 2391 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_38	Iliniwek Village	F123 2584 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_39	Iliniwek Village	F123 2584 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_40	Iliniwek Village	F22 N1/2 2673 House 1	turquoise blue, seed	opaque	IIa31	MDNR
IV_41	Iliniwek Village	F146 S1/2 2874 House 2	turquoise blue, seed	opaque	IIa31	MDNR
IV_42	Iliniwek Village	F175 E 1/2 3333 House 2	light turquoise blue, seed	opaque	IIa31	MDNR
IV_43	Iliniwek Village	F175 W1/2 3980 House 2	light turquoise blue, seed, patinated	opaque	IIa31	MDNR
IV_44	Iliniwek Village	F175 W1/2 3980 House 2	light turquoise blue, seed irregular	opaque	IIa31	MDNR
IV_45	Iliniwek Village	F191 float 4084 House 2	turquoise blue,seed fragment	opaque	IIa31	MDNR
IV_46	Iliniwek Village	F191 float 4084 House 2	turquoise blue, seed	opaque	IIa31	MDNR
IV_47	Iliniwek Village	F191 float 4084 House 2	turquoise blue, seed	translucent	IIa31	MDNR
IV_48	Iliniwek Village	F39 S1/2 1018 House 1	blue, seed	opaque	IIa31?	MDNR
IV_49	Iliniwek Village	F43 1031 House 1	blue, seed	opaque	IIa31?	MDNR
IV_50	Iliniwek Village	F72 Stratum IV 1718 House 1	blue, seed	opaque	IIa31?	MDNR
IV_51	Iliniwek Village	F72 Stratum I 1738 House 1	blue, seed	opaque	IIa31?	MDNR
IV_52	Iliniwek Village	F72 Stratum II 1744 House 1	turquoise irregular, patinated and heavily pitted	translucent	IIa31?	MDNR
IV_53	Iliniwek Village	F72 Stratum II 1744 House 1	blue, seed	opaque	IIa31?	MDNR
IV_54	Iliniwek Village	F72 Stratum III 1745 House 1	blue, seed	opaque	IIa31?	MDNR

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
IV_55	Iliniwek Village	F22 N1/2 2673 House 1	blue, seed	opaque	IIa31?	MDNR
IV_56	Iliniwek Village	F39 1009 House 1	turquoise blue, medium fragment	opaque	IIa40	MDNR
IV_57	Iliniwek Village	F43 1031 House 1	turquoise blue, medium fragment	opaque	IIa40	MDNR
IV_58	Iliniwek Village	F54 E1/2 1234 House 1	turquoise blue, medium	opaque	IIa40	MDNR
IV_59	Iliniwek Village	F54 1254 House 1	turquoise blue, medium fragment	opaque	IIa40	MDNR
IV_60	Iliniwek Village	F72 1724 House 1	turquoise blue, medium fragment	opaque	IIa40	MDNR
IV_61	Iliniwek Village	F175 E 1/2 3333 House 2	turquoise blue, medium	opaque	IIa40	MDNR
IV_62	Iliniwek Village	F175 W1/2 3980 House 2	turquoise blue, medium	opaque	IIa40	MDNR
IV_63	Iliniwek Village	F47 1097 House 1	light blue, seed	opaque	IIa46/47	MDNR
IV_64	Iliniwek Village	F47 1097 House 1	light blue, seed	opaque	IIa46/47	MDNR
IV_65	Iliniwek Village	F90 E1/2 2162 House 1	light blue, seed	opaque	IIa46/47	MDNR
IV_66	Iliniwek Village	F90 E1/2 2162 House 1	light blue, seed	opaque	IIa46/47	MDNR
IV_67	Iliniwek Village	F121 W1/2 2391 House 1	blue, seed	opaque	IIa46/47	MDNR
IV_68	Iliniwek Village	F123 2584 House 1	light blue, seed	opaque	IIa46/47	MDNR
IV_69	Iliniwek Village	F123 2584 House 1	blue, seed	opaque	IIa46/47	MDNR
IV_70	Iliniwek Village	F146 N1/2 2803 House 2	light blue, seed, patinated	opaque	IIa46/47	MDNR
BL_01_1	La Belle Shipwreck	5858.2.11 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_02_1	La Belle Shipwreck	5858.2.12 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_03_1	La Belle Shipwreck	5858.2.13 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_04_1	La Belle Shipwreck	5858.2.14 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_05_1	La Belle Shipwreck	5858.2.15 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_06_1	La Belle Shipwreck	5858.2.16 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_07_1	La Belle Shipwreck	5858.2.17 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_08_1	La Belle Shipwreck	5858.2.23 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_09_1	La Belle Shipwreck	5858.2.24 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_10_1	La Belle Shipwreck	5858.2.25 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_11_1	La Belle Shipwreck	5858.2.26 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_12_1	La Belle Shipwreck	5858.2.27 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_13_1	La Belle Shipwreck	5858.2.28 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_14_1	La Belle Shipwreck	5858.2.29 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_15_1	La Belle Shipwreck	5858.2.35 Aft Hold	Dk. Blue Type 1- dark patina	translucent	IIa55/56	TSHC
BL_16_1	La Belle Shipwreck	5858.2.36 Aft Hold	Dk. Blue Type 1- dark patina	translucent	IIa55/56	TSHC

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
BL_17_1	La Belle Shipwreck	5858.2.37 Aft Hold	Dk. Blue Type 1- dark patina	translucent	IIa55/56	TSHC
BL_18_1	La Belle Shipwreck	5858.2.38 Aft Hold	Dk. Blue Type 1- dark patina	translucent	IIa55/56	TSHC
BL_19_1	La Belle Shipwreck	5858.2.39 Aft Hold	Dk. Blue Type 1- dark patina	translucent	IIa55/56	TSHC
BL_20_1	La Belle Shipwreck	5858.2.40 Aft Hold	Dk. Blue Type 1- dark patina	translucent	IIa55/56	TSHC
BL_21_1	La Belle Shipwreck	5858.2.41 Aft Hold	Dk. Blue Type 1- dark patina	translucent	IIa55/56	TSHC
BL_22_1	La Belle Shipwreck	5858.2.51 Aft Hold	Blue Tubular Type 8 (small tubular)	translucent	Ia19	TSHC
BL_23_1	La Belle Shipwreck	5858.2.52 Aft Hold	Blue Tubular Type 8 (small tubular)	translucent	Ia19	TSHC
BL_24_1	La Belle Shipwreck	5858.2.53 Aft Hold	Blue Tubular Type 8 (small tubular)	translucent	Ia19	TSHC
BL_25_1	La Belle Shipwreck	5858.2.47 Aft Hold	Blue/White Type 4 - white possibly corrosion	opaque	IIa31?	TSHC
BL_26_1	La Belle Shipwreck	5858.2.48 Aft Hold	Blue/White Type 4 - cored?	opaque	IVa16?	TSHC
BL_27_1	La Belle Shipwreck	5858.2.49 Aft Hold	Blue/White Type 4 - cored	opaque	IIa31?	TSHC
BL_28_1	La Belle Shipwreck	5858.2.50 (a) Aft Hold	Blue/White Type 4 - CORED - point 1 outer	opaque	IVa16?	TSHC
BL_29_1	La Belle Shipwreck	5858.2.5 (b) Aft Hold	Blue/White Type 4 - CORED - point 3 inner	opaque	IVa16?	TSHC
BL_30_1	La Belle Shipwreck	5858.2.5 (c) Aft Hold	Blue/White Type 4 - CORED - point 2 mid	opaque	IVa16?	TSHC
BL_31_1	La Belle Shipwreck	5858.2.1 Aft Hold	Black Type 2	opaque	IIa7	TSHC
BL_32_1	La Belle Shipwreck	5858.2.2 Aft Hold	Black Type 2	opaque	IIa7	TSHC
BL_33_1	La Belle Shipwreck	5858.2.3 Aft Hold	Black Type 2	opaque	IIa7	TSHC
BL_34_1	La Belle Shipwreck	5858.2.4 Aft Hold	Black Type 2	opaque	IIa7	TSHC
BL_35_1	La Belle Shipwreck	5858.2.5 Aft Hold	Black Type 2	opaque	IIa7	TSHC
BL_36_1	La Belle Shipwreck	5858.2.6 Aft Hold	White Type 3 - cored	opaque	IIa14 / IVa13	TSHC
BL_37_1	La Belle Shipwreck	5858.2.7 Aft Hold	White Type 3 - cored	opaque	IIa14 / IVa13	TSHC
BL_38_1	La Belle Shipwreck	5858.2.8 Aft Hold	White Type 3 - cored	opaque	IIa14 / IVa13	TSHC
BL_39_1	La Belle Shipwreck	5858.2.9 Aft Hold	White Type 3 - cored	opaque	IIa14 / IVa13	TSHC
BL_40_1	La Belle Shipwreck	5858.2.10 Aft Hold	White Type 3 - cored	opaque	IIa14 / IVa13	TSHC

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
BL_41_1	La Belle Shipwreck	5858.2.54 Aft Hold	Blue Tubular Type 8	translucent	Ia19	TSHC
BL_42_1	La Belle Shipwreck	5858.2.55 Aft Hold	Blue Tubular Type 8	translucent	Ia19	TSHC
BL_43_1	La Belle Shipwreck	5858.2.56 Aft Hold	Blue Tubular Type 8	translucent	Ia19	TSHC
BL_44_1	La Belle Shipwreck	6002.1.1 Main Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_45_1	La Belle Shipwreck	6002.1.2 Main Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_46_1	La Belle Shipwreck	6002.1.3 Main Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_47_1	La Belle Shipwreck	6002.1.4 Main Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_48_1	La Belle Shipwreck	6002.1.6 Main Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_49_1	La Belle Shipwreck	6002.1.7 Main Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_50_1	La Belle Shipwreck	6002.1.8 Main Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_51_1	La Belle Shipwreck	6002.1.9 Main Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_52_1	La Belle Shipwreck	6002.1.11 Main Hold	Opaque Blue Type 1/3?	opaque	IIa31	TSHC
BL_53_1	La Belle Shipwreck	6002.1.12 Main Hold	Opaque Blue Type 1/3?	opaque	IIa31	TSHC
BL_54_1	La Belle Shipwreck	6002.1.13 Main Hold	Opaque Blue Type 1/3?	opaque	IIa31	TSHC
BL_55_1	La Belle Shipwreck	6002.1.14 Main Hold	Opaque Blue Type 1/3?	opaque	IIa31	TSHC
BL_56_1	La Belle Shipwreck	7841.1.1 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_57_1	La Belle Shipwreck	7841.1.2 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_58_1	La Belle Shipwreck	7841.1.3 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_59_1	La Belle Shipwreck	7841.1.4 Aft Hold	Lt. Blue Type 1	translucent	IIa55/56	TSHC
BL_60_1	La Belle Shipwreck	7841.1.6 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_61_1	La Belle Shipwreck	7841.1.7 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_62_1	La Belle Shipwreck	7841.1.8 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_63_1	La Belle Shipwreck	7841.1.9 Aft Hold	Med. Blue Type 1	translucent	IIa55/56	TSHC
BL_64_1	La Belle Shipwreck	7841.1.11 Aft Hold	Dk. Blue Type 1	translucent	IIa55/56	TSHC
BL_65_1	La Belle Shipwreck	7841.1.12 Aft Hold	Dk. Blue Type 1	translucent	IIa55/56	TSHC
BL_66_1	La Belle Shipwreck	7841.1.13 Aft Hold	Dk. Blue Type 1	translucent	IIa55/56	TSHC
BL_67_1	La Belle Shipwreck	7841.1.14 Aft Hold	Dk. Blue Type 1	translucent	IIa55/56	TSHC
MA_13	Marina (La Pointe)	MI1983.237.842 (Al Galazen?); 20th century collector, probable either Cadotte or Marina site	pendant, turquoise, opaque	opaque	pendant (larger)	WHS
MA_14	Marina (La Pointe)	MI1983.237.842 (Al Galazen?); 20th century collector, probable either Cadotte or Marina site	pendant, turquoise, opaque	opaque	pendant (smaller)	WHS
MA_15	Marina (La Pointe)	MI1983.237.842 (Al Galazen?); 20th century collector, probable either Cadotte or Marina site	turquoise blue, seed bead	opaque	IIa31	WHS

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
MA_16	Marina (La Pointe)	MI1983.237.842 (Al Galazen?); 20th century collector, probable either Cadotte or Marina site	turquoise blue, seed bead	opaque	IIa31	WHS
MA_17	Marina (La Pointe)	MI1983.237.842 (Al Galazen?); 20th century collector, probable either Cadotte or Marina site	turquoise blue, seed bead	opaque	IIa31	WHS
MA_01	Marina	167, N186 E100 L 5 F10; N186 E100, Feature 10, Level 5. was the dog burial, bead found in the fill above the feature	turquoise blue, round	opaque	IIa40	WHS
MA_02	Marina	F.S. #33; N330 E82, Feature 62 top lens flotation sample, w/14 white seed beads	cobalt blue, seed bead	translucent	IIa55/56	WHS
MA_03	Marina	N316 E82 F.80; N316 E82 F.80, layer #3, float sample 50, sediment fraction	cobalt blue, seed bead	translucent	IIa55/56	WHS
MA_04	Marina	F.S. #115; N330 E84, F128 black sand zone 20-32cm, with other seed beads, ceramics, chert, cut brass	pastel blue, seed bead	opaque	IIa46	WHS
MA_05	Marina	F.S. #115; N330 E84, F128 black sand zone 20-32cm, with other seed beads, ceramics, chert, cut brass	turquoise blue, seed bead	opaque	IIa31	WHS
MA_06	Marina	456, N334 E82 Zone 1 F 65; N334 E82 Zone 1, Feature 65	turquoise blue, seed bead	opaque	IIa31	WHS
MA_07	Marina	F.S. #68; N342 E82 F. 97, Profile #7 (pit)	turquoise blue, seed bead	opaque	IIa31	WHS
MA_08	Marina	766-769, N336 E82; N336 E82 Zone I level 2. Strung together, will not need to detach.	turquoise blue, seed bead	opaque	IIa31	WHS
MA_09	Marina	766-769, N336 E82; N336 E82 Zone I level 2. Strung together, will not need to detach.	turquoise blue, seed bead	opaque	IIa31	WHS
MA_10	Marina	766-769, N336 E82; N336 E82 Zone I level 2. Strung together, will not need to detach.	turquoise blue, seed bead	opaque	IIa31	WHS
MA_11	Marina	766-769, N336 E82; N336 E82 Zone I level 2. Strung together, will not need to detach.	turquoise blue, seed bead	opaque	IIa31	WHS
MA_12	Marina	228, N360 E82; N360 E82 Zone 3, level 1 F. 114	cobalt blue, tubular, large	translucent	Ia19/20	WHS
MRK_01	Markman	Lot 373	turquoise blue, round	opaque	IIa40	UWO
MM_001	Marquette Mission	5810.2.222.01.02	cobalt blue, elongate (barrel)	translucent	IIa57	MSU
MM_002	Marquette Mission	5810.2.155.01	turquoise blue, elongate fragment (barrel)	translucent	IIa38	MSU
MM_003	Marquette Mission	5810.2.221.01.04	cobalt blue, round/barrel	translucent	IIa44	MSU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
MM_004	Marquette Mission	5810.2.222.01.04	cobalt blue, round/barrel	translucent	IIa44	MSU
MM_005	Marquette Mission	5810.2.216.01.03	cobalt blue, round/barrel, patinated	translucent	IIa44	MSU
MM_006	Marquette Mission	5810.2.237.01	cobalt blue, round/barrel, patinated	translucent	IIa44	MSU
MM_007	Marquette Mission	5810.2.203.01	cobalt blue, round	translucent	IIa44	MSU
MM_008	Marquette Mission	5810.2.222.01.02	cobalt blue, round, patinated	translucent	IIa44	MSU
MM_009	Marquette Mission	5810.2.229.01	cobalt blue, round	translucent	IIa44	MSU
MM_010	Marquette Mission	5810.2.203.01	cobalt blue, disk	translucent	IIa56	MSU
MM_011	Marquette Mission	5810.2.222.01.02	cobalt blue, round	translucent	IIa44	MSU
MM_012	Marquette Mission	5810.2.229.01	turquoise blue, round, crazed/heated	opaque	IIa40	MSU
MM_013	Marquette Mission	5810.2.188.01	cobalt blue, disk	translucent	IIa56	MSU
MM_014	Marquette Mission	5810.2.205.01.04	cobalt blue, disk	translucent	IIa56	MSU
MM_015	Marquette Mission	5810.2.136.04	turquoise blue, round	opaque	IIa40	MSU
MM_016	Marquette Mission	5810.2.216.01.03	turquoise blue, round	opaque	IIa40	MSU
MM_017	Marquette Mission	5810.2.216.01.03	turquoise blue, barrel shaped fragment	translucent	IIa38	MSU
MM_018	Marquette Mission	5810.2.216.01.03	turquoise blue, round	translucent	IIa36	MSU
MM_019	Marquette Mission	5810.2.216.01.03	turquoise blue, round	opaque	IIa40	MSU
MM_020	Marquette Mission	5810.2.203.01.01	turquoise blue, round (color is darker; IIa48?)	opaque	IIa40	MSU
MM_021	Marquette Mission	5810.2.212.01	turquoise blue, round	opaque	IIa40	MSU
MM_022	Marquette Mission	5810.2.226.02	turquoise blue, round	opaque	IIa40	MSU
MM_023	Marquette Mission	5810.2.222.01.03	turquoise blue, round	opaque	IIa40	MSU
MM_024	Marquette Mission	5810.2.136.01	turquoise blue, round	opaque	IIa40	MSU
MM_025	Marquette Mission	5810.2.154.01.02.01	turquoise, trapezoidal/triangular	opaque	pendant	MSU
MM_026	Marquette Mission	5810.171.01C.05	turquoise, trapezoidal/triangular	opaque	pendant	MSU
MM_027	Marquette Mission	5810.2.192.01	turquoise, trapezoidal/triangular	opaque	pendant	MSU
MM_028	Marquette Mission	5810.2.215.01.01	turquoise, rounded trapezoid	opaque	pendant	MSU
MM_029	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_030	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_031	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
MM_032	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_033	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_034	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_035	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_036	Marquette Mission	5810.2.215.01.01	cobalt blue, seed bead	translucent	IIa55/57	MSU
MM_037	Marquette Mission	5810.2.215.01.01	pastel blue (opacified cobalt?)	opaque	IIa46/47	MSU
MM_038	Marquette Mission	5810.2.215.01.01	pastel blue (opacified cobalt?)	opaque	IIa46/47	MSU
MM_039	Marquette Mission	5810.2.215.01.01	pastel blue (opacified cobalt?)	opaque	IIa46/47	MSU
MM_040	Marquette Mission	5810.2.215.01.01	pastel blue, seed beed, patinated	opaque	IIa46/47	MSU
MM_041	Marquette Mission	5810.2.215.01.01	pastel blue, seed beed, patinated	opaque	IIa46/47	MSU
MM_042	Marquette Mission	5810.2.215.01.01	pastel blue, seed beed, patinated	opaque	IIa46/47	MSU
MM_043	Marquette Mission	5810.2.215.01.01	pastel blue, seed beed, patinated	opaque	IIa46/47	MSU
MM_044	Marquette Mission	5810.2.222.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_045	Marquette Mission	5810.2.222.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_046	Marquette Mission	5810.2.222.01.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_047	Marquette Mission	5810.2.222.01.01	pastel blue (opacified cobalt?)	opaque	IIa46/47	MSU
MM_048	Marquette Mission	5810.2.206.01.03	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_049	Marquette Mission	5810.2.206.01.03	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_050	Marquette Mission	5810.2.206.01.03	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_051	Marquette Mission	5810.2.206.01.03	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_052	Marquette Mission	5810.2.206.01.03	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_053	Marquette Mission	5810.2.206.01.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_054	Marquette Mission	5810.2.206.01.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_055	Marquette Mission	5810.2.206.01.03	pastel blue, seed beed, patinated	opaque	IIa46/47	MSU
MM_056	Marquette Mission	5810.2.206.01.03	pastel blue, seed beed, patinated	opaque	IIa46/47	MSU
MM_057	Marquette Mission	5810.2.206.01.03	pastel blue (opacified cobalt?)	opaque	IIa46/47	MSU
MM_058	Marquette Mission	5810.2.184.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_059	Marquette Mission	5810.2.184.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_060	Marquette Mission	5810.2.184.01	cobalt blue, seed bead	translucent	IIa55/56	MSU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
MM_061	Marquette Mission	5810.2.184.01	cobalt blue, seed bead, patinated	translucent	IIa55/56	MSU
MM_062	Marquette Mission	5810.2.184.01	cobalt blue, seed bead, patinated	translucent	IIa55/56	MSU
MM_063	Marquette Mission	5810.2.184.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_064	Marquette Mission	5810.2.184.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_065	Marquette Mission	5810.2.184.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_066	Marquette Mission	5810.2.183.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_067	Marquette Mission	5810.2.183.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_068	Marquette Mission	5810.2.183.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_069	Marquette Mission	5810.2.183.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_070	Marquette Mission	5810.2.183.01	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_071	Marquette Mission	5810.2.289.01 L1	cobalt blue, disk	translucent	IIa56	MSU
MM_072	Marquette Mission	5810.2.289.01 L1	turquoise blue, seed bead	translucent	IIa31	MSU
MM_073	Marquette Mission	5810.2.289.01 L1	turquoise blue, seed bead	translucent	IIa31	MSU
MM_074	Marquette Mission	5810.2.289.01 L1	turquoise blue, seed bead	opaque	IIa31	MSU
MM_075	Marquette Mission	5810.2.2.216.01.03	turquoise blue, round, imperfect shape	opaque	IIa40	MSU
MM_076	Marquette Mission	5810.2.2.216.01.03	turquoise blue, round, imperfect shape	opaque	IIa40	MSU
MM_077	Marquette Mission	5810.2.291.I	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_078	Marquette Mission	5810.2.291.I	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_079	Marquette Mission	5810.2.291.I	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_080	Marquette Mission	5810.2.291.I	turquoise blue, seed bead, patinated	opaque	IIa31	MSU
MM_081	Marquette Mission	5810.2.291.I	turquoise blue, seed bead	opaque	IIa31	MSU
MM_082	Marquette Mission	5810.2.291.02-92	turquoise blue, seed bead	opaque	IIa31	MSU
MM_083	Marquette Mission	5810.2.291.02-92	turquoise blue, seed bead	opaque	IIa31	MSU
MM_084	Marquette Mission	5810.2.291.02-92	turquoise blue, seed bead	opaque	IIa31	MSU
MM_085	Marquette Mission	5810.2.291.02-92	pastel blue (opacified cobalt?)	opaque	IIa46/47	MSU
MM_086	Marquette Mission	5810.2.291.02-92	cobalt blue, seed bead	translucent	IIa55/56	MSU
MM_087	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_088	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_089	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_090	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_091	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
MM_092	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_093	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_094	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_095	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_096	Marquette Mission	5810.2.190.01	turquoise blue, seed bead	opaque	IIa31	MSU
MM_097	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_098	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_099	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_100	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_101	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_102	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_103	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_104	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_105	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_106	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_107	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_108	Marquette Mission	5810.2.206.03	turquoise blue, seed bead	opaque	IIa31	MSU
MM_109	Marquette Mission	5810.2.222.01.02	cobalt blue, seed	translucent	IIa55/56	MSU
MM_110	Marquette Mission	5810.2.222.01.02	cobalt blue, seed	translucent	IIa55/56	MSU
MM_111	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	translucent	IIa31	MSU
MM_112	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	translucent	IIa31	MSU
MM_113	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	translucent	IIa31	MSU
MM_114	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	translucent	IIa31	MSU
MM_115	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	translucent	IIa31	MSU
MM_116	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	opaque	IIa31	MSU
MM_117	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	opaque	IIa31	MSU
MM_118	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	opaque	IIa31	MSU
MM_119	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	opaque	IIa31	MSU
MM_120	Marquette Mission	5810.2.222.01.02	turquoise blue, seed bead	opaque	IIa31	MSU
ML_01_1	Milford	Feat. 3 Unit 340 N11 E3 40 - 50 cm	cobalt blue, seed, patinated	translucent	IIa55/56	IOSA
ML_02_1	Milford	Feat. 3 Unit 340 N11 E3 40 - 50 cm	cobalt blue, seed, patinated	translucent	IIa55/56	IOSA
ML_03_1	Milford	Feat. 3 Unit 340 N11 E3 50 - 60 cm	cobalt blue, seed, patinated	translucent	IIa55/56	IOSA
ML_04_1	Milford	Feat. 3 Unit 340 N11 E3 70 - 80 cm	cobalt blue, seed, patinated	translucent	IIa55/56	IOSA
ML_05_1	Milford	Feat. 3 Unit 340 N11 E3 90 - 100 cm	cobalt blue, seed, patinated	translucent	IIa55/56	IOSA
MP_01	Mormon Print Shop	Unit 4 30-40 cm 2012	cobalt blue, seed	opaque	IIa55/56	NMU
MP_02	Mormon Print Shop	Unit 4 50 -60 cm 2012	turquoise blue, seed	opaque	IIa31	NMU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
MP_03	Mormon Print Shop	3340 Unit 5 F7 E1/2	white, seed, "cored"	opaque	IIa13/14	NMU
MP_04	Mormon Print Shop	Unit 4 60-70 cm F.7	cobalt blue, seed	translucent	IIa55/56	NMU
NL_01	New Lenox	F151 N1/2 1/16" w.s.	cobalt (brite navy), tubular, fragment	translucent	Ia19	MARS
NL_02	New Lenox	F121 S1/2 1/4" w.s.	brite copan blue , medium, sphere	translucent	IIa45	MARS
NL_03	New Lenox	F205 surface of SE corner	cerulean blue, oblong spherical fragment	translucent	IIa44	MARS
NL_04	New Lenox	F220 N1/2, Zone 3 1/16" w.s.	cobalt (brite navy), round, small	translucent	IIa55	MARS
NL_05	New Lenox	F201 N1/2 Zone 1 1/16" w.s.	cobalt (brite navy), round, small	translucent	IIa55	MARS
NL_06	New Lenox	F120B N1/2 Zone 3	cobalt (brite navy), oval, small	translucent	IIa57	MARS
NL_07	New Lenox	F124 N1/2 Zone 2 1/16" w.s.	cobalt (brite navy), oval, small	translucent	IIa57	MARS
NL_08	New Lenox	F111 N1/2 w.s.	turquoise round, medium, patinated	opaque	IIa40	MARS
NL_09	New Lenox	F109 N1/2 Zone 2 w.s.	turquoise round, medium	opaque	IIa40	MARS
NL_10	New Lenox	F124 N1/2 Zone 2 1/4" w.s.	turquoise round, medium	opaque	IIa40	MARS
NL_11	New Lenox	F309 N1/2	turquoise round, medium, fragment	opaque	IIa40	MARS
NL_12	New Lenox	F205 Unit 33 1/4 in w.s.	aqua, round, large	translucent	IIa33	MARS
NV_01	Norge Village	TU 5 Lvl 2	turquoise blue seed	opaque	IIa 31	MOSA
PP_01	Peshtigo Point	Ron Strojny surface collection	turquoise blue round, medium	opaque	IIa40	private
PP_02	Peshtigo Point	Ron Strojny surface collection	turquoise blue round, medium	opaque	IIa40	private
PP_03	Peshtigo Point	Ron Strojny surface collection	turquoise blue round, medium	opaque	IIa40	private
PP_04	Peshtigo Point	Ron Strojny surface collection	turquoise blue round, medium	opaque	IIa40	private
PP_05	Peshtigo Point	Ron Strojny surface collection	turquoise blue round, medium	opaque	IIa40	private
PP_06	Peshtigo Point	Ron Strojny surface collection	turquoise blue round fragment	opaque	IIa40	private
PP_07	Peshtigo Point	Ron Strojny surface collection	turquoise blue round, medium	opaque	IIa40	private
PP_08	Peshtigo Point	Ron Strojny surface collection	turquoise blue, seed	opaque	IIa31	private
PP_09	Peshtigo Point	Ron Strojny surface collection	turquoise blue, seed	opaque	IIa31	private
PP_10	Peshtigo Point	Ron Strojny surface collection	turquoise blue, seed	opaque	IIa31	private
PP_11	Peshtigo Point	Ron Strojny surface collection	turquoise blue, seed	opaque	IIa31	private
PTS_1_1	Point Sauble	1951.436	turquoise blue	opaque	IIa31	WHS
PTS_2_1	Point Sauble	1951.437	turquoise blue, round	opaque	IIa40	WHS
PTS_3_1	Point Sauble	1951.438	turquoise blue, round	opaque	IIa40	WHS

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
PTS_4_1	Point Sauble	1951.432	cobalt blue, round	translucent	IIa55	WHS
PTS_5_1	Point Sauble	1951.433	cobalt blue, round	translucent	IIa55	WHS
RB_01	Red Banks	5300/2531 Jane Jennings, found in the ground near Red Banks prior to 1925	blue, larger round	opaque	IIa40	NPM
RB_02	Red Banks	5300/2531 Jane Jennings, found in the ground near Red Banks prior to 1925	turquoise blue, round, medium	opaque	IIa40	NPM
RB_03	Red Banks	181/3770 John P. Schumacher prior to 1927 at Red Banks	turquoise blue, round, medium	opaque	IIa40	NPM
RB_04	Red Banks	181/3770 John P. Schumacher prior to 1927 at Red Banks	turquoise, oval	opaque	IIa36	NPM
RB_05	Red Banks	L3771 John P. Schumacher prior to 1927 at Red Banks	turquoise blue, seed	opaque	IIa31	NPM
RB_06	Red Banks	L3771 John P. Schumacher prior to 1927 at Red Banks	doubled bead; ablation area 1	translucent	WIc (?)	NPM
RB_07	Red Banks	L3771 John P. Schumacher prior to 1927 at Red Banks	doubled bead; ablation area 2	translucent	Wic (?)	NPM
RB_08	Red Banks	L3771 John P. Schumacher prior to 1927 at Red Banks	turquoise blue, round, medium	opaque	IIa40	NPM
RB_09	Red Banks	L3771 John P. Schumacher prior to 1927 at Red Banks	turquoise blue, seed	opaque	IIa31	NPM
RB_10	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, seed	translucent	IIa55/56	NPM
RB_11	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, seed	translucent	IIa55/56	NPM
RB_12	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, seed	translucent	IIa55/56	NPM
RB_13	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, seed	translucent	IIa55/56	NPM
RB_14	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, seed	translucent	IIa55/56	NPM
RB_15	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, seed	translucent	IIa55/56	NPM
RB_16	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, oval	translucent	IIa57	NPM
RB_17	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, oval	translucent	IIa57	NPM

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
RB_18	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	cobalt blue, oval	translucent	IIa57	NPM
RB_19	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	turquoise blue, round, medium	opaque	IIa40	NPM
RB_21	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	turquoise blue, round, medium	opaque	IIa40	NPM
RB_22	Red Banks	177/3772 John P. Schumacher prior to 1927 at Red Banks	"melon"-shaped	translucent	WIIe6 (?)	NPM
RI_001	Rock Island 3a	Unit H Block 31-B2	cobalt blue, seed	translucent	IIa55/56	LU
RI_002	Rock Island 3a	Unit H Block 48-B2	turquoise blue, seed	translucent	IIa31	LU
RI_003	Rock Island 3a	Unit H Block 48-B2	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_004	Rock Island 2	Unit H Block 42 Pit	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_005	Rock Island 3a	Unit H Block Trench 2 -B3	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_006	Rock Island 3b	Unit E Block 27-B1	turquoise blue, small, fragment	opaque	IIa40	LU
RI_007	Rock Island 3b	Unit E Block 42-B1	turquoise blue, seed	opaque	IIa31	LU
RI_008	Rock Island 3b	Unit E Block 39-B1	turquoise blue, round, medium	opaque	IIa40	LU
RI_009	Rock Island 3a	Unit E Block 38-B2	light blue, seed	opaque	IIa46/47	LU
RI_010	Rock Island 3a	Unit E Block 49-B2	turquoise blue, seed	opaque	IIa31	LU
RI_011	Rock Island 3a	Unit E Block 32-B2	light blue, seed	opaque	IIa46/47	LU
RI_012	Rock Island 3a	Unit E Block 17-B2	turquoise blue, round, medium	translucent	IIa44	LU
RI_013	Rock Island 3a	Unit E Block 17-B2	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_014	Rock Island 3a	Unit E Block 39-B2	turquoise blue, seed	translucent	IIa55/56	LU
RI_015	Rock Island 3a	Unit E Block 33-B2	light blue, seed	opaque	IIa46/47	LU
RI_016	Rock Island 3b	Unit B Block E5 N10 B1	turquoise blue, seed	opaque	IIa31	LU
RI_017	Rock Island 3a	Unit B Block E0 N0 St. B	cobalt blue, seed	translucent	IIa55/56	LU
RI_018	Rock Island 2	Unit G Block W20 N10 B1	turquoise blue, seed	opaque	IIa31	LU
RI_019	Rock Island 2	Unit G Block W15 N5 B	turquoise blue, seed	opaque	IIa31	LU
RI_020	Rock Island 2	Unit G Block W15 N10 B	turquoise blue, seed	opaque	IIa31	LU
RI_021	Rock Island 2	Unit G Block W15 N10 B	turquoise blue, seed	opaque	IIa31	LU
RI_023	Rock Island 3 or 4	Unit A Block B	turq pendant turq	opaque	n/a	LU
RI_024	Rock Island 3 or 4	Unit A Block B	dk blue pendant bl.	opaque	n/a	LU
RI_025	Rock Island 3 or 4	Unit A Block B	turq pend, white	opaque	n/a	LU
RI_026	Rock Island 3 or 4	Unit A Block B	dk blue pend, white	opaque	n/a	LU
RI_027	Rock Island 4	Unit K Block outside Bldg 3	pendant frag. Pt. A	opaque	n/a	LU
RI_028	Rock Island 4	Unit K Block outside Bldg 3	pendant frag. Pt. B	opaque	n/a	LU
RI_029	Rock Island 4	Unit K Block Bldg 3	melted, dk blue	opaque	n/a	LU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
RI_030	Rock Island 4	Unit K Block Bldg 3	melted, lt. blue?	opaque	n/a	LU
RI_031	Rock Island 4	Unit K Block Bldg 3	melted, med. Blue	opaque	n/a	LU
RI_032	Rock Island 1	Unit J-K (K) Block 11-B3	turquoise blue, round, medium	opaque	IIa40	LU
RI_033	Rock Island 3b	Unit J-K (K) Block 10-B2	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_034	Rock Island 3b	Unit J-K (K) Block 16-B2	turquoise blue, seed	opaque	IIa31	LU
RI_035	Rock Island 3b	Unit J-K (K) Block 16-B2	turquoise blue, seed	opaque	IIa31	LU
RI_036	Rock Island 3b	Unit J-K (K) Block 16-B2	turquoise blue, seed	opaque	IIa31	LU
RI_037	Rock Island 3b	Unit J-K (K) Block 16-B2	turquoise blue, seed	opaque	IIa31	LU
RI_038	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	cobalt blue seed	translucent	IIa55/56	LU
RI_039	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_040	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_041	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_042	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_043	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_044	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_045	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_046	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_047	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_048	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2	turquoise blue, seed	opaque	IIa31	LU
RI_049	Rock Island 4	Unit M Block Burial 13	cobalt blue seed	translucent	IIa55/56	LU
RI_052b	Rock Island 4	Unit M Block Burial 13	duplicate analysis of RI_052	translucent	IIa55/56	LU
RI_053b	Rock Island 4	Unit M Block Burial 13	duplicate analysis of RI_053	translucent	IIa55/56	LU
RI_054	Rock Island 4	Unit M Block Burial 13	cobalt blue seed	translucent	IIa55/56	LU
RI_055	Rock Island 4	Unit M Block Burial 13	cobalt blue seed	translucent	IIa55/56	LU
RI_056	Rock Island 4	Unit M Block Burial 13	cobalt blue seed	translucent	IIa55/56	LU
RI_057	Rock Island 4	Unit M Block Burial 13	cobalt blue seed	translucent	IIa55/56	LU
RI_058	Rock Island 4	Unit M Block Burial 13	cobalt blue seed	translucent	IIa55/56	LU
RI_059	Rock Island 4	Unit M Block Burial 13	turquoise blue, seed	opaque	IIa31	LU
RI_060	Rock Island 4	Unit M Block Burial 13	turquoise blue, seed	opaque	IIa31	LU
RI_061	Rock Island 4	Unit M Block Burial 14 - under lid	turquoise blue, seed	opaque	IIa31	LU
RI_062	Rock Island 4	Unit M Block Burial 14 - under lid	turquoise blue, seed	opaque	IIa31	LU
RI_063	Rock Island 4	Unit M Block Burial 14 - under lid	turquoise blue, seed	opaque	IIa31	LU
RI_064	Rock Island 4	Unit M Block Burial 14 - under lid	cobalt blue, seed	translucent	IIa55/56	LU
RI_065	Rock Island 4	Unit M Block Burial 14 - under lid	cobalt blue, seed	translucent	IIa55/56	LU
RI_066	Rock Island 4	Unit M Block Burial 12	cobalt blue, seed	translucent	IIa55/56	LU
RI_067	Rock Island 4	Unit M Block Burial 12	cobalt blue, seed	translucent	IIa55/56	LU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
RI_068	Rock Island 4	Unit M Block Burial 12	cobalt blue, seed	translucent	IIa55/56	LU
RI_069	Rock Island 4	Unit M Block Burial 12	cobalt blue, seed	translucent	IIa55/56	LU
RI_070	Rock Island 4	Unit M Block Burial 12	cobalt blue, seed	translucent	IIa55/56	LU
RI_071	Rock Island 4	Unit M Block Burial 5 - locus 1	cobalt blue, seed	translucent	IIa55/56	LU
RI_072	Rock Island 4	Unit M Block Burial 5 - locus 1	cobalt blue, seed	translucent	IIa55/56	LU
RI_073	Rock Island 4	Unit M Block Burial 5 - locus 1	cobalt blue, seed	translucent	IIa55/56	LU
RI_074	Rock Island 4	Unit M Block Burial 5 - locus 1	cobalt blue seed, heated	translucent	IIa55/56	LU
RI_075	Rock Island 4	Unit M Block Burial 5 - locus 1	cobalt blue seed, heated	translucent	IIa55/56	LU
RI_076	Rock Island 4	Unit M Block Burial 4	cobalt blue seed, heated	translucent	IIa55/56	LU
RI_077	Rock Island 4	Unit M Block Burial 4	cobalt blue seed, heated	translucent	IIa55/56	LU
RI_078	Rock Island 4	Unit M Block Burial 4	cobalt blue seed, heated	translucent	IIa55/56	LU
RI_079	Rock Island 4	Unit M Block Burial 4	cobalt blue seed	translucent	IIa55/56	LU
RI_080	Rock Island 4	Unit M Block Burial 4	cobalt blue seed	translucent	IIa55/56	LU
RI_081	Rock Island 4	Unit M Block Burial 3	cobalt blue seed	translucent	IIa55/56	LU
RI_082	Rock Island 4	Unit M Block Burial 3	cobalt blue seed	translucent	IIa55/56	LU
RI_083	Rock Island 4	Unit M Block Burial 3	cobalt blue seed	translucent	IIa55/56	LU
RI_084	Rock Island 4	Unit M Block Burial 3	cobalt blue seed	translucent	IIa55/56	LU
RI_085	Rock Island 4	Unit M Block Burial 3	cobalt blue seed	translucent	IIa55/56	LU
RI_086	Rock Island 4	Unit M Block Burial 1	cobalt blue seed	translucent	IIa55/56	LU
RI_087	Rock Island 4	Unit M Block Burial 1	cobalt blue seed	translucent	IIa55/56	LU
RI_088	Rock Island 4	Unit M Block Burial 1	cobalt blue seed	translucent	IIa55/56	LU
RI_089	Rock Island 4	Unit M Block Burial 1	light blue, seed	opaque	IIa46/47	LU
RI_090	Rock Island 4	Unit M Block Burial 1	light blue, seed	opaque	IIa46/47	LU
RI_091	Rock Island 4	Unit M Block Burial 1	light blue, seed	opaque	IIa46/47	LU
RI_092	Rock Island 4	Unit M Block Burial 1	light blue, seed	opaque	IIa46/47	LU
RI_093	Rock Island 4	Unit M Block Burial 1	light blue, seed	opaque	IIa46/47	LU
RI_094	Rock Island 3b	Unit M Block Burial 1	turquoise blue, seed	opaque	IIa31	LU
RI_095	Rock Island 3b	Unit M Block Burial 1	turquoise blue, seed	opaque	IIa31	LU
RI_096	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU
RI_097	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU
RI_098	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU
RI_099	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU
RI_100	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU
RI_101	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU
RI_102	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU
RI_103	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, seed	opaque	IIa31	LU

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
RI_104	Rock Island 3	Unit J-K (J) Block Tr 3-11, B2 & B3	turquoise blue, round, medium	opaque	IIa40	LU
RI_105	Rock Island 3b	Unit J-K (J) Block Tr 3-11, B2 & B3	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_106	Rock Island 3b	Unit H Block 39 B	turquoise blue, large, round	translucent	IIa28/29	LU
RI_107	Rock Island 2(?)	Unit I Block 9	cobalt blue, seed	translucent	IIa55/56	LU
RI_108	Rock Island 3b	Unit I Block 9	light blue, seed	opaque	IIa46/47	LU
RI_109	Rock Island 3	Unit H Block 36-Pit B	cobalt blue, seed	translucent	IIa55/56	LU
RI_110	Rock Island 3	Unit I Block 9	cobalt blue, seed	translucent	IIa55/56	LU
RI_111	Rock Island 3	Unit H Block 12 B	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_112	Rock Island 3a	Unit H Block 19-B2	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_113	Rock Island 3a	Unit H Block 12 B	cobalt blue, tubular, large	translucent	Ia19/20	LU
RI_114	Rock Island 3b	Unit B Block E555 St. B2	cobalt blue, seed	translucent	IIa55/56	LU
RI_115	Rock Island 3b	Unit B Block E10 N0 St. B2	cobalt blue, seed	translucent	IIa55/56	LU
RI_116	Rock Island 3b	Unit I Block 9	cobalt blue, seed	translucent	IIa55/56	LU
RI_117	Rock Island 3b	Unit I Block 9	cobalt blue, seed	translucent	IIa55/56	LU
RI_118	Rock Island 3b	Unit I Block 9	cobalt blue, seed	translucent	IIa55/56	LU
RI_119	Rock Island 3b	Unit I Block 9	turquoise blue, seed	opaque	IIa31	LU
RI_120	Rock Island 3b	Unit I Block 9	turquoise blue, seed	opaque	IIa31	LU
RI_121	Rock Island 3b	Unit I Block 9	turquoise blue, seed	opaque	IIa31	LU
RI_122	Rock Island 3b	Unit I Block 9	turquoise blue, seed	opaque	IIa31	LU
RI_123	Rock Island 3b	Unit I Block 9	turquoise blue, seed	translucent	IIa31	LU
RI_124	Rock Island 4	Unit I Block 9	turquoise blue, seed	opaque	IIa31	LU
RI_125	Rock Island 4	Unit I Block 9	turquoise blue, seed	opaque	IIa31	LU
RI_126	Rock Island 4	Block K, House 2, stratum II (Odawa House)	turquoise blue, seed	opaque	IIa31	LU
RI_127	Rock Island 4	Block K, House 2, stratum II (Odawa House)	turquoise blue, seed	opaque	IIa31	LU
RI_128	Rock Island 4	Block K, House 2, stratum II (Odawa House)	turquoise blue, seed	opaque	IIa31	LU
RI_129	Rock Island 4	Block K, Unit 11, B1 Odawa house (House 2)	blue opaque bottle(?) fragment	opaque	high Ca frag?	LU
RI_130	Rock Island 4	Block K, Unit 17, B1 Odawa house (House 2)	blue opaque bottle(?) fragment	opaque	high Ca frag?	LU
WA_01_1	Wanampito	surface collection, Area 3	turquoise blue, small/med, round	opaque	IIa36	IOSA
ZM_01	Zimmerman	Lot #143 Square S45 W190 Feature 43 Level 6 Portion NW1/4	refired glass fragment, curved	opaque	n/a	ISM
ZM_02	Zimmerman	Lot #714 Square S283 W315 Feature 102 Level n/a Portion N1/2	refired blue glass fragment	opaque	n/a	ISM

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
ZM_03	Zimmerman	Lot #676 Square S45 W196 Feature 131 Level n/a Portion N1/2	refired blue glass fragment, possible metal adhering?	opaque	n/a	ISM
ZM_04	Zimmerman	Lot #699 Square Test Unit 7 Feature n/a Level plowzone Portion n/a	refired blue glass fragment, triangular	opaque	n/a	ISM
ZM_05	Zimmerman	Lot #55 Square S45 W215 Feature n/a Level 3 Portion n/a	refired blue glass fragment, one curved edge	opaque	n/a	ISM
ZM_06	Zimmerman	Lot #394 Square S250 W100 Feature n/a Level 1 and 2 Portion n/a	refired light blue glass fragment, triangular corner	opaque	n/a	ISM
ZM_07	Zimmerman	Lot #728 Square S284 W219 Feature 78 Level n/a Portion E1/2	refired glass fragment, light blue or white portion	opaque	n/a	ISM
ZM_08	Zimmerman	Lot #728 Square S284 W219 Feature 78 Level n/a Portion E1/2	refired glass fragment, blue portion	opaque	n/a	ISM
ZM_09	Zimmerman	Lot #149 Square S45 W90 Feature 43 Level 7 Portion NE1/4	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_10	Zimmerman	Lot #760 Square S284 W219 Feature 78 Level n/a Portion Zone B	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_11	Zimmerman	Lot #760 Square S284 W219 Feature 78 Level n/a Portion Zone B	cobalt blue translucent, patinated	translucent	IIa55/56	ISM
ZM_12	Zimmerman	Lot #713 Square S283 W315 Feature 102 Level n/a Portion N1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_13	Zimmerman	Lot #710 Square S283 W312 Feature 103 Level n/a Portion W1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_14	Zimmerman	Lot #710 Square S283 W312 Feature 103 Level n/a Portion W1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_15	Zimmerman	Lot #709 Square S283 W312 Feature 103 Level n/a Portion E1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_16	Zimmerman	Lot #674 Square S45 E187 Feature 130 Level n/a Portion S1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_17	Zimmerman	Lot #677 Square S45 W196 Feature 131 Level n/a Portion S1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_18	Zimmerman	Lot #677 Square S45 W196 Feature 131 Level n/a Portion S1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_19	Zimmerman	Lot #677 Square S45 W196 Feature 131 Level n/a Portion S1/2	cobalt blue translucent, very small	translucent	IIa55/56	ISM
ZM_20	Zimmerman	Lot #679 Square S37 W187 Feature 132 Level n/a Portion S1/2	cobalt blue translucent	translucent	IIa55/56	ISM

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
ZM_21	Zimmerman	Lot #681 Square S36 W185 Feature 134 Level n/a Portion N1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_22	Zimmerman	Lot #706 Square S37 W183 Feature 135 Level n/a Portion N1/2	cobalt blue translucent	translucent	IIa55/56	ISM
ZM_23	Zimmerman	Lot #143 Square S45 W190 Feature 43 Level 6 Portion NW1/4	turquoise blue seed bead	opaque	IIa31	ISM
ZM_24	Zimmerman	Lot #143 Square S45 W190 Feature 43 Level 6 Portion NW1/4	turquoise blue seed bead	opaque	IIa31	ISM
ZM_25	Zimmerman	Lot #143 Square S45 W190 Feature 43 Level 6 Portion NW1/4	turquoise blue seed bead, v. small	opaque	IIa31	ISM
ZM_26	Zimmerman	Lot #411 Square S270 W365 Feature 61 Level 5 Portion n/a	turquoise blue seed bead, large	opaque	IIa31	ISM
ZM_27	Zimmerman	Lot #411 Square S270 W365 Feature 61 Level 5 Portion n/a	turquoise blue seed bead	opaque	IIa31	ISM
ZM_28	Zimmerman	Lot #411 Square S270 W365 Feature 61 Level 5 Portion n/a	turquoise blue seed bead	opaque	IIa31	ISM
ZM_29	Zimmerman	Lot #722 Square S318 E93 Feature 73 Level n/a Portion Zone A	turquoise blue seed bead	opaque	IIa31	ISM
ZM_30	Zimmerman	Lot #723 Square S319 E93 Feature 74 Level n/a Portion W1/2	turquoise blue seed bead, large	opaque	IIa31	ISM
ZM_31	Zimmerman	Lot #723 Square S319 E93 Feature 74 Level n/a Portion W1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_32	Zimmerman	Lot #728 Square S284 W219 Feature 78 Level n/a Portion E1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_33	Zimmerman	Lot #760 Square S284 W219 Feature 78 Level n/a Portion W1/2 Zone B	turquoise blue seed bead	opaque	IIa31	ISM
ZM_34	Zimmerman	Lot #713 Square S283 W315 Feature 102 Level n/a Portion N1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_35	Zimmerman	Lot #709 Square S283 W312 Feature 103 Level n/a Portion E1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_36	Zimmerman	Lot #674 Square S45 E187 Feature 130 Level n/a Portion S1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_37	Zimmerman	Lot #677 Square S45 W196 Feature 131 Level n/a Portion S1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_38	Zimmerman	Lot #677 Square S45 W196 Feature 131 Level n/a Portion S1/2	turquoise blue seed bead	opaque	IIa31	ISM

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
ZM_39	Zimmerman	Lot #679 Square S37 W187 Feature 132 Level n/a Portion S1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_40	Zimmerman	Lot #681 Square S36 W185 Feature 134 Level n/a Portion N1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_41	Zimmerman	Lot #682 Square S36 W185 Feature 134 Level n/a Portion S1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_42	Zimmerman	Lot #706 Square S37 W183 Feature 135 Level n/a Portion N1/2	turquoise blue seed bead	opaque	IIa31	ISM
ZM_43	Zimmerman	Lot #723 Square S319 E93 Feature 74 Level n/a Portion W1/2	turquoise blue seed bead	translucent	IIa31?	ISM
ZM_44	Zimmerman	Lot #723 Square S319 E93 Feature 74 Level n/a Portion W1/2	turquoise blue seed bead	translucent	IIa31?	ISM
ZM_45	Zimmerman	Lot #677 Square S45 W196 Feature 131 Level n/a Portion S1/2	turquoise blue seed bead, very small	translucent	IIa31?	ISM
ZM_46	Zimmerman	Lot #728 Square S284 W219 Feature 78 Level n/a Portion E1/2	turquoise blue round bead, patinated	opaque	IIa40	ISM
ZM_47	Zimmerman	Lot #760 Square S284 W219 Feature 78 Level n/a Portion Zone B	turquoise blue round bead, fragment	opaque	IIa40	ISM
ZM_48	Zimmerman	Lot #143 Square S45 W190 Feature 43 Level 6 Portion NW1/4	blue seed bead	opaque	IIa46/47	ISM
ZM_49	Zimmerman	Lot #143 Square S45 W190 Feature 43 Level 6 Portion NW1/4	blue seed bead	opaque	IIa46/47	ISM
ZM_50	Zimmerman	Lot #722 Square S318 E93 Feature 73 Level n/a Portion Zone A	blue seed bead	opaque	IIa46/47	ISM
ZM_51	Zimmerman	Lot #722 Square S318 E93 Feature 73 Level n/a Portion Zone A	blue seed bead	opaque	IIa46/47	ISM
ZM_52	Zimmerman	Lot #723 Square S319 E93 Feature 74 Level n/a Portion W1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_53	Zimmerman	Lot #723 Square S319 E93 Feature 74 Level n/a Portion W1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_54	Zimmerman	Lot #728 Square S284 W219 Feature 78 Level n/a Portion E1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_55	Zimmerman	Lot #760 Square S284 W219 Feature 78 Level n/a Portion Zone B	blue seed bead	opaque	IIa46/47	ISM
ZM_56	Zimmerman	Lot #713 Square S283 W315 Feature 102 Level n/a Portion N1/2	blue seed bead	opaque	IIa46/47	ISM

Sample ID	Site	Provenience and Artifact ID	Description	Transparency	K&K	Curation
ZM_57	Zimmerman	Lot #710 Square S283 W312 Feature 103 Level n/a Portion W1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_58	Zimmerman	Lot #709 Square S283 W312 Feature 103 Level n/a Portion E1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_59	Zimmerman	Lot #674 Square S45 E187 Feature 130 Level n/a Portion S1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_60	Zimmerman	Lot #677 Square S45 W196 Feature 131 Level n/a Portion S1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_61	Zimmerman	Lot #679 Square S37 W187 Feature 132 Level n/a Portion S1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_62	Zimmerman	Lot #819 Square S39 W188 Feature 133 Level n/a Portion float	blue seed bead, corroded	opaque	IIa46/47	ISM
ZM_63	Zimmerman	Lot #819 Square S39 W188 Feature 133 Level n/a Portion float	blue seed bead, corroded	opaque	IIa46/47	ISM
ZM_64	Zimmerman	Lot #682 Square S36 W185 Feature 134 Level n/a Portion S1/2	blue seed bead	opaque	IIa46/47	ISM
ZM_65	Zimmerman	Lot #706 Square S37 W183 Feature 135 Level n/a Portion N1/2	blue seed bead	opaque	IIa46/47	ISM

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	5.2.1 Cobalt-colored translucent dark blue beads (IIa55/56 & Ia19/20)												
	Subgroup: Mg-low-P (n=219)												
AR_01	Arrowsmith	66.5%	13.5%	3.2%	2.2%	0.3%	2.4%	10.0%	0.1%	0.6%	0.0%	5	241
B177	Bell	69.3%	11.5%	2.6%	2.4%	0.3%	3.6%	8.5%	0.1%	1.1%	0.0%	3	509
B1832	Bell	69.5%	12.9%	2.9%	2.0%	0.3%	2.1%	8.5%	0.1%	1.1%	0.0%	6	852
B1956	Bell	68.1%	12.1%	2.7%	1.3%	0.3%	2.7%	10.7%	0.2%	0.7%	0.0%	16	1759
B1990	Bell	65.6%	11.8%	3.1%	1.6%	0.2%	4.8%	11.2%	0.0%	0.8%	0.0%	4	192
B2065	Bell	67.2%	12.6%	3.0%	1.7%	0.3%	2.3%	11.2%	0.1%	0.9%	0.0%	4	815
B411	Bell	66.5%	12.0%	3.2%	2.1%	0.3%	1.7%	12.1%	0.0%	1.1%	0.0%	6	1086
B425	Bell	69.2%	10.2%	3.0%	2.4%	0.3%	3.3%	9.6%	0.1%	1.2%	0.0%	5	1009
B632	Bell	68.3%	11.3%	3.5%	1.6%	0.3%	2.3%	11.1%	0.2%	0.8%	0.0%	3	375
B701	Bell	67.4%	11.6%	3.2%	2.5%	0.3%	2.7%	10.3%	0.1%	1.2%	0.0%	6	1207
B738	Bell	69.5%	12.4%	2.7%	1.6%	0.4%	2.0%	9.7%	0.1%	0.9%	0.0%	7	858
B932	Bell	68.1%	12.0%	3.2%	1.9%	0.3%	1.7%	10.8%	0.0%	1.1%	0.0%	3	737
BL_01_1	La Belle Shipwreck	69.0%	12.6%	3.1%	1.6%	0.3%	2.0%	9.2%	0.1%	1.0%	0.0%	24	208
BL_02_1	La Belle Shipwreck	69.2%	12.5%	3.3%	1.2%	0.3%	2.0%	9.5%	0.0%	0.7%	0.0%	9	1206
BL_03_1	La Belle Shipwreck	68.9%	11.9%	2.9%	1.4%	0.4%	2.6%	9.8%	0.1%	0.8%	0.0%	16	926
BL_04_1	La Belle Shipwreck	69.0%	12.7%	3.4%	1.2%	0.2%	1.9%	9.5%	0.0%	0.7%	0.0%	11	1950
BL_05_1	La Belle Shipwreck	68.8%	12.5%	3.3%	1.6%	0.3%	2.2%	9.1%	0.1%	0.9%	0.0%	38	1211
BL_06_1	La Belle Shipwreck	68.2%	12.0%	3.5%	1.9%	0.3%	2.3%	9.3%	0.0%	1.1%	0.0%	27	602
BL_07_1	La Belle Shipwreck	65.9%	11.0%	2.9%	1.4%	0.5%	4.1%	12.2%	0.1%	0.7%	0.0%	20	880
BL_08_1	La Belle Shipwreck	68.7%	12.5%	3.3%	1.5%	0.3%	2.1%	9.4%	0.1%	0.9%	0.0%	23	772
BL_09_1	La Belle Shipwreck	68.2%	12.2%	3.0%	1.5%	0.4%	2.6%	9.9%	0.1%	0.9%	0.0%	13	916
BL_10_1	La Belle Shipwreck	68.3%	12.6%	3.3%	1.6%	0.3%	2.2%	9.4%	0.1%	0.9%	0.0%	12	860
BL_11_1	La Belle Shipwreck	68.5%	12.5%	3.2%	1.5%	0.3%	2.2%	9.4%	0.1%	0.9%	0.0%	18	837
BL_12_1	La Belle Shipwreck	67.8%	12.1%	3.6%	1.7%	0.3%	2.3%	10.0%	0.0%	1.0%	0.0%	20	464
BL_13_1	La Belle Shipwreck	68.1%	11.9%	3.5%	1.7%	0.3%	2.3%	10.0%	0.0%	1.0%	0.0%	44	524
BL_14_1	La Belle Shipwreck	68.6%	12.8%	3.4%	1.2%	0.3%	2.0%	9.7%	0.0%	0.7%	0.0%	14	1140
BL_15_1	La Belle Shipwreck	70.0%	11.6%	3.4%	1.0%	0.3%	1.9%	9.9%	0.1%	0.6%	0.0%	27	856
BL_16_1	La Belle Shipwreck	70.8%	10.8%	2.7%	1.3%	0.4%	2.5%	9.3%	0.1%	0.8%	0.0%	81	1117
BL_17_1	La Belle Shipwreck	68.9%	9.7%	3.3%	1.2%	0.5%	3.6%	10.8%	0.1%	0.8%	0.0%	46	476
BL_18_1	La Belle Shipwreck	67.5%	12.2%	3.5%	1.9%	0.3%	2.3%	9.8%	0.0%	1.1%	0.0%	14	466
BL_19_1	La Belle Shipwreck	67.7%	12.0%	3.5%	1.7%	0.3%	2.4%	10.0%	0.0%	1.0%	0.0%	19	530
BL_20_1	La Belle Shipwreck	68.4%	12.7%	3.4%	1.5%	0.3%	2.0%	9.6%	0.1%	0.9%	0.0%	14	942
BL_21_1	La Belle Shipwreck	68.8%	11.5%	2.9%	1.2%	0.4%	2.8%	10.3%	0.1%	0.7%	0.0%	15	497
BL_22_1	La Belle Shipwreck	66.9%	12.4%	3.6%	1.7%	0.3%	2.4%	10.3%	0.0%	1.0%	0.0%	7	473

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	5.2.1 Cobalt-colored translucent dark blue beads (IIa55/56 & Ia19/20)														
	Subgroup: Mg-low-P (n=219)														
AR_01	15	1	91	5	668	20	37	208	434	50	470	18	431	31	3
B177	31	1	91	4	149	17	20	111	498	36	973	26	392	33	3
B1832	16	1	92	4	143	17	22	204	436	35	401	18	421	28	3
B1956	10	0	83	3	99	12	14	153	304	34	480	14	563	20	2
B1990	23	0	66	3	112	15	10	113	511	65	847	28	674	28	2
B2065	11	1	88	3	117	14	18	382	489	43	716	18	501	25	2
B411	11	1	76	3	156	17	27	68	661	44	649	13	569	37	3
B425	14	1	99	4	164	20	28	101	531	47	521	19	417	32	3
B632	11	1	92	3	89	14	22	79	604	44	1658	14	504	20	2
B701	16	1	79	4	168	19	26	115	629	61	714	19	490	36	3
B738	11	1	98	3	101	15	23	77	775	42	1266	12	461	22	2
B932	11	1	97	4	151	17	28	63	533	38	579	13	508	31	3
BL_01_1	7	1	84	4	387	17	28	219	607	43	1040	9	545	25	2
BL_02_1	6	0	83	3	277	13	21	167	519	35	1018	10	557	19	2
BL_03_1	9	1	91	3	305	14	18	181	592	34	1536	12	569	25	2
BL_04_1	7	1	81	3	260	12	17	164	524	33	1070	11	638	20	2
BL_05_1	8	1	91	4	383	16	20	169	576	42	1324	13	579	32	3
BL_06_1	8	1	90	4	488	19	24	198	617	47	1398	14	540	43	3
BL_07_1	12	1	79	3	253	11	14	199	662	35	1185	16	594	27	2
BL_08_1	8	1	92	3	376	16	21	203	609	40	1007	12	542	28	2
BL_09_1	9	1	84	3	355	15	19	175	551	37	1176	12	558	26	2
BL_10_1	8	1	90	3	391	16	19	174	608	37	1349	10	531	29	2
BL_11_1	8	1	89	3	390	16	18	175	601	35	1287	10	522	28	2
BL_12_1	8	1	86	3	429	17	18	181	540	42	1206	12	504	36	3
BL_13_1	7	1	84	3	429	16	18	173	511	45	1165	14	486	36	3
BL_14_1	7	1	79	3	292	13	14	165	511	38	943	9	572	19	2
BL_15_1	7	0	84	3	221	9	14	199	535	38	1218	10	524	19	2
BL_16_1	8	0	78	3	293	12	17	179	526	37	1048	10	527	23	2
BL_17_1	11	1	72	3	236	10	15	233	672	86	1325	14	556	27	2
BL_18_1	8	1	86	4	489	19	20	181	523	41	1098	11	518	40	3
BL_19_1	8	1	94	3	442	17	19	184	562	43	1274	15	502	36	3
BL_20_1	7	1	81	3	356	16	18	197	596	35	1135	9	566	22	2
BL_21_1	9	0	82	3	265	11	15	186	686	33	1982	10	563	22	2
BL_22_1	8	1	88	3	440	17	20	186	559	40	1252	12	516	36	3

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	5.2.1 Cobalt-colored translucent dark blue beads (IIa55/56 & Ia19/20)														
	Subgroup: Mg-low-P (n=219)														
AR_01	0	260	1	72	5	9	1	0	0	5	109	1	0	8	4
B177	0	310	1	128	6	12	2	0	0	5	281	2	1	5	5
B1832	0	229	1	112	5	12	2	0	0	5	142	1	0	8	5
B1956	0	1055	0	141	3	7	1	0	0	3	176	6	0	5	3
B1990	0	456	1	100	5	10	1	0	0	4	247	9	0	9	4
B2065	0	144	1	110	5	10	1	0	0	5	343	15	1	5	4
B411	0	95	0	203	7	13	2	0	0	7	174	1	1	9	6
B425	0	169	1	135	6	13	2	0	0	6	87	1	1	7	6
B632	0	25	0	128	4	8	1	0	0	4	199	2	0	13	4
B701	0	199	1	150	7	14	2	0	0	7	126	1	1	8	6
B738	0	48	0	112	4	9	1	0	0	4	212	1	0	9	4
B932	0	53	0	185	6	12	2	0	0	6	176	1	1	7	5
BL_01_1	1	342	0	100	4	7	1	0	0	4	325	3	0	4	4
BL_02_1	1	25	0	106	3	5	1	0	0	3	266	2	0	5	3
BL_03_1	1	32	0	115	4	8	1	0	0	4	400	3	0	6	4
BL_04_1	1	27	0	144	4	7	1	0	0	3	379	3	0	5	3
BL_05_1	1	73	0	133	5	9	1	0	0	4	369	3	0	5	5
BL_06_1	1	162	0	115	6	11	1	0	0	5	408	3	0	5	5
BL_07_1	1	67	0	124	4	7	1	0	0	4	289	4	0	4	4
BL_08_1	1	44	0	108	4	7	1	0	0	4	320	2	0	5	4
BL_09_1	1	32	0	110	4	7	1	0	0	4	324	2	0	5	4
BL_10_1	1	59	0	110	4	8	1	0	0	4	301	2	0	5	4
BL_11_1	1	57	0	108	4	7	1	0	0	4	286	2	0	5	4
BL_12_1	1	132	0	107	4	9	1	0	0	4	293	2	0	5	4
BL_13_1	1	145	0	114	4	9	1	0	0	4	330	2	0	5	4
BL_14_1	1	26	0	110	3	6	1	0	0	3	270	2	0	5	3
BL_15_1	1	182	0	110	3	5	1	0	0	3	391	3	0	7	2
BL_16_1	1	66	0	105	3	6	1	0	0	3	348	2	0	5	3
BL_17_1	1	102	0	114	4	7	1	0	0	4	369	4	0	6	3
BL_18_1	1	145	0	107	5	10	1	0	0	5	307	2	0	4	5
BL_19_1	1	137	0	115	4	9	1	0	0	4	318	2	0	6	4
BL_20_1	1	31	0	104	3	7	1	0	0	4	323	2	0	4	3
BL_21_1	1	49	0	105	3	6	1	0	0	3	409	3	0	8	3
BL_22_1	1	130	0	109	5	9	1	0	0	5	301	2	0	5	4

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	5.2.1 Cobalt-colored translucent dark blue beads (IIa55/56 & Ia19/20)											
	Subgroup: Mg-low-P (n=219)											
AR_01	1	0	1	0	1	0	0	0	0	0	1	1
B177	1	0	1	0	1	0	1	0	0	0	1	2
B1832	1	0	1	0	1	0	0	0	0	0	1	2
B1956	1	0	1	0	1	0	0	0	0	0	1	1
B1990	1	0	1	0	1	0	0	0	0	0	1	2
B2065	1	0	1	0	1	0	0	0	0	0	1	1
B411	1	0	1	0	1	0	1	0	1	0	1	2
B425	1	0	1	0	1	0	1	0	1	0	1	1
B632	1	0	1	0	1	0	0	0	0	0	1	1
B701	1	0	1	0	1	0	1	0	1	0	1	2
B738	1	0	1	0	1	0	0	0	0	0	1	1
B932	1	0	1	0	1	0	1	0	0	0	1	1
BL_01_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_02_1	1	0	1	0	0	0	0	0	0	0	1	1
BL_03_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_04_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_05_1	1	0	1	0	1	0	1	0	1	0	1	1
BL_06_1	1	0	1	0	1	0	1	0	1	0	1	1
BL_07_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_08_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_09_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_10_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_11_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_12_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_13_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_14_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_15_1	1	0	1	0	0	0	0	0	0	0	1	1
BL_16_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_17_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_18_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_19_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_20_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_21_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_22_1	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
BL_23_1	La Belle Shipwreck	66.9%	12.6%	3.6%	1.7%	0.3%	2.4%	10.2%	0.0%	1.0%	0.0%	7	551
BL_24_1	La Belle Shipwreck	67.5%	12.2%	3.0%	1.4%	0.4%	2.8%	10.6%	0.1%	0.8%	0.0%	10	683
BL_41_1	La Belle Shipwreck	70.5%	11.7%	3.0%	1.5%	0.3%	2.2%	9.7%	0.1%	0.9%	0.0%	9	531
BL_42_1	La Belle Shipwreck	67.8%	10.5%	2.8%	1.1%	0.5%	4.0%	12.6%	0.0%	0.6%	0.0%	5	164
BL_43_1	La Belle Shipwreck	70.3%	11.8%	3.0%	1.5%	0.3%	2.0%	10.0%	0.1%	0.9%	0.0%	14	362
BL_44_1	La Belle Shipwreck	70.1%	11.4%	2.8%	1.5%	0.4%	2.5%	10.4%	0.1%	0.8%	0.0%	21	444
BL_45_1	La Belle Shipwreck	70.0%	11.7%	2.8%	1.7%	0.4%	2.3%	10.1%	0.1%	0.9%	0.0%	13	559
BL_46_1	La Belle Shipwreck	69.5%	11.3%	2.8%	1.2%	0.4%	2.7%	11.4%	0.1%	0.7%	0.0%	22	249
BL_47_1	La Belle Shipwreck	70.0%	12.0%	3.0%	1.6%	0.3%	2.1%	9.9%	0.1%	0.9%	0.0%	13	501
BL_48_1	La Belle Shipwreck	68.7%	11.9%	3.4%	1.9%	0.4%	2.1%	10.4%	0.0%	1.1%	0.0%	16	493
BL_49_1	La Belle Shipwreck	69.0%	11.8%	2.8%	1.5%	0.4%	2.5%	10.9%	0.1%	0.8%	0.0%	16	491
BL_50_1	La Belle Shipwreck	68.2%	12.0%	3.4%	1.7%	0.3%	2.2%	11.0%	0.0%	1.0%	0.0%	16	276
BL_51_1	La Belle Shipwreck	68.1%	11.9%	3.5%	2.0%	0.4%	2.2%	10.7%	0.1%	1.1%	0.0%	35	143
BL_56_1	La Belle Shipwreck	68.5%	12.0%	2.9%	1.3%	0.4%	2.8%	11.3%	0.0%	0.7%	0.0%	9	526
BL_57_1	La Belle Shipwreck	66.1%	11.1%	2.9%	1.2%	0.5%	4.2%	13.3%	0.0%	0.6%	0.0%	6	147
BL_58_1	La Belle Shipwreck	67.5%	12.3%	3.6%	2.0%	0.4%	2.3%	10.8%	0.0%	1.1%	0.0%	5	135
BL_59_1	La Belle Shipwreck	65.5%	11.5%	3.1%	1.2%	0.5%	4.3%	13.3%	0.0%	0.7%	0.0%	13	273
BL_60_1	La Belle Shipwreck	67.7%	13.4%	3.3%	1.7%	0.3%	2.2%	10.3%	0.1%	1.0%	0.0%	23	231
BL_61_1	La Belle Shipwreck	67.6%	12.2%	3.1%	1.2%	0.4%	3.0%	11.6%	0.1%	0.7%	0.0%	13	518
BL_62_1	La Belle Shipwreck	67.8%	12.4%	3.1%	1.3%	0.4%	2.8%	11.4%	0.1%	0.8%	0.0%	10	601
BL_63_1	La Belle Shipwreck	67.8%	13.3%	3.4%	1.5%	0.3%	2.2%	10.4%	0.1%	0.9%	0.0%	8	821
BL_64_1	La Belle Shipwreck	66.9%	12.8%	3.7%	2.0%	0.3%	2.4%	10.7%	0.0%	1.1%	0.0%	12	556
BL_65_1	La Belle Shipwreck	69.1%	9.9%	2.8%	1.3%	0.5%	3.7%	11.7%	0.0%	0.7%	0.0%	57	483
BL_66_1	La Belle Shipwreck	69.0%	12.1%	3.6%	1.1%	0.3%	2.1%	11.0%	0.1%	0.6%	0.0%	85	901
BL_67_1	La Belle Shipwreck	67.2%	12.6%	3.7%	2.0%	0.3%	2.4%	10.4%	0.1%	1.2%	0.0%	25	845
CAD_6_1	Cadotte	62.3%	14.5%	3.2%	1.8%	0.3%	3.8%	12.8%	0.3%	0.9%	0.0%	11	108
CAR_1_1	Carcajou Point	69.0%	12.6%	3.1%	2.0%	0.3%	2.2%	9.4%	0.1%	1.1%	0.0%	7	463
CHK_9_1	Chickadee	65.5%	16.0%	3.5%	2.0%	0.2%	1.7%	10.0%	0.1%	0.7%	0.0%	2	49
CL_01_1	Cloudman	67.7%	13.7%	3.5%	1.4%	0.3%	1.8%	9.8%	0.4%	0.7%	0.0%	32	132
CL_02_1	Cloudman	67.8%	13.6%	3.9%	1.0%	0.3%	2.4%	9.6%	0.3%	0.5%	0.0%	19	54
CL_03_1	Cloudman	67.6%	14.1%	3.5%	1.4%	0.3%	1.7%	9.6%	0.4%	0.6%	0.0%	33	90
CL_04_1	Cloudman	67.5%	13.5%	3.9%	1.0%	0.3%	2.5%	9.9%	0.3%	0.5%	0.0%	19	52
CL_05_1	Cloudman	67.7%	13.5%	3.9%	1.1%	0.3%	2.6%	9.6%	0.3%	0.5%	0.0%	17	52
CL_06_1	Cloudman	66.7%	13.2%	4.1%	1.5%	0.3%	2.7%	10.1%	0.1%	0.7%	0.0%	11	371
CL_07_1	Cloudman	66.7%	13.6%	4.0%	1.1%	0.3%	2.5%	10.3%	0.1%	0.7%	0.0%	3	283
CL_08_1	Cloudman	66.8%	15.9%	3.2%	2.2%	0.2%	1.2%	8.0%	0.4%	1.1%	0.0%	212	1444
CL_09_1	Cloudman	67.4%	13.2%	4.0%	1.1%	0.3%	2.5%	10.1%	0.1%	0.6%	0.0%	3	379

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
BL_23_1	9	0	89	3	446	18	21	193	586	39	1353	14	516	37	3
BL_24_1	10	1	88	3	314	14	17	188	635	33	1545	10	576	25	2
BL_41_1	8	0	101	4	345	15	18	199	594	38	1074	11	446	23	2
BL_42_1	12	0	84	3	200	9	2	203	621	29	1342	12	494	21	1
BL_43_1	8	0	94	4	356	16	2	188	559	38	905	8	456	24	2
BL_44_1	9	0	90	3	320	15	1	175	555	29	1179	8	467	22	2
BL_45_1	9	0	86	4	368	17	3	174	487	31	828	7	463	24	2
BL_46_1	9	0	91	3	236	11	0	166	623	29	1745	9	476	19	1
BL_47_1	8	0	93	3	369	16	3	183	637	41	1326	7	438	25	2
BL_48_1	8	0	90	4	455	19	2	210	638	40	1268	8	433	33	3
BL_49_1	10	0	90	3	318	15	0	181	578	30	1257	8	473	22	2
BL_50_1	8	0	88	3	415	17	1	181	544	37	1169	9	436	32	2
BL_51_1	8	0	87	4	462	18	3	187	555	41	1346	9	451	36	3
BL_56_1	10	0	83	3	275	13	0	165	494	30	863	9	475	19	2
BL_57_1	13	0	75	2	208	10	0	209	657	27	1313	12	499	22	1
BL_58_1	9	0	90	4	468	18	2	181	544	38	1369	9	453	36	3
BL_59_1	13	1	79	2	214	10	0	212	657	31	1496	15	628	26	2
BL_60_1	8	1	83	3	386	18	0	225	629	48	1009	10	611	28	2
BL_61_1	10	1	82	2	252	12	0	187	703	36	1984	13	625	24	2
BL_62_1	10	0	87	2	265	12	0	184	675	37	1859	13	613	24	2
BL_63_1	9	1	91	3	366	17	0	210	644	38	1044	13	600	29	2
BL_64_1	9	1	87	3	478	20	0	201	623	46	1342	13	574	44	3
BL_65_1	10	1	74	2	239	10	0	204	608	46	1443	16	608	30	2
BL_66_1	7	1	81	2	225	9	0	209	564	48	1269	12	613	23	2
BL_67_1	9	1	92	3	479	20	0	211	660	54	1450	17	592	45	3
CAD_6_1	36	1	82	3	1252	18	18	324	561	71	1836	20	572	187	5
CAR_1_1	14	1	75	3	750	17	22	194	449	74	506	17	484	33	3
CHK_9_1	9	1	97	2	287	8	10	100	1014	40	1951	12	580	15	2
CL_01_1	8	1	86	1	164	10	8	140	679	35	1170	9	622	38	2
CL_02_1	9	0	106	2	107	10	15	228	796	46	1708	11	574	17	1
CL_03_1	9	0	88	2	164	10	9	121	638	37	1068	8	642	39	2
CL_04_1	9	0	122	1	112	10	12	236	851	55	1795	12	609	19	1
CL_05_1	9	0	98	1	112	10	8	220	935	45	1804	15	605	19	1
CL_06_1	12	1	89	2	165	11	13	140	599	41	1460	18	638	22	2
CL_07_1	10	1	112	1	135	10	10	110	448	36	776	14	597	17	2
CL_08_1	12	1	83	2	181	12	9	473	1182	56	500	14	378	30	2
CL_09_1	10	1	106	2	136	10	11	112	445	36	742	14	617	18	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
BL_23_1	1	141	0	114	4	9	1	0	0	5	315	2	0	6	4
BL_24_1	1	30	0	106	4	7	1	0	0	4	346	2	0	6	3
BL_41_1	1	36	0	73	3	5	1	0	0	3	209	1	0	4	2
BL_42_1	1	40	0	83	3	5	1	0	0	3	200	3	0	5	2
BL_43_1	1	39	0	73	3	5	1	0	0	3	200	1	0	4	3
BL_44_1	1	21	0	72	3	5	1	0	0	3	209	1	0	4	2
BL_45_1	1	24	0	72	3	5	1	0	0	3	202	1	0	3	3
BL_46_1	2	14	0	73	2	4	1	0	0	3	222	2	0	6	2
BL_47_1	1	44	0	74	3	5	1	0	0	3	212	2	0	4	2
BL_48_1	1	113	0	70	3	7	1	0	0	4	232	1	0	4	3
BL_49_1	1	21	0	73	3	5	1	0	0	3	219	1	0	4	2
BL_50_1	1	98	0	76	3	6	1	0	0	4	195	1	0	4	3
BL_51_1	1	209	0	70	3	7	1	0	0	4	202	1	0	4	3
BL_56_1	1	34	0	72	2	4	1	0	0	3	185	1	0	4	2
BL_57_1	1	40	0	82	3	5	1	0	0	3	201	3	0	5	2
BL_58_1	1	184	0	68	4	7	1	0	0	4	203	1	0	4	3
BL_59_1	1	53	0	131	4	8	1	0	0	4	344	5	0	6	4
BL_60_1	1	419	0	114	4	8	1	0	0	4	362	3	0	4	4
BL_61_1	1	28	0	119	4	7	1	0	0	4	415	3	0	8	4
BL_62_1	1	31	0	119	4	7	1	0	0	4	403	3	0	8	3
BL_63_1	1	48	0	123	4	8	1	0	0	4	362	3	0	6	4
BL_64_1	1	180	0	119	6	11	1	0	0	5	382	3	0	5	5
BL_65_1	1	130	0	147	5	9	1	0	1	4	470	6	0	6	4
BL_66_1	1	249	0	141	4	7	1	0	0	3	469	5	0	8	3
BL_67_1	1	190	0	125	6	12	2	0	0	6	442	3	0	6	6
CAD_6_1	1	2	1	191	6	12	2	0	0	8	185	6	1	11	5
CAR_1_1	2	296	1	122	6	11	1	0	0	5	147	2	0	8	5
CHK_9_1	0	97	0	100	3	6	1	0	0	3	404	1	0	1	3
CL_01_1	0	62	0	112	3	7	1	0	0	4	278	1	0	2	3
CL_02_1	0	41	0	76	3	5	1	0	0	3	398	2	0	6	2
CL_03_1	0	73	0	121	4	7	1	0	0	4	247	1	0	2	3
CL_04_1	0	39	0	80	3	5	1	0	0	3	409	2	0	6	2
CL_05_1	0	62	0	78	3	5	1	0	0	3	389	2	0	6	3
CL_06_1	0	103	0	93	4	8	1	0	0	4	344	2	0	7	3
CL_07_1	0	55	0	85	3	7	1	0	0	3	199	2	0	7	3
CL_08_1	0	253	0	122	4	9	1	0	0	5	824	8	1	4	4
CL_09_1	0	67	0	88	3	6	1	0	0	3	193	2	0	7	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
BL_23_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_24_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_41_1	1	0	0	0	0	0	0	0	0	0	0	0
BL_42_1	0	0	0	0	0	0	0	0	0	0	0	1
BL_43_1	1	0	0	0	0	0	0	0	0	0	1	1
BL_44_1	1	0	0	0	0	0	0	0	0	0	0	1
BL_45_1	1	0	1	0	0	0	0	0	0	0	0	1
BL_46_1	0	0	0	0	0	0	0	0	0	0	0	0
BL_47_1	1	0	0	0	0	0	0	0	0	0	1	1
BL_48_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_49_1	1	0	0	0	0	0	0	0	0	0	1	1
BL_50_1	1	0	1	0	0	0	0	0	0	0	1	1
BL_51_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_56_1	0	0	0	0	0	0	0	0	0	0	0	0
BL_57_1	0	0	0	0	0	0	0	0	0	0	0	1
BL_58_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_59_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_60_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_61_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_62_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_63_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_64_1	1	0	1	0	1	0	1	0	1	0	1	1
BL_65_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_66_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_67_1	1	0	1	0	1	0	1	0	1	0	1	1
CAD_6_1	1	0	1	0	1	0	1	0	1	0	5	2
CAR_1_1	1	0	1	0	1	0	0	0	1	0	1	2
CHK_9_1	1	0	1	0	1	0	0	0	0	0	0	1
CL_01_1	1	0	1	0	1	0	0	0	0	0	1	1
CL_02_1	1	0	0	0	0	0	0	0	0	0	0	1
CL_03_1	1	0	1	0	1	0	0	0	0	0	1	1
CL_04_1	1	0	0	0	0	0	0	0	0	0	1	1
CL_05_1	0	0	0	0	0	0	0	0	0	0	0	1
CL_06_1	1	0	1	0	1	0	0	0	0	0	1	1
CL_07_1	1	0	1	0	0	0	0	0	0	0	0	1
CL_08_1	1	0	1	0	1	0	0	0	0	0	1	1
CL_09_1	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
CL_10_1	Cloudman	66.7%	13.7%	4.0%	1.1%	0.3%	2.5%	10.3%	0.1%	0.6%	0.0%	2	398
CL_11_1	Cloudman	66.8%	13.6%	4.0%	1.1%	0.3%	2.5%	10.3%	0.1%	0.6%	0.0%	2	247
CL_12_1	Cloudman	67.9%	14.1%	4.0%	0.9%	0.3%	2.1%	9.3%	0.2%	0.5%	0.0%	32	75
CL_13_1	Cloudman	69.9%	12.4%	3.7%	0.9%	0.3%	2.3%	9.0%	0.3%	0.6%	0.0%	22	58
CL_14_1	Cloudman	69.8%	12.7%	3.7%	0.9%	0.3%	2.3%	8.8%	0.3%	0.6%	0.0%	16	53
CL_15_1	Cloudman	67.6%	13.2%	4.1%	1.4%	0.3%	2.4%	9.5%	0.1%	0.8%	0.0%	4	231
CM_13	Fort Michilimackinac	68.1%	13.3%	3.0%	1.9%	0.4%	2.0%	10.2%	0.1%	0.9%	0.0%	7	227
CM_23	Fort Michilimackinac	65.3%	12.0%	3.2%	1.9%	0.3%	4.5%	11.0%	0.0%	0.5%	0.0%	6	168
DB2_1	Hanson	67.6%	11.3%	3.0%	1.7%	0.4%	3.6%	9.9%	1.0%	0.9%	0.0%	98	622
DI_16	Doty Island Village	67.9%	13.4%	3.1%	1.4%	0.5%	1.5%	10.1%	0.4%	0.7%	0.0%	31	243
DI_17	Doty Island Village	65.0%	16.0%	3.1%	2.2%	0.6%	2.1%	9.2%	0.1%	0.8%	0.0%	4	271
DI_40	Doty Island Village	67.3%	11.4%	3.6%	1.4%	0.7%	2.3%	12.0%	0.1%	0.7%	0.0%	2	203
DI_47	Doty Island Village	64.9%	13.9%	3.8%	1.6%	0.6%	2.3%	11.5%	0.1%	0.7%	0.0%	5	580
FV_01	Farley Village	67.3%	12.5%	2.7%	1.8%	0.2%	5.5%	8.7%	0.0%	0.2%	0.1%	330	314
FV_02	Farley Village	68.8%	15.7%	2.1%	1.2%	0.1%	2.6%	7.5%	0.1%	0.3%	0.4%	382	655
GC_07	Gros Cap	66.9%	13.5%	3.2%	2.0%	0.3%	2.5%	9.9%	0.1%	0.4%	0.0%	5	243
GG_08_1	Gillett Grove	63.2%	13.2%	4.7%	1.9%	0.4%	2.4%	12.5%	0.1%	1.0%	0.0%	4	474
GG_16_1	Gillett Grove	63.4%	13.8%	3.4%	1.9%	0.2%	4.6%	10.4%	0.8%	0.8%	0.0%	18	620
GL_01	Goose Lake Outlet #3	65.0%	12.8%	3.0%	1.3%	0.3%	4.1%	11.3%	0.8%	0.5%	0.0%	85	129
IV_01	Iliniwek Village	65.3%	14.9%	3.9%	1.1%	0.3%	2.2%	11.5%	0.2%	0.5%	0.0%	35	119
IV_02	Iliniwek Village	62.7%	17.3%	3.5%	2.0%	0.3%	2.8%	10.7%	0.2%	0.5%	0.0%	6	42
IV_03	Iliniwek Village	63.8%	14.2%	3.6%	1.6%	0.3%	3.3%	12.2%	0.4%	0.5%	0.0%	48	254
IV_04	Iliniwek Village	64.1%	14.3%	4.3%	2.0%	0.3%	2.6%	12.0%	0.0%	0.4%	0.0%	3	192
IV_05	Iliniwek Village	66.7%	13.3%	3.6%	1.1%	0.3%	2.4%	11.7%	0.3%	0.4%	0.0%	14	45
IV_06	Iliniwek Village	65.6%	15.0%	3.9%	0.9%	0.3%	2.5%	11.4%	0.1%	0.3%	0.0%	2	10
IV_07	Iliniwek Village	63.7%	13.8%	4.2%	2.2%	0.4%	2.5%	12.7%	0.0%	0.4%	0.0%	3	170
IV_08	Iliniwek Village	66.7%	13.1%	3.6%	1.1%	0.3%	2.4%	11.9%	0.3%	0.4%	0.0%	13	46
IV_09	Iliniwek Village	66.1%	14.2%	3.7%	1.1%	0.4%	2.1%	11.8%	0.2%	0.4%	0.0%	30	69
IV_10	Iliniwek Village	63.6%	16.2%	3.4%	2.4%	0.3%	2.1%	11.4%	0.1%	0.5%	0.0%	2	22
IV_11	Iliniwek Village	64.3%	16.0%	3.3%	2.3%	0.3%	2.0%	11.2%	0.1%	0.5%	0.0%	3	14
IV_12	Iliniwek Village	63.3%	16.7%	3.4%	2.3%	0.3%	2.1%	11.4%	0.1%	0.4%	0.0%	2	32
IV_14	Iliniwek Village	63.1%	16.5%	3.3%	2.0%	0.3%	2.7%	11.3%	0.2%	0.4%	0.0%	6	53
IV_15	Iliniwek Village	63.4%	15.8%	3.3%	2.4%	0.3%	2.2%	11.9%	0.1%	0.5%	0.0%	2	24
IV_16	Iliniwek Village	63.8%	16.5%	3.4%	2.3%	0.3%	2.0%	11.0%	0.1%	0.5%	0.0%	4	15
IV_17	Iliniwek Village	63.6%	16.2%	3.4%	2.1%	0.3%	2.5%	11.2%	0.2%	0.5%	0.0%	6	23
IV_18	Iliniwek Village	64.7%	13.9%	3.8%	1.3%	0.3%	2.0%	13.3%	0.1%	0.5%	0.0%	4	100
IV_19	Iliniwek Village	64.4%	19.4%	2.8%	1.8%	0.2%	1.2%	9.4%	0.0%	0.5%	0.0%	6	1250

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
CL_10_1	10	0	112	2	142	10	11	113	459	34	781	16	598	18	2
CL_11_1	10	0	113	2	139	10	11	112	459	37	795	13	630	18	2
CL_12_1	8	0	106	1	92	7	6	105	960	39	1488	10	611	16	1
CL_13_1	8	0	148	1	104	9	6	232	806	50	1866	12	573	17	1
CL_14_1	8	0	124	1	103	9	8	181	866	49	1815	13	567	17	1
CL_15_1	12	1	103	2	152	11	11	112	456	44	1229	16	577	20	2
CM_13	12	1	86	5	436	16	33	77	727	55	1731	14	565	29	2
CM_23	15	0	103	5	543	18	27	192	409	39	535	26	545	31	2
DB2_1	32	2	72	2	549	12	11	300	938	212	1808	22	565	241	6
DI_16	9	0	66	2	94	11	12	136	676	39	1051	8	632	39	2
DI_17	13	1	86	2	78	11	12	104	964	47	2803	15	592	20	2
DI_40	9	0	68	2	101	12	10	127	697	40	1314	9	725	44	2
DI_47	12	0	69	2	88	11	13	108	454	44	1032	17	658	21	2
FV_01	23	0	88	3	367	11	11	507	1692	51	2592	31	344	33	2
FV_02	15	1	80	4	1016	9	14	469	1057	40	1017	11	263	223	5
GC_07	15	1	94	3	643	18	31	209	426	48	498	16	432	30	3
GG_08_1	9	1	196	2	174	10	15	97	761	29	999	13	707	21	2
GG_16_1	26	1	76	2	406	15	11	297	446	91	1845	22	524	201	5
GL_01	29	2	75	4	917	13	22	318	931	207	2246	27	643	233	6
IV_01	9	0	84	3	257	9	20	112	1000	46	1674	13	743	20	2
IV_02	13	1	94	4	288	9	21	251	964	37	1888	26	618	18	2
IV_03	10	1	86	3	453	12	21	144	704	45	1446	11	844	50	2
IV_04	11	1	108	3	210	8	19	60	543	32	1030	20	645	13	1
IV_05	9	0	113	4	263	11	23	184	847	49	1614	11	549	18	1
IV_06	9	0	102	4	174	7	20	84	1005	40	4007	13	536	8	1
IV_07	10	1	97	4	232	7	20	59	553	30	1061	20	652	14	1
IV_08	9	0	113	4	270	11	24	181	868	45	1618	11	560	18	1
IV_09	9	0	100	4	234	9	23	109	956	40	1470	10	593	18	1
IV_10	14	1	134	4	314	10	22	115	961	42	2119	13	589	18	2
IV_11	14	1	117	4	242	9	22	98	962	44	2558	12	567	14	2
IV_12	11	1	104	4	260	10	22	86	983	42	2024	13	591	16	2
IV_14	13	1	106	4	254	9	22	255	949	37	1627	21	477	15	2
IV_15	15	1	127	4	325	11	23	132	980	45	2058	15	577	18	2
IV_16	14	1	115	3	242	9	21	99	962	42	2503	12	557	14	2
IV_17	13	1	102	4	256	9	22	235	910	34	1585	20	468	15	2
IV_18	11	1	92	4	305	10	25	211	922	38	1624	13	691	18	2
IV_19	14	1	87	4	335	13	24	641	1054	45	2365	9	463	21	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
CL_10_1	0	71	0	91	3	6	1	0	0	3	202	2	0	7	3
CL_11_1	0	55	0	92	3	6	1	0	0	3	216	2	0	7	3
CL_12_1	0	135	0	79	3	5	1	0	0	3	193	2	0	5	2
CL_13_1	1	41	0	78	3	5	1	0	0	3	447	2	0	6	3
CL_14_1	0	71	0	79	3	5	1	0	0	3	365	2	0	6	2
CL_15_1	0	85	0	92	4	8	1	0	0	4	285	1	0	6	4
CM_13	0	66	0	149	5	10	1	0	0	5	291	1	0	11	5
CM_23	0	250	0	83	4	8	1	0	115	5	171	12	1	6	4
DB2_1	2	4	1	423	6	12	2	1	0	11	588	16	8	13	7
DI_16	0	60	0	139	4	7	1	0	0	4	205	1	0	2	3
DI_17	0	50	0	101	4	7	1	0	0	4	244	1	0	2	3
DI_40	0	9	0	136	4	8	1	0	0	4	99	1	0	7	4
DI_47	1	68	0	120	4	9	1	0	0	4	254	2	0	6	4
FV_01	2	2	1	139	4	8	1	0	0	4	555	7	1	19	4
FV_02	0	7	0	67	3	5	1	0	1	7	79	1	1	0	3
GC_07	0	270	1	70	5	9	1	0	1	5	118	1	0	8	4
GG_08_1	0	5	0	207	6	7	1	0	0	5	40	2	0	5	4
GG_16_1	1	746	1	416	9	17	2	0	1	10	219	6	4	9	8
GL_01	1082	5	1	429	6	10	1	1	0	11	527	18	10	15	6
IV_01	0	589	1	139	4	6	1	0	0	3	260	3	0	5	3
IV_02	0	35	1	141	5	9	1	0	1	4	654	1	1	9	4
IV_03	0	85	0	212	5	10	1	0	1	5	442	2	1	3	5
IV_04	0	76	0	111	2	4	1	0	1	3	18	2	0	4	2
IV_05	0	50	0	92	2	4	1	0	0	3	290	2	0	5	2
IV_06	0	3	0	69	2	3	0	0	0	2	77	0	0	25	1
IV_07	0	67	0	185	2	5	1	0	0	3	20	3	0	4	2
IV_08	0	52	0	103	3	5	1	0	0	3	294	2	0	5	2
IV_09	1	109	0	118	3	5	1	0	0	3	176	2	0	5	3
IV_10	0	120	0	91	3	6	1	0	0	4	307	1	0	2	3
IV_11	0	7	0	87	3	5	1	0	0	3	313	1	0	1	2
IV_12	0	52	0	90	3	5	1	0	1	3	253	1	0	2	3
IV_14	0	33	0	90	3	6	1	0	0	3	385	0	0	7	3
IV_15	0	103	0	94	3	6	1	0	1	4	302	1	0	2	3
IV_16	0	7	0	81	3	5	1	0	0	3	307	1	0	1	3
IV_17	0	24	0	93	3	6	1	0	1	3	378	0	0	6	3
IV_18	1	71	0	156	3	6	1	0	0	3	155	1	0	5	3
IV_19	0	223	0	97	3	6	1	0	1	4	437	19	1	4	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
CL_10_1	1	0	1	0	1	0	0	0	0	0	1	1
CL_11_1	1	0	1	0	1	0	0	0	0	0	1	1
CL_12_1	0	0	0	0	0	0	0	0	0	0	0	1
CL_13_1	1	0	1	0	1	0	0	0	0	0	1	1
CL_14_1	1	0	0	0	0	0	0	0	0	0	1	1
CL_15_1	1	0	1	0	1	0	0	0	0	0	1	1
CM_13	1	0	1	0	1	0	1	0	1	0	1	1
CM_23	1	0	1	0	1	0	0	0	0	0	1	1
DB2_1	2	0	2	0	2	0	1	0	1	0	7	3
DI_16	1	0	1	0	1	0	0	0	0	0	1	1
DI_17	1	0	1	0	1	0	0	0	0	0	1	1
DI_40	1	0	1	0	1	0	0	0	0	0	1	1
DI_47	1	0	1	0	1	0	0	0	0	0	1	1
FV_01	1	0	1	0	1	0	0	0	1	0	1	1
FV_02	1	0	1	0	1	0	1	0	1	0	6	1
GC_07	1	0	1	0	1	0	0	0	1	0	1	1
GG_08_1	1	0	1	0	1	0	0	0	0	0	1	1
GG_16_1	2	0	2	0	2	0	1	0	1	0	6	3
GL_01	2	0	2	0	2	0	1	0	1	0	7	2
IV_01	1	0	1	0	1	0	1	0	1	0	1	1
IV_02	1	0	1	0	1	0	1	0	0	0	1	1
IV_03	2	1	2	0	2	0	1	0	1	0	2	2
IV_04	0	0	1	0	0	0	0	0	0	0	0	1
IV_05	0	0	0	0	0	0	0	0	0	0	0	1
IV_06	0	0	0	0	0	0	0	0	0	0	0	0
IV_07	1	0	1	0	1	0	0	0	0	0	0	1
IV_08	1	0	0	0	0	0	0	0	0	0	0	1
IV_09	1	0	0	0	0	0	0	0	0	0	0	1
IV_10	1	0	1	0	1	0	0	0	0	0	1	1
IV_11	1	0	1	0	1	0	0	0	0	0	1	1
IV_12	1	0	1	0	0	0	0	0	0	0	0	1
IV_14	1	0	1	0	1	0	1	0	1	0	1	1
IV_15	1	0	1	0	1	0	1	0	1	0	1	1
IV_16	1	0	1	0	1	0	0	0	0	0	0	1
IV_17	1	0	1	0	0	0	0	0	0	0	0	1
IV_18	1	0	1	0	0	0	0	0	0	0	1	1
IV_19	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
IV_20	Iliniwek Village	65.7%	14.4%	3.0%	1.8%	0.2%	2.5%	10.7%	0.7%	0.6%	0.0%	103	229
MA_03	Marina	67.9%	11.4%	3.0%	1.7%	0.3%	2.4%	11.5%	0.1%	1.1%	0.0%	13	452
MA_12	Marina	68.7%	12.5%	2.9%	2.4%	0.3%	2.4%	8.6%	0.0%	1.2%	0.0%	17	824
ML_01_1	Milford	66.0%	13.1%	3.8%	1.3%	0.3%	5.0%	9.0%	0.1%	0.6%	0.0%	4	310
ML_03_1	Milford	67.5%	11.4%	3.8%	2.6%	0.3%	2.5%	10.3%	0.1%	0.8%	0.0%	3	123
ML_04_1	Milford	67.0%	11.6%	3.9%	2.5%	0.3%	2.5%	10.5%	0.1%	0.8%	0.0%	3	102
MM_001	Marquette Mission	64.0%	13.2%	3.1%	1.9%	0.2%	4.5%	11.4%	0.7%	0.4%	0.0%	19	414
MM_003	Marquette Mission	67.2%	14.2%	3.9%	1.5%	0.3%	2.2%	9.8%	0.0%	0.4%	0.0%	9	80
MM_004	Marquette Mission	66.8%	13.5%	3.8%	0.9%	0.2%	1.9%	11.9%	0.1%	0.3%	0.0%	3	54
MM_005	Marquette Mission	66.3%	13.7%	3.7%	1.4%	0.4%	1.9%	11.1%	0.6%	0.5%	0.0%	5	51
MM_006	Marquette Mission	66.2%	15.3%	3.9%	1.0%	0.3%	2.3%	9.9%	0.2%	0.4%	0.0%	11	66
MM_007	Marquette Mission	63.6%	9.5%	3.4%	2.4%	1.1%	5.1%	11.7%	0.9%	0.6%	0.1%	344	8603
MM_008	Marquette Mission	66.4%	13.8%	3.9%	1.4%	0.3%	1.9%	11.0%	0.6%	0.4%	0.0%	5	51
MM_009	Marquette Mission	67.5%	13.3%	3.5%	1.6%	0.3%	2.9%	9.4%	0.7%	0.4%	0.0%	3	23
MM_010	Marquette Mission	66.6%	14.9%	3.3%	1.5%	0.2%	1.9%	10.5%	0.1%	0.5%	0.0%	3	251
MM_011	Marquette Mission	65.8%	14.2%	4.0%	1.4%	0.3%	1.9%	11.1%	0.6%	0.4%	0.0%	5	52
MM_013	Marquette Mission	65.9%	15.8%	3.3%	1.4%	0.2%	1.9%	10.5%	0.1%	0.4%	0.0%	3	208
MM_014	Marquette Mission	66.1%	15.5%	3.2%	1.5%	0.3%	2.0%	10.5%	0.1%	0.4%	0.0%	3	229
MM_029	Marquette Mission	69.0%	13.9%	3.0%	1.4%	0.2%	1.9%	9.9%	0.1%	0.2%	0.0%	3	228
MM_030	Marquette Mission	69.1%	16.2%	2.4%	2.2%	0.2%	1.1%	7.2%	0.4%	0.3%	0.1%	231	2871
MM_031	Marquette Mission	68.9%	11.6%	3.4%	2.0%	0.3%	2.3%	9.9%	0.7%	0.4%	0.0%	41	576
MM_032	Marquette Mission	68.9%	11.9%	3.2%	2.0%	0.4%	2.4%	10.4%	0.1%	0.4%	0.0%	5	487
MM_033	Marquette Mission	67.4%	14.2%	3.2%	1.5%	0.3%	1.6%	10.6%	0.4%	0.4%	0.0%	36	72
MM_034	Marquette Mission	68.5%	12.4%	3.6%	1.1%	0.3%	1.9%	11.4%	0.1%	0.3%	0.0%	3	110
MM_035	Marquette Mission	66.7%	12.6%	4.1%	0.8%	0.2%	2.1%	12.5%	0.2%	0.3%	0.0%	5	64
MM_036	Marquette Mission	66.4%	13.3%	3.6%	1.2%	0.3%	2.6%	11.8%	0.1%	0.4%	0.0%	3	259
MM_040	Marquette Mission	64.9%	14.5%	3.8%	1.9%	0.3%	2.3%	11.1%	0.3%	0.4%	0.0%	31	765
MM_041	Marquette Mission	65.4%	14.0%	3.8%	1.7%	0.3%	2.2%	11.4%	0.2%	0.6%	0.0%	50	125
MM_042	Marquette Mission	65.7%	13.8%	3.7%	1.7%	0.4%	2.2%	11.2%	0.2%	0.6%	0.0%	53	111
MM_043	Marquette Mission	66.3%	13.4%	3.8%	1.6%	0.4%	2.3%	11.3%	0.1%	0.6%	0.0%	9	268
MM_046	Marquette Mission	64.0%	14.1%	4.2%	1.8%	0.3%	3.0%	11.6%	0.2%	0.2%	0.0%	20	271
MM_048	Marquette Mission	66.8%	15.0%	3.8%	1.0%	0.3%	2.0%	10.4%	0.1%	0.2%	0.0%	34	50
MM_049	Marquette Mission	65.5%	14.2%	3.9%	1.6%	0.3%	2.4%	11.4%	0.1%	0.3%	0.0%	8	228
MM_050	Marquette Mission	65.1%	14.2%	4.0%	1.7%	0.3%	2.4%	11.6%	0.1%	0.4%	0.0%	5	139
MM_052	Marquette Mission	65.3%	14.5%	3.9%	1.6%	0.3%	2.4%	11.2%	0.1%	0.4%	0.0%	7	187
MM_054	Marquette Mission	62.0%	15.3%	3.7%	3.0%	0.4%	2.5%	12.1%	0.0%	0.4%	0.0%	3	132
MM_055	Marquette Mission	65.3%	14.1%	3.8%	1.3%	0.3%	2.4%	11.7%	0.1%	0.5%	0.0%	3	277

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
IV_20	20	1	75	4	509	14	22	365	1000	48	1831	20	490	36	2
MA_03	12	1	86	3	613	16	23	85	717	45	1495	21	631	28	3
MA_12	20	1	72	4	824	18	29	217	417	65	601	14	415	37	3
ML_01_1	20	1	68	1	92	6	5	249	895	29	1419	25	601	18	1
ML_03_1	11	1	86	2	176	11	11	160	734	76	1459	18	658	44	3
ML_04_1	12	2	86	2	178	11	8	160	728	31	1411	18	662	45	3
MM_001	23	2	103	3	865	13	14	310	448	101	1931	22	498	207	5
MM_003	14	2	108	2	237	9	22	356	682	49	1573	16	567	18	2
MM_004	9	1	111	2	245	9	12	107	518	65	2216	12	718	21	1
MM_005	11	1	100	3	322	9	16	353	690	358	1934	13	614	25	2
MM_006	11	1	122	2	196	7	10	235	893	45	2170	14	550	14	1
MM_007	23	2	173	4	1001	17	26	147	424	268	524	77	581	134	4
MM_008	13	1	99	2	293	9	14	361	695	345	1915	13	601	24	2
MM_009	22	2	86	3	354	11	21	63	403	61	1738	33	580	46	2
MM_010	28	1	104	3	331	12	21	179	739	64	3970	19	553	43	2
MM_011	16	1	114	2	278	9	17	362	679	363	1838	13	614	22	2
MM_013	32	1	83	2	327	11	16	177	712	57	3548	19	550	44	2
MM_014	32	1	99	3	391	12	19	176	711	77	3688	19	559	44	2
MM_029	28	1	84	2	378	11	14	186	733	72	3823	21	578	45	2
MM_030	11	1	86	2	321	11	12	448	829	68	917	11	424	23	2
MM_031	14	1	100	3	413	14	20	128	715	50	1343	19	524	26	2
MM_032	14	1	92	3	438	14	25	283	953	47	1676	18	577	26	2
MM_033	8	1	89	3	409	11	15	128	625	39	1132	8	669	43	2
MM_034	9	1	107	2	299	9	15	134	514	85	1854	12	649	24	1
MM_035	8	1	94	2	211	7	15	94	613	34	1824	11	737	13	1
MM_036	9	1	105	3	352	11	18	113	395	36	693	15	605	19	2
MM_040	11	1	97	3	249	8	17	112	537	35	587	19	637	17	2
MM_041	12	1	97	3	359	12	22	172	842	46	1232	14	599	28	2
MM_042	12	2	100	4	404	12	24	180	853	52	1240	15	598	29	2
MM_043	11	1	97	4	392	12	23	131	535	50	1369	15	588	21	2
MM_046	15	1	98	2	297	10	16	230	683	42	753	17	640	19	2
MM_048	9	1	84	2	231	7	13	100	850	41	1401	10	573	16	1
MM_049	14	1	97	2	376	10	18	103	432	47	1012	15	559	20	2
MM_050	13	1	97	3	387	11	20	104	409	53	1087	15	587	22	2
MM_052	13	1	92	3	370	11	21	109	444	48	1015	16	550	19	2
MM_054	24	2	99	2	291	12	17	399	815	82	2398	22	675	17	2
MM_055	11	1	104	3	339	11	23	114	439	45	772	14	606	18	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
IV_20	0	87	0	168	5	10	1	0	1	5	664	2	1	5	5
MA_03	1	207	0	214	5	10	1	0	1	5	258	2	0	15	5
MA_12	0	1188	0	132	6	11	1	0	0	6	151	2	0	6	5
ML_01_1	0	1189	0	81	3	6	1	0	0	3	548	1	0	4	3
ML_03_1	0	309	0	121	4	8	1	0	0	6	142	1	0	7	4
ML_04_1	0	293	0	119	4	9	1	0	0	6	142	1	0	7	4
MM_001	1	653	1	404	8	16	2	0	0	9	220	6	3	9	7
MM_003	2	118	0	75	3	6	1	0	0	4	828	5	1	11	3
MM_004	1	288	0	109	3	5	1	0	1	3	377	3	0	8	3
MM_005	1	112	0	137	5	8	1	0	0	5	966	17	1	6	4
MM_006	1	409	0	72	3	5	1	0	5	3	647	1	0	8	3
MM_007	1	838	1	499	15	25	3	0	1	8	206	6	2	4	11
MM_008	1	139	0	101	4	8	1	0	1	4	811	16	1	6	3
MM_009	1	7	1	178	5	11	1	0	0	4	93	2	1	5	4
MM_010	1	290	1	135	5	12	1	0	2	5	431	37	1	11	5
MM_011	1	96	0	103	4	8	1	0	4	4	763	18	1	7	4
MM_013	1	284	1	132	5	12	1	0	1	5	401	35	2	11	5
MM_014	1	291	1	145	6	12	1	0	3	5	449	36	2	12	5
MM_029	1	286	1	51	6	12	1	0	1	5	459	38	1	12	5
MM_030	1	255	0	42	4	7	1	0	8	5	700	8	1	5	3
MM_031	0	691	0	40	5	8	1	0	7	5	192	2	0	9	4
MM_032	0	126	0	41	4	8	1	0	2	5	486	3	1	19	4
MM_033	0	63	0	48	4	7	1	0	4	4	297	1	0	2	4
MM_034	0	190	0	43	3	6	1	0	4	3	326	5	0	7	3
MM_035	1	504	0	36	2	5	1	0	1	2	210	1	0	17	3
MM_036	1	68	0	33	3	6	1	0	1	3	180	2	0	7	3
MM_040	1	338	0	38	3	5	1	0	1	3	179	2	1	6	3
MM_041	1	69	0	40	4	7	1	0	1	4	190	2	1	9	4
MM_042	0	45	0	45	4	8	1	0	1	4	221	2	1	9	5
MM_043	1	76	0	38	4	7	1	0	1	4	331	2	1	6	3
MM_046	1	507	0	36	3	6	1	0	2	4	146	1	0	14	3
MM_048	1	135	0	31	2	4	1	0	1	3	191	2	1	5	2
MM_049	1	104	0	35	4	7	1	0	7	4	249	2	1	6	4
MM_050	1	65	0	36	4	8	1	0	2	4	274	1	1	6	4
MM_052	1	157	0	34	4	7	1	0	1	4	251	1	1	6	4
MM_054	1	1343	1	40	4	6	1	0	2	5	518	20	1	12	3
MM_055	0	70	0	36	3	6	1	0	1	3	220	2	0	7	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
IV_20	1	0	1	0	1	0	0	0	1	0	1	1
MA_03	1	0	1	0	1	0	1	0	1	0	1	1
MA_12	1	0	1	0	1	0	1	0	1	0	1	2
ML_01_1	1	0	1	0	0	0	0	0	0	0	1	1
ML_03_1	1	0	1	0	1	0	1	0	1	0	1	1
ML_04_1	1	0	1	0	1	0	1	0	1	0	1	1
MM_001	2	0	1	0	2	0	1	0	1	0	6	3
MM_003	1	0	1	0	1	0	0	0	0	0	1	1
MM_004	0	0	1	0	0	0	0	0	0	0	1	1
MM_005	1	0	1	0	1	0	0	0	0	0	1	1
MM_006	1	0	0	0	0	0	0	0	0	0	0	1
MM_007	2	0	2	0	2	0	1	0	1	0	4	3
MM_008	1	0	1	0	1	0	0	0	0	0	1	1
MM_009	1	0	1	0	1	0	0	0	0	0	1	2
MM_010	1	0	1	0	1	0	0	0	0	0	1	1
MM_011	1	0	1	0	1	0	1	0	1	0	1	1
MM_013	2	0	1	0	1	0	1	0	1	0	2	1
MM_014	1	0	1	0	1	0	1	0	1	0	2	1
MM_029	1	0	1	0	1	0	0	0	0	0	1	1
MM_030	1	0	1	0	1	0	0	0	0	0	1	1
MM_031	1	0	1	0	1	0	0	0	0	0	1	1
MM_032	1	0	1	0	1	0	0	0	0	0	1	1
MM_033	1	0	1	0	1	0	0	0	0	0	1	1
MM_034	1	0	1	0	0	0	0	0	0	0	1	1
MM_035	0	0	0	0	0	0	0	0	0	0	0	1
MM_036	1	0	1	0	1	0	0	0	0	0	1	1
MM_040	1	0	1	0	1	0	1	0	1	0	1	1
MM_041	1	0	1	0	1	0	1	0	0	0	1	1
MM_042	1	0	2	0	1	0	1	0	1	0	1	1
MM_043	1	0	1	0	1	0	0	0	1	0	1	1
MM_046	1	0	1	0	1	0	0	0	0	0	1	1
MM_048	1	0	1	0	1	0	0	0	0	0	1	1
MM_049	1	0	1	0	1	0	1	0	1	0	1	1
MM_050	1	0	1	0	1	0	1	0	1	0	1	1
MM_052	1	0	1	0	1	0	1	0	0	0	1	1
MM_054	1	0	1	0	1	0	0	0	0	0	1	1
MM_055	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
MM_056	Marquette Mission	64.9%	14.2%	3.9%	1.2%	0.3%	2.3%	12.2%	0.1%	0.5%	0.0%	3	176
MM_059	Marquette Mission	65.6%	13.9%	3.9%	1.8%	0.4%	1.9%	11.6%	0.0%	0.4%	0.0%	11	171
MM_060	Marquette Mission	66.6%	8.8%	3.5%	1.8%	0.4%	6.5%	11.4%	0.1%	0.5%	0.0%	6	808
MM_061	Marquette Mission	65.0%	15.2%	3.6%	1.7%	0.3%	1.9%	11.2%	0.2%	0.6%	0.0%	25	215
MM_062	Marquette Mission	64.2%	14.1%	4.1%	1.7%	0.3%	1.8%	12.2%	0.5%	0.7%	0.0%	15	127
MM_068	Marquette Mission	65.1%	14.3%	3.8%	1.6%	0.3%	2.3%	11.2%	0.1%	0.8%	0.0%	25	243
MM_070	Marquette Mission	69.1%	11.5%	3.5%	1.2%	0.3%	2.0%	11.8%	0.3%	0.2%	0.0%	22	202
MM_071	Marquette Mission	66.8%	12.7%	3.7%	1.6%	0.3%	2.3%	12.2%	0.0%	0.3%	0.0%	10	385
MM_077	Marquette Mission	67.0%	12.0%	3.7%	1.6%	0.3%	2.2%	12.6%	0.1%	0.3%	0.0%	6	963
MM_078	Marquette Mission	65.4%	13.6%	3.7%	1.4%	0.3%	2.2%	12.4%	0.5%	0.3%	0.0%	4	361
MM_080	Marquette Mission	65.3%	13.2%	3.5%	1.2%	0.3%	2.4%	13.2%	0.5%	0.3%	0.0%	1	85
MM_086	Marquette Mission	66.3%	12.3%	3.8%	1.6%	0.3%	2.2%	12.4%	0.1%	0.5%	0.0%	161	1794
MM_116	Marquette Mission	65.0%	16.4%	3.4%	1.7%	0.3%	2.5%	9.8%	0.2%	0.5%	0.0%	6	60
MP_04	Mormon Print Shop	63.6%	14.9%	4.3%	1.4%	0.3%	1.8%	12.3%	0.1%	0.5%	0.0%	8	778
NL_01	New Lenox	63.2%	13.5%	3.4%	1.1%	0.2%	5.9%	10.7%	0.6%	0.4%	0.0%	3	48
NL_04	New Lenox	66.4%	14.1%	3.1%	1.3%	0.2%	4.1%	9.4%	0.0%	0.2%	0.0%	8	259
NL_05	New Lenox	62.4%	14.5%	3.9%	1.8%	0.4%	4.6%	9.7%	1.1%	0.4%	0.0%	463	1801
NL_06	New Lenox	66.2%	12.2%	3.2%	1.3%	0.2%	5.7%	9.2%	0.5%	0.5%	0.0%	23	61
NL_07	New Lenox	66.4%	14.7%	3.1%	1.1%	0.2%	3.6%	9.2%	0.1%	0.6%	0.0%	6	58
RB_10	Red Banks	67.4%	14.2%	3.0%	1.2%	0.2%	4.0%	8.5%	0.1%	0.8%	0.1%	88	454
RB_12	Red Banks	67.5%	13.9%	2.9%	1.3%	0.2%	4.1%	8.5%	0.1%	0.8%	0.0%	48	358
RB_13	Red Banks	67.5%	14.2%	3.0%	1.2%	0.2%	4.0%	8.5%	0.1%	0.8%	0.1%	82	331
RB_14	Red Banks	67.9%	14.3%	3.0%	1.1%	0.2%	3.9%	8.2%	0.1%	0.7%	0.0%	25	282
RB_15	Red Banks	67.1%	12.4%	2.9%	1.2%	0.3%	6.0%	8.4%	0.5%	0.7%	0.0%	23	226
RB_16	Red Banks	65.7%	12.1%	2.7%	1.6%	0.3%	6.2%	8.3%	1.6%	0.9%	0.0%	22	434
RI_001	Rock Island 3a	67.9%	11.4%	3.0%	1.5%	0.2%	4.6%	9.6%	0.1%	1.0%	0.0%	6	952
RI_003	Rock Island 3a	68.1%	12.8%	2.9%	1.9%	0.3%	2.3%	9.7%	0.1%	1.2%	0.0%	7	901
RI_004	Rock Island 2	68.1%	12.7%	2.9%	1.9%	0.3%	2.2%	9.8%	0.1%	1.1%	0.0%	7	1083
RI_005	Rock Island 3a	68.1%	12.7%	3.0%	2.1%	0.3%	2.3%	9.6%	0.1%	1.1%	0.0%	7	1034
RI_013	Rock Island 3a	68.1%	13.1%	3.0%	1.9%	0.3%	2.1%	9.6%	0.1%	1.1%	0.0%	7	864
RI_052b	Rock Island 4	68.4%	11.0%	2.9%	1.9%	0.3%	3.2%	10.2%	0.1%	1.1%	0.0%	4	1832
RI_053b	Rock Island 4	67.5%	11.4%	3.1%	1.9%	0.3%	3.2%	10.5%	0.1%	1.1%	0.0%	4	2037
RI_054	Rock Island 4	67.7%	11.7%	3.1%	1.8%	0.3%	3.2%	10.1%	0.1%	1.1%	0.0%	4	2034
RI_055	Rock Island 4	68.0%	11.9%	3.1%	1.8%	0.3%	3.2%	9.6%	0.1%	1.1%	0.0%	4	2248
RI_058	Rock Island 4	67.3%	11.7%	3.0%	1.9%	0.3%	3.2%	10.5%	0.1%	1.1%	0.0%	4	1944
RI_069	Rock Island 4	67.6%	12.3%	3.4%	1.4%	0.3%	3.1%	10.3%	0.1%	0.7%	0.0%	5	1022
RI_070	Rock Island 4	67.6%	13.8%	2.7%	1.5%	0.4%	2.8%	9.3%	0.2%	0.8%	0.0%	28	1456

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
MM_056	11	1	99	3	352	11	24	110	413	47	703	14	612	19	2
MM_059	14	2	94	3	336	9	18	153	598	96	388	12	640	30	2
MM_060	9	1	90	3	422	12	19	188	600	44	849	23	647	41	2
MM_061	13	1	84	3	299	9	22	251	956	69	1781	14	626	19	2
MM_062	11	1	84	4	344	11	24	254	703	49	1261	12	700	25	2
MM_068	13	1	91	5	407	12	30	109	437	50	963	15	550	20	2
MM_070	9	1	100	2	345	9	15	127	685	73	2825	12	717	27	2
MM_071	10	1	89	2	434	12	20	131	563	44	1450	16	691	24	2
MM_077	8	1	77	2	387	9	19	152	647	43	1083	13	774	38	2
MM_078	8	1	105	3	413	12	22	202	683	49	1709	14	700	22	2
MM_080	9	1	97	2	360	10	20	91	687	39	1096	15	687	18	2
MM_086	9	1	80	3	385	10	24	145	630	41	933	13	746	37	2
MM_116	12	2	95	2	280	8	11	247	941	34	1240	19	530	17	2
MP_04	9	1	105	4	287	9	22	194	860	43	632	11	740	27	2
NL_01	27	1	63	5	1455	14	23	115	1616	47	5005	26	445	367	6
NL_04	19	1	65	3	1652	11	13	134	1703	275	3497	19	425	488	9
NL_05	24	1	82	3	1604	17	20	372	1518	268	3054	30	443	410	9
NL_06	35	1	69	4	1263	16	24	126	1874	50	4632	26	439	374	7
NL_07	25	1	65	5	1988	14	32	141	1096	42	3750	23	530	474	11
RB_10	26	1	59	4	616	13	20	142	1093	82	3389	21	482	431	11
RB_12	26	1	59	3	602	13	17	150	1089	64	3153	24	478	429	11
RB_13	26	1	61	3	612	13	19	142	1104	64	3163	22	490	443	11
RB_14	26	1	63	3	597	13	17	131	1078	65	3300	20	481	425	11
RB_15	34	1	61	3	368	14	10	105	1782	59	3600	27	416	333	6
RB_16	36	2	52	3	496	20	15	250	2557	88	4614	30	460	467	9
RI_001	16	0	88	3	192	14	10	371	612	40	629	27	586	30	2
RI_003	16	1	72	4	274	18	25	224	499	53	559	19	498	35	3
RI_004	15	1	72	4	276	18	26	205	483	59	552	19	490	34	3
RI_005	15	1	68	4	283	18	24	192	463	49	512	19	512	37	3
RI_013	16	1	76	3	257	18	22	206	457	46	477	18	491	32	3
RI_052b	14	1	61	3	389	17	25	275	693	70	1101	23	498	34	3
RI_053b	14	1	65	3	392	18	24	287	707	64	1133	21	504	34	3
RI_054	14	1	71	3	382	17	24	270	693	68	1091	20	499	33	3
RI_055	14	1	74	3	370	17	24	280	680	65	1122	21	493	33	3
RI_058	14	1	68	3	372	17	22	259	680	61	1083	20	509	34	3
RI_069	11	1	102	2	195	12	14	192	623	57	1745	19	559	19	2
RI_070	12	0	100	2	225	14	21	86	481	62	1102	16	423	21	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
MM_056	1	48	0	36	3	6	1	0	2	3	193	2	0	7	3
MM_059	1	257	0	38	4	7	1	0	1	4	143	1	1	5	3
MM_060	1	51	0	44	4	8	1	0	1	5	166	1	1	6	4
MM_061	1	514	0	35	3	6	1	0	4	4	321	3	1	5	3
MM_062	1	114	0	82	4	7	1	0	1	4	208	1	1	12	4
MM_068	1	289	0	44	4	7	1	0	2	4	285	1	1	6	4
MM_070	1	299	0	156	3	6	1	0	2	4	508	3	0	7	3
MM_071	1	111	0	136	4	8	1	0	2	4	346	2	1	7	4
MM_077	0	17	0	132	4	7	1	0	1	4	122	1	1	4	3
MM_078	1	244	0	132	4	7	1	0	0	4	402	1	0	4	3
MM_080	1	363	0	136	3	6	1	0	4	3	38	4	0	7	3
MM_086	0	308	0	130	4	7	1	0	1	4	106	1	0	5	3
MM_116	0	35	0	107	3	6	1	0	1	3	526	0	1	6	3
MP_04	0	151	0	108	3	7	1	0	3	4	54	0	0	6	3
NL_01	1	4	1	103	4	8	1	0	0	9	147	4	2	11	4
NL_04	1	3	0	48	5	9	1	1	0	9	193	11	1	28	5
NL_05	0	5	1	210	7	14	2	1	0	10	205	9	8	40	7
NL_06	1	3	1	143	6	12	2	1	1	10	152	9	3	16	6
NL_07	1	4	1	59	8	17	2	1	0	13	271	10	2	20	7
RB_10	7	3	1	82	7	17	2	1	0	13	227	9	2	20	7
RB_12	6	3	1	85	8	17	2	1	0	13	252	10	2	20	7
RB_13	7	3	1	84	8	17	2	1	0	13	239	10	2	20	7
RB_14	8	3	1	77	7	17	2	1	0	12	240	10	2	20	6
RB_15	3	2	1	194	6	12	2	1	0	9	136	9	3	18	5
RB_16	22	3	1	579	7	13	2	1	1	13	297	9	7	25	7
RI_001	0	271	0	92	4	9	1	0	0	6	204	30	1	15	4
RI_003	0	278	1	127	6	12	2	0	0	6	144	1	0	10	6
RI_004	0	273	1	127	6	13	2	0	0	6	134	2	0	7	5
RI_005	0	262	1	148	6	13	2	0	0	6	126	1	0	7	6
RI_013	0	268	1	123	6	13	2	0	0	5	120	1	0	8	5
RI_052b	1	239	0	112	6	11	1	0	0	8	416	15	0	23	5
RI_053b	0	258	1	118	6	11	2	0	0	8	472	17	0	24	5
RI_054	1	251	1	118	6	11	1	0	0	8	472	18	0	23	5
RI_055	1	256	1	119	6	12	1	0	0	8	498	18	0	23	5
RI_058	0	247	1	136	6	11	1	0	0	7	433	15	0	25	5
RI_069	0	44	0	115	4	7	1	0	0	4	253	3	0	6	3
RI_070	0	230	0	104	4	9	1	0	0	4	240	4	0	6	4

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
MM_056	1	0	1	0	0	0	0	0	0	0	1	1
MM_059	1	0	1	0	1	0	0	0	1	0	1	1
MM_060	1	0	2	0	1	0	1	0	1	0	2	1
MM_061	1	0	1	0	1	0	0	0	1	0	1	1
MM_062	1	0	1	0	1	0	0	0	1	0	1	1
MM_068	1	0	1	0	1	0	1	0	1	0	1	1
MM_070	1	0	1	0	1	0	0	0	0	0	1	1
MM_071	1	0	1	0	1	0	0	0	1	0	1	1
MM_077	1	0	1	0	1	0	0	0	1	0	1	1
MM_078	1	0	1	0	1	0	0	0	0	0	1	1
MM_080	1	0	1	0	1	0	0	0	0	0	1	1
MM_086	1	0	1	0	1	0	0	0	0	0	1	1
MM_116	1	0	1	0	1	0	0	0	0	0	0	1
MP_04	1	0	1	0	1	0	0	0	0	0	1	1
NL_01	1	0	1	0	1	0	1	0	1	0	9	1
NL_04	2	0	1	0	2	0	1	0	2	0	14	3
NL_05	2	0	2	0	2	0	1	0	1	0	12	3
NL_06	1	0	1	0	2	0	1	0	1	0	11	2
NL_07	2	0	2	0	2	0	2	0	2	0	14	3
RB_10	1	0	2	0	2	0	1	0	2	0	12	3
RB_12	2	0	2	0	2	0	1	0	2	0	13	3
RB_13	2	0	2	0	2	0	1	0	2	0	13	3
RB_14	2	0	2	0	2	0	1	0	2	0	13	3
RB_15	1	0	1	0	1	0	1	0	1	0	9	2
RB_16	2	0	2	0	2	0	1	0	2	0	12	2
RI_001	1	0	1	0	1	0	1	0	1	0	1	1
RI_003	1	0	1	0	1	0	0	0	0	0	1	2
RI_004	1	0	1	0	1	0	0	0	0	0	1	2
RI_005	1	0	1	0	1	0	1	0	0	0	1	2
RI_013	1	0	1	0	1	0	0	0	0	0	1	1
RI_052b	1	0	1	0	1	0	1	0	1	0	1	2
RI_053b	1	0	1	0	1	0	1	0	1	0	1	2
RI_054	1	0	1	0	1	0	1	0	1	0	1	2
RI_055	1	0	1	0	1	0	1	0	1	0	1	2
RI_058	1	0	1	0	1	0	1	0	1	0	1	2
RI_069	1	0	1	0	1	0	0	0	0	0	1	1
RI_070	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
RI_071	Rock Island 4	67.4%	11.8%	3.6%	1.5%	0.3%	2.9%	10.6%	0.2%	0.7%	0.0%	7	1999
RI_073	Rock Island 4	66.5%	12.4%	3.4%	1.5%	0.3%	3.1%	10.9%	0.2%	0.7%	0.2%	21	2060
RI_105	Rock Island 3b	66.5%	13.8%	3.0%	2.2%	0.3%	2.3%	9.6%	0.1%	1.2%	0.0%	211	1694
RI_107	Rock Island 2(?)	67.1%	12.8%	2.8%	1.4%	0.3%	2.9%	10.4%	0.2%	0.7%	0.0%	18	2446
RI_109	Rock Island 3	65.8%	12.9%	3.2%	1.7%	0.2%	4.5%	9.8%	0.0%	1.0%	0.0%	4	274
RI_110	Rock Island 3	64.6%	12.2%	3.3%	1.8%	0.3%	5.6%	10.3%	0.0%	0.9%	0.0%	6	246
RI_111	Rock Island 3	66.4%	14.0%	3.0%	2.1%	0.3%	2.5%	9.4%	0.1%	1.1%	0.0%	7	1056
RI_112	Rock Island 3a	66.4%	14.5%	3.1%	2.2%	0.3%	2.2%	9.2%	0.1%	1.1%	0.0%	7	1045
RI_113	Rock Island 3a	66.6%	14.3%	3.1%	2.1%	0.3%	2.2%	9.0%	0.1%	1.2%	0.0%	8	1037
RI_114	Rock Island 3b	68.1%	11.2%	3.2%	1.5%	0.3%	2.9%	11.0%	0.1%	0.8%	0.0%	4	767
RI_115	Rock Island 3b	66.6%	11.7%	3.1%	2.2%	0.3%	3.3%	10.9%	0.1%	1.2%	0.0%	10	818
RI_117	Rock Island 3b	64.9%	11.8%	3.1%	1.8%	0.2%	5.8%	10.4%	0.0%	1.1%	0.0%	5	462
RI_118	Rock Island 3b	66.7%	11.8%	3.1%	2.2%	0.3%	3.3%	10.5%	0.1%	1.1%	0.0%	10	758
SJ_11	Fort St. Joseph	68.5%	11.9%	2.8%	1.5%	0.4%	2.1%	10.8%	0.1%	0.7%	0.0%	8	517
SJ_13	Fort St. Joseph	67.0%	14.6%	3.0%	0.9%	0.8%	2.7%	8.8%	0.1%	0.5%	0.0%	10	2853
SJ_14	Fort St. Joseph	66.4%	13.4%	3.0%	1.7%	0.3%	2.5%	11.1%	0.1%	0.6%	0.0%	2	316
SJ_15	Fort St. Joseph	66.2%	13.2%	3.0%	1.7%	0.3%	2.5%	11.2%	0.2%	0.6%	0.0%	4	798
SJ_20	Fort St. Joseph	67.2%	13.1%	3.1%	1.7%	0.3%	2.6%	11.1%	0.1%	0.6%	0.0%	9	347
SJ_21	Fort St. Joseph	67.2%	13.3%	3.1%	1.6%	0.3%	2.5%	11.2%	0.1%	0.5%	0.0%	2	195
SL_02_1	Fort St. Louis	66.4%	12.9%	4.0%	2.0%	0.4%	2.4%	10.8%	0.1%	1.1%	0.0%	6	246
SL_03_1	Fort St. Louis	66.7%	12.8%	3.8%	1.8%	0.3%	2.4%	11.0%	0.0%	1.0%	0.0%	6	624
SL_04_1	Fort St. Louis	67.7%	13.2%	3.5%	1.6%	0.3%	2.2%	10.3%	0.1%	0.9%	0.0%	5	721
SL_05_1	Fort St. Louis	66.4%	13.0%	3.9%	1.9%	0.3%	2.3%	10.8%	0.1%	1.1%	0.0%	8	317
SL_09_1	Fort St. Louis	67.5%	10.3%	2.8%	1.3%	0.2%	6.1%	10.5%	0.5%	0.5%	0.0%	9	2748
SL_13_1	Fort St. Louis	65.9%	12.0%	3.6%	2.7%	0.4%	2.5%	11.8%	0.1%	0.9%	0.0%	6	1012
ZM_09	Zimmerman	64.5%	13.2%	3.5%	1.8%	0.3%	3.5%	11.3%	0.3%	0.6%	0.0%	34	533
ZM_10	Zimmerman	63.4%	16.4%	3.4%	2.2%	0.3%	2.0%	10.3%	0.1%	0.6%	0.0%	3	41
ZM_12	Zimmerman	62.2%	14.6%	4.6%	1.4%	0.3%	2.6%	12.9%	0.0%	0.5%	0.0%	5	1033
ZM_14	Zimmerman	62.7%	16.8%	3.4%	2.2%	0.3%	2.4%	10.5%	0.1%	0.5%	0.0%	54	39
ZM_15	Zimmerman	62.2%	14.4%	4.7%	1.4%	0.3%	2.5%	12.9%	0.1%	0.5%	0.0%	2	465
ZM_16	Zimmerman	64.3%	15.6%	3.5%	1.9%	0.3%	2.4%	10.3%	0.2%	0.6%	0.0%	3	56
ZM_17	Zimmerman	63.9%	15.3%	3.8%	1.5%	0.3%	3.1%	10.1%	0.6%	0.5%	0.0%	38	108
ZM_18	Zimmerman	62.1%	14.9%	4.8%	1.4%	0.2%	2.7%	12.3%	0.1%	0.5%	0.0%	2	324
ZM_19	Zimmerman	63.6%	17.7%	3.9%	1.5%	0.3%	1.9%	9.2%	0.2%	0.5%	0.0%	3	90
ZM_20	Zimmerman	61.3%	15.1%	3.7%	2.7%	0.3%	2.7%	12.7%	0.0%	0.5%	0.0%	6	638
ZM_21	Zimmerman	65.8%	13.3%	4.2%	1.4%	0.3%	2.2%	12.2%	0.0%	0.4%	0.0%	2	1134
ZM_22	Zimmerman	65.9%	13.8%	2.9%	1.9%	0.2%	4.0%	10.6%	0.0%	0.5%	0.0%	3	58

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
RI_071	11	1	108	2	191	14	18	128	674	66	2061	17	547	18	2
RI_073	14	1	92	2	168	12	15	129	589	56	1737	19	558	17	2
RI_105	16	1	61	3	153	18	23	187	457	79	485	20	529	40	3
RI_107	10	0	69	2	92	13	14	129	279	57	497	19	610	22	2
RI_109	15	0	76	3	114	16	10	186	425	43	571	29	550	29	2
RI_110	23	0	59	3	118	16	12	133	533	86	899	33	721	33	2
RI_111	16	0	62	3	146	18	23	193	451	49	498	20	511	34	3
RI_112	16	1	64	3	148	18	22	198	457	52	506	19	527	37	3
RI_113	16	0	62	3	148	18	23	197	441	53	486	19	518	35	3
RI_114	9	1	60	3	111	12	14	226	720	47	2054	17	591	20	2
RI_115	10	1	65	3	204	17	23	160	758	42	1384	22	610	34	3
RI_117	14	1	77	3	172	17	10	318	504	39	953	30	570	31	3
RI_118	11	1	69	3	205	17	23	162	742	45	1391	21	580	33	3
SJ_11	9	0	88	5	520	19	38	145	767	51	1803	12	634	27	2
SJ_13	12	0	166	4	208	8	17	483	518	64	730	10	552	22	1
SJ_14	9	1	85	4	501	14	28	352	443	45	732	18	578	30	3
SJ_15	9	1	83	5	500	15	29	354	471	45	879	19	576	30	3
SJ_20	12	1	100	5	497	15	28	429	516	112	743	15	484	26	2
SJ_21	11	1	95	5	495	15	27	356	461	41	609	16	489	26	2
SL_02_1	9	0	89	3	475	19	0	194	590	41	1663	13	620	48	4
SL_03_1	9	1	90	3	426	18	0	192	596	40	1441	14	594	42	3
SL_04_1	9	1	97	2	375	17	0	203	623	38	1098	15	638	32	3
SL_05_1	9	1	92	3	445	19	0	194	579	39	1563	13	627	45	3
SL_09_1	26	1	65	2	237	8	0	173	506	45	1256	59	586	59	2
SL_13_1	34	1	95	2	296	15	0	119	618	42	822	22	690	32	3
ZM_09	13	1	90	4	349	10	23	322	737	126	2850	20	629	39	2
ZM_10	12	1	100	4	243	10	28	100	1002	48	2241	13	638	17	2
ZM_12	9	1	87	4	293	11	28	124	816	42	1245	16	793	19	2
ZM_14	12	1	99	5	304	11	29	97	880	45	3167	15	622	20	2
ZM_15	9	1	88	4	285	11	24	114	821	42	1467	16	809	19	2
ZM_16	9	1	89	5	234	10	27	203	847	47	1362	16	609	16	2
ZM_17	8	1	92	5	250	10	27	408	630	51	1278	17	576	21	1
ZM_18	8	1	78	5	269	11	28	93	700	40	1655	16	797	17	2
ZM_19	10	1	89	5	419	13	29	256	1565	41	4616	13	398	34	2
ZM_20	20	2	88	5	257	15	28	558	1093	94	2549	24	732	18	2
ZM_21	10	1	112	3	326	10	21	122	822	43	1262	15	732	18	2
ZM_22	20	1	67	4	305	9	23	446	1062	28	1758	25	821	27	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
RI_071	0	114	0	125	4	7	1	0	0	4	335	2	1	11	3
RI_073	2	179	0	122	4	7	1	0	0	4	303	6	0	6	3
RI_105	0	281	1	129	7	14	2	0	0	6	155	2	0	7	7
RI_107	0	1132	0	148	4	7	1	0	0	4	179	7	0	5	4
RI_109	0	167	0	81	5	10	1	0	0	5	198	17	1	8	4
RI_110	0	395	1	118	5	11	1	0	0	5	254	12	0	10	5
RI_111	0	268	1	125	6	13	2	0	0	6	160	2	0	9	6
RI_112	0	276	1	129	7	14	2	0	0	6	173	2	0	10	6
RI_113	0	271	1	134	7	13	2	0	0	6	163	2	0	9	6
RI_114	0	35	0	117	4	7	1	0	0	4	213	2	0	7	3
RI_115	0	68	1	126	6	12	1	0	0	6	132	1	0	9	5
RI_117	0	204	1	89	5	10	1	0	0	6	285	21	2	10	4
RI_118	0	71	1	123	6	12	1	0	0	6	139	1	0	8	5
SJ_11	1	21	0	132	5	9	1	0	1	5	820	1	0	5	4
SJ_13	1	356	0	53	3	5	1	0	0	2	742	8	1	4	3
SJ_14	0	173	1	132	5	10	1	0	0	5	422	16	1	6	5
SJ_15	0	243	1	139	5	11	1	0	0	5	379	15	1	6	5
SJ_20	0	128	0	95	4	7	1	0	0	4	271	11	1	5	3
SJ_21	0	122	0	92	4	7	1	0	0	4	255	9	0	4	3
SL_02_1	1	311	0	126	6	13	2	0	0	6	400	3	0	6	6
SL_03_1	1	168	0	140	6	11	1	0	0	5	402	3	0	6	6
SL_04_1	1	59	0	141	5	10	1	0	0	4	417	3	0	7	5
SL_05_1	1	406	0	132	6	13	2	0	0	5	418	3	0	6	6
SL_09_1	1	64	1	159	6	11	1	0	0	4	388	8	1	9	5
SL_13_1	0	289	1	175	6	12	2	0	0	6	233	4	1	17	6
ZM_09	27	327	0	88	4	7	1	0	1	4	820	2	1	12	4
ZM_10	8	50	0	73	4	7	1	0	1	4	402	2	1	2	3
ZM_12	1	12	0	81	4	7	1	0	2	4	41	2	1	6	3
ZM_14	0	107	0	73	4	7	1	0	0	4	328	2	0	2	3
ZM_15	0	6	0	82	4	7	1	0	0	4	39	3	1	7	4
ZM_16	0	423	0	74	3	6	1	0	1	3	294	1	0	2	3
ZM_17	0	225	0	100	3	6	1	0	0	3	304	1	0	5	3
ZM_18	62	6	0	75	3	7	1	0	1	3	30	2	1	7	3
ZM_19	0	67	0	60	4	8	1	0	1	4	453	3	0	10	4
ZM_20	18	252	1	86	4	7	1	0	1	5	757	28	1	14	3
ZM_21	1	5	1	103	3	6	1	0	201	4	38	3	1	6	3
ZM_22	0	120	0	115	4	7	1	0	0	3	299	1	0	10	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
RI_071	1	0	1	0	1	0	0	0	0	0	1	1
RI_073	1	0	1	0	1	0	0	0	0	0	1	1
RI_105	1	0	1	0	1	0	1	0	1	0	1	2
RI_107	1	0	1	0	1	0	0	0	0	0	1	1
RI_109	1	0	1	0	1	0	0	0	0	0	1	1
RI_110	1	0	1	0	1	0	1	0	1	0	1	2
RI_111	1	0	1	0	1	0	1	0	1	0	1	2
RI_112	1	0	1	0	1	0	1	0	1	0	1	2
RI_113	1	0	1	0	1	0	1	0	0	0	1	2
RI_114	1	0	1	0	1	0	0	0	0	0	1	1
RI_115	1	0	1	0	1	0	1	0	1	0	1	1
RI_117	1	0	1	0	1	0	1	0	0	0	1	1
RI_118	1	0	1	0	1	0	1	0	1	0	1	1
SJ_11	1	0	1	0	1	0	1	0	0	0	1	1
SJ_13	1	0	1	0	1	0	0	0	1	0	1	1
SJ_14	1	0	1	0	1	0	1	0	1	0	1	1
SJ_15	1	0	1	0	1	0	1	0	0	0	1	1
SJ_20	1	0	1	0	1	0	0	0	0	0	1	1
SJ_21	1	0	1	0	1	0	0	0	0	0	1	1
SL_02_1	1	0	1	0	1	0	1	0	1	0	2	1
SL_03_1	1	0	1	0	1	0	1	0	1	0	1	1
SL_04_1	1	0	1	0	1	0	1	0	0	0	1	1
SL_05_1	1	0	1	0	1	0	1	0	1	0	1	1
SL_09_1	1	0	1	0	1	0	1	0	1	0	2	2
SL_13_1	1	0	1	0	1	0	1	0	1	0	1	2
ZM_09	1	0	1	0	1	0	1	0	1	0	1	1
ZM_10	1	0	1	0	1	0	1	0	1	0	1	1
ZM_12	1	0	1	0	1	0	0	0	0	0	1	1
ZM_14	1	0	1	0	1	0	0	0	0	0	1	1
ZM_15	1	0	1	0	1	0	1	0	1	0	1	1
ZM_16	1	0	1	0	1	0	0	0	1	0	1	1
ZM_17	1	0	1	0	1	0	0	0	0	0	1	1
ZM_18	1	0	1	0	1	0	0	0	0	0	0	1
ZM_19	1	0	1	0	1	0	0	0	0	0	1	1
ZM_20	1	0	1	0	1	0	1	0	1	0	1	1
ZM_21	1	0	1	0	1	0	0	0	0	0	1	1
ZM_22	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	Subgroup: P-low-Mg (n=101)												
B_028	Bell	71.9%	10.7%	1.2%	1.0%	0.7%	5.8%	7.2%	0.1%	0.6%	0.0%	4	961
B_029	Bell	72.7%	11.4%	1.1%	1.1%	0.7%	4.7%	6.9%	0.1%	0.6%	0.0%	4	873
B_030	Bell	72.2%	11.6%	1.1%	1.0%	0.7%	4.7%	7.2%	0.1%	0.6%	0.0%	3	870
B_031	Bell	72.2%	11.6%	1.1%	1.0%	0.7%	4.8%	7.0%	0.1%	0.6%	0.0%	3	792
B_032	Bell	68.4%	9.0%	2.1%	1.9%	0.9%	5.4%	9.2%	1.0%	1.1%	0.0%	16	1107
B_033	Bell	69.5%	8.8%	2.0%	1.8%	1.0%	5.5%	9.2%	0.5%	1.0%	0.0%	13	616
B1428	Bell	70.0%	10.8%	1.2%	1.1%	0.7%	6.2%	8.5%	0.1%	0.6%	0.0%	4	1053
B2041	Bell	66.2%	12.0%	2.3%	1.9%	0.4%	2.9%	11.8%	0.4%	1.0%	0.0%	11	1388
B2125	Bell	66.2%	12.2%	2.4%	1.6%	0.4%	3.1%	11.6%	0.6%	0.7%	0.0%	19	2835
B2128	Bell	65.4%	12.5%	2.0%	2.4%	0.7%	4.5%	10.0%	0.1%	0.8%	0.0%	8	4340
B2445	Bell	66.1%	12.2%	2.2%	1.8%	0.5%	3.0%	11.8%	0.5%	1.0%	0.0%	8	1007
B643	Bell	68.4%	10.3%	1.6%	1.4%	0.8%	4.7%	10.6%	0.2%	0.7%	0.0%	10	4092
B872	Bell	70.9%	11.2%	1.3%	1.2%	0.6%	4.5%	8.5%	0.1%	0.7%	0.0%	5	1506
B956	Bell	68.4%	11.3%	1.3%	1.3%	0.8%	5.0%	9.9%	0.1%	0.9%	0.0%	3	2012
CM_01	Fort Michilimackinac	65.0%	12.7%	2.4%	1.9%	0.5%	3.5%	12.6%	0.5%	0.7%	0.0%	9	800
CM_02	Fort Michilimackinac	66.5%	11.5%	2.0%	1.6%	0.8%	5.9%	10.9%	0.1%	0.6%	0.0%	3	146
CM_03	Fort Michilimackinac	64.8%	12.4%	1.6%	1.5%	0.9%	6.2%	11.8%	0.2%	0.5%	0.0%	4	1300
CM_04	Fort Michilimackinac	65.8%	13.5%	2.1%	1.4%	0.7%	4.5%	10.6%	0.4%	0.7%	0.0%	10	499
CM_05	Fort Michilimackinac	67.2%	13.3%	1.4%	1.0%	0.9%	6.0%	9.4%	0.1%	0.6%	0.0%	5	658
CM_06	Fort Michilimackinac	69.7%	13.2%	1.5%	1.4%	0.7%	4.8%	8.1%	0.0%	0.5%	0.0%	3	264
CM_07	Fort Michilimackinac	66.5%	12.4%	1.6%	1.7%	0.7%	5.8%	10.3%	0.2%	0.7%	0.0%	4	581
CM_08	Fort Michilimackinac	67.6%	11.9%	1.5%	1.7%	0.7%	5.7%	9.8%	0.2%	0.7%	0.0%	4	608
CM_09	Fort Michilimackinac	66.8%	12.0%	1.4%	1.5%	0.8%	5.5%	11.1%	0.1%	0.6%	0.0%	6	572
CM_10	Fort Michilimackinac	69.7%	11.8%	1.5%	0.9%	0.7%	5.9%	8.5%	0.1%	0.6%	0.0%	4	527
CM_11	Fort Michilimackinac	68.7%	12.3%	2.4%	1.1%	0.5%	4.4%	10.0%	0.1%	0.4%	0.0%	3	251
CM_12	Fort Michilimackinac	69.8%	11.3%	1.8%	1.9%	0.6%	4.4%	9.1%	0.2%	0.9%	0.0%	11	120
CM_14	Fort Michilimackinac	66.7%	13.1%	1.6%	1.6%	0.6%	5.3%	10.2%	0.1%	0.4%	0.0%	5	549
CM_15	Fort Michilimackinac	67.3%	12.5%	1.8%	1.4%	0.7%	5.3%	10.2%	0.2%	0.7%	0.0%	4	436
CM_16	Fort Michilimackinac	67.6%	11.8%	2.2%	1.6%	0.7%	5.6%	9.4%	0.4%	0.7%	0.0%	13	290
CM_17	Fort Michilimackinac	67.0%	12.9%	1.5%	1.1%	0.7%	5.5%	10.2%	0.2%	0.5%	0.0%	7	1623
CM_18	Fort Michilimackinac	66.7%	11.8%	1.5%	1.5%	0.9%	5.8%	10.9%	0.2%	0.6%	0.0%	4	1273
CM_19	Fort Michilimackinac	67.8%	12.3%	1.7%	1.6%	0.7%	5.0%	9.9%	0.1%	0.6%	0.0%	6	608
CM_20	Fort Michilimackinac	67.8%	12.7%	1.4%	1.1%	0.7%	4.3%	9.7%	0.1%	0.3%	0.0%	2	503
CM_21	Fort Michilimackinac	66.5%	13.1%	1.7%	1.6%	0.8%	4.1%	9.7%	0.1%	0.5%	0.0%	4	982

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	Subgroup: P-low-Mg (n=101)														
B_028	17	0	111	3	112	10	10	380	715	61	645	19	564	23	1
B_029	18	0	108	3	109	9	10	377	712	64	652	16	592	22	1
B_030	18	0	104	3	110	9	10	377	703	66	655	16	572	22	1
B_031	19	0	123	3	113	9	10	381	723	69	621	17	562	21	1
B_032	20	0	130	4	213	16	14	408	834	65	1143	27	538	49	3
B_033	20	1	126	3	181	13	12	383	676	62	1018	28	515	51	2
B1428	20	0	102	3	62	9	9	380	737	66	652	44	594	21	1
B2041	11	1	68	3	122	14	16	131	664	50	897	13	862	28	2
B2125	11	1	89	2	70	10	10	337	470	49	641	28	499	17	2
B2128	24	1	97	3	86	12	11	204	657	61	1100	19	556	28	2
B2445	11	0	68	3	122	14	15	137	655	46	1020	13	918	30	2
B643	14	1	138	3	75	11	9	108	435	79	581	19	490	26	2
B872	18	0	116	3	73	10	11	413	780	65	647	17	540	22	2
B956	17	0	117	3	74	11	10	135	550	59	419	13	557	32	2
CM_01	12	1	69	4	548	16	24	156	717	56	1125	16	1169	37	3
CM_02	18	0	114	4	412	14	22	404	564	72	669	18	935	35	3
CM_03	18	0	121	3	359	12	11	162	613	73	524	15	784	46	2
CM_04	17	0	119	4	335	12	19	475	462	66	714	16	824	28	2
CM_05	17	0	123	4	232	8	15	444	702	113	1046	18	713	24	1
CM_06	18	1	108	4	279	11	16	333	659	72	694	12	762	24	2
CM_07	22	0	116	4	358	13	17	293	688	68	632	21	897	32	2
CM_08	21	0	114	4	345	13	18	286	677	67	646	19	888	31	2
CM_09	13	0	119	4	332	13	19	242	356	61	383	24	722	32	2
CM_10	20	1	104	4	197	8	13	1042	725	305	1406	14	926	19	1
CM_11	15	0	93	2	320	10	12	378	637	78	1161	21	697	22	2
CM_12	20	1	114	5	422	15	22	288	574	70	431	23	736	46	3
CM_14	22	1	120	3	342	12	10	425	584	74	793	18	899	32	2
CM_15	17	0	107	4	356	12	18	470	688	138	1101	19	768	32	2
CM_16	19	0	133	4	328	13	19	349	394	74	830	15	817	36	2
CM_17	15	0	110	4	269	9	16	360	558	87	813	23	741	23	2
CM_18	17	0	107	4	329	12	17	147	546	69	491	16	736	42	2
CM_19	21	1	108	4	330	13	17	663	851	69	904	19	779	33	2
CM_20	16	0	141	3	277	10	16	479	759	271	1142	21	630	23	2
CM_21	13	0	145	5	466	16	28	478	592	64	630	19	588	28	3

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	Subgroup: P-low-Mg (n=101)														
B_028	0	63	0	67	3	6	1	0	0	3	480	5	0	3	2
B_029	0	61	0	72	3	6	1	0	0	2	502	5	0	3	3
B_030	0	60	0	63	3	6	1	0	0	2	514	5	0	3	2
B_031	0	56	0	67	3	6	1	0	0	2	460	4	0	3	3
B_032	0	782	0	254	5	10	1	0	0	5	187	3	0	3	5
B_033	0	466	0	220	5	10	1	0	0	4	166	3	0	3	4
B1428	0	99	0	68	3	6	1	0	0	2	469	5	0	3	2
B2041	0	123	0	137	5	10	1	0	0	5	399	2	0	4	4
B2125	1	279	0	165	4	7	1	0	0	4	347	11	0	7	3
B2128	7	1559	0	94	4	9	1	0	0	5	229	137	1	16	4
B2445	0	130	0	140	5	10	1	0	0	5	503	1	0	3	4
B643	0	148	0	291	4	8	1	0	0	3	227	1	0	4	3
B872	0	187	0	69	3	6	1	0	0	3	403	4	0	4	3
B956	0	88	0	99	4	8	1	0	0	3	180	2	0	8	3
CM_01	0	183	0	172	5	11	1	0	0	6	588	2	0	3	5
CM_02	0	251	0	132	4	9	1	0	0	4	644	5	0	4	4
CM_03	0	151	0	136	4	9	1	0	0	4	247	3	0	9	4
CM_04	0	1705	0	131	4	8	1	0	0	3	638	3	0	4	4
CM_05	1	259	0	85	3	5	1	0	0	3	700	11	0	8	3
CM_06	0	486	0	231	4	7	1	0	0	10	452	30	0	2	3
CM_07	0	612	0	322	5	9	1	0	0	13	442	46	0	3	4
CM_08	3	555	0	325	5	9	1	0	0	13	452	45	0	2	4
CM_09	0	340	0	80	5	8	1	0	2	4	426	3	0	4	4
CM_10	1	150	0	84	2	5	1	0	4	6	584	52	0	14	3
CM_11	0	159	0	87	3	6	1	0	0	3	562	2	0	8	3
CM_12	0	305	0	122	6	11	1	0	0	5	602	2	1	3	5
CM_14	2	1261	0	101	4	9	1	0	0	4	655	7	0	3	4
CM_15	1	200	0	141	4	8	1	0	0	7	364	293	3	7	4
CM_16	0	502	0	138	4	8	1	0	1	4	509	4	0	3	4
CM_17	0	493	0	187	3	6	1	0	7	4	370	24	0	5	3
CM_18	0	151	0	132	4	8	1	0	0	4	249	3	0	8	4
CM_19	0	1988	0	86	4	8	1	0	10	3	808	3	0	3	4
CM_20	0	648	0	70	3	5	1	0	0	5	510	33	0	30	2
CM_21	0	368	0	69	4	8	1	0	0	3	545	3	0	2	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	Subgroup: P-low-Mg (n=101)											
B_028	1	0	0	0	0	0	0	0	0	0	1	1
B_029	1	0	0	0	0	0	0	0	0	0	1	1
B_030	0	0	0	0	0	0	0	0	0	0	1	1
B_031	1	0	0	0	0	0	0	0	0	0	1	1
B_032	1	0	1	0	1	0	0	0	0	0	1	1
B_033	1	0	1	0	1	0	0	0	0	0	1	1
B1428	1	0	1	0	0	0	0	0	0	0	1	1
B2041	1	0	1	0	1	0	0	0	0	0	1	1
B2125	1	0	1	0	1	0	0	0	0	0	0	1
B2128	1	0	1	0	1	0	1	0	0	0	1	1
B2445	1	0	1	0	1	0	0	0	0	0	1	1
B643	1	0	1	0	1	0	0	0	0	0	1	1
B872	1	0	1	0	0	0	0	0	0	0	1	1
B956	1	0	1	0	1	0	0	0	0	0	1	1
CM_01	1	0	1	0	1	0	1	0	1	0	1	1
CM_02	1	0	1	0	1	0	0	0	0	0	1	1
CM_03	1	0	1	0	1	0	0	0	0	0	1	1
CM_04	1	0	1	0	1	0	0	0	0	0	1	1
CM_05	1	0	1	0	1	0	0	0	0	0	1	1
CM_06	1	0	1	0	2	0	1	0	1	0	1	1
CM_07	2	0	2	0	3	1	1	0	1	0	1	2
CM_08	1	0	2	0	3	1	1	0	1	0	1	2
CM_09	1	0	1	0	1	0	0	0	0	0	1	2
CM_10	1	0	1	0	1	0	1	0	1	0	1	1
CM_11	1	0	1	0	1	0	0	0	0	0	1	1
CM_12	1	0	1	0	1	0	1	0	0	0	2	2
CM_14	1	0	1	0	1	0	0	0	0	0	1	1
CM_15	2	0	2	0	2	0	1	0	1	0	1	1
CM_16	1	0	1	0	1	0	0	0	0	0	1	1
CM_17	1	0	1	0	1	0	0	0	0	0	1	1
CM_18	1	0	1	0	1	0	0	0	0	0	1	1
CM_19	1	0	1	0	1	0	0	0	0	0	1	1
CM_20	1	0	1	0	1	0	0	0	0	0	1	1
CM_21	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
CM_22	Fort Michilimackinac	66.6%	12.7%	1.5%	1.5%	0.7%	4.9%	9.8%	0.1%	0.5%	0.0%	4	402
CM_25	Fort Michilimackinac	68.3%	11.5%	1.5%	1.5%	0.7%	5.0%	8.8%	0.1%	0.4%	0.0%	28	3031
CM_49	Fort Michilimackinac	64.6%	11.4%	2.2%	1.5%	1.1%	4.7%	12.1%	0.3%	0.5%	0.1%	36	649
CM_50	Fort Michilimackinac	65.2%	13.5%	1.4%	1.1%	0.9%	6.0%	9.8%	0.1%	0.4%	0.0%	6	707
DI_3	Doty Island Village	67.4%	11.5%	1.9%	1.5%	0.9%	5.5%	8.8%	0.2%	0.8%	0.0%	19	3216
DI_4	Doty Island Village	67.2%	12.3%	1.7%	1.1%	1.0%	5.5%	9.7%	0.1%	0.6%	0.0%	2	242
DI_49	Doty Island Village	65.7%	12.1%	1.9%	1.8%	1.4%	4.6%	10.4%	0.1%	1.0%	0.0%	3	923
DI_5	Doty Island Village	67.5%	11.5%	1.8%	1.4%	1.0%	5.6%	8.5%	0.3%	0.8%	0.0%	14	5305
DI_6	Doty Island Village	68.0%	11.2%	1.8%	1.4%	1.0%	5.5%	8.6%	0.3%	0.8%	0.0%	14	4326
DI_7	Doty Island Village	67.3%	11.4%	1.9%	1.5%	1.0%	5.4%	8.8%	0.3%	0.8%	0.1%	16	4161
DI_8	Doty Island Village	66.7%	11.6%	1.9%	1.5%	1.0%	5.6%	9.1%	0.3%	0.8%	0.0%	15	4493
M_01	Mahler	64.9%	14.7%	1.5%	1.5%	0.7%	4.9%	9.2%	0.1%	0.8%	0.0%	6	2205
M_04	Mahler	69.5%	9.6%	1.9%	1.8%	0.5%	4.5%	9.0%	0.5%	1.0%	0.0%	20	5115
M_05	Mahler	69.1%	9.7%	1.9%	1.9%	0.5%	4.5%	9.3%	0.5%	1.1%	0.0%	21	5153
M_06	Mahler	68.6%	11.3%	1.6%	1.4%	0.6%	5.4%	9.2%	0.2%	0.8%	0.0%	10	1516
M_07	Mahler	68.5%	11.0%	1.7%	1.4%	0.7%	5.8%	9.4%	0.2%	0.7%	0.0%	2	158
M_13	Mahler	68.1%	11.3%	1.9%	1.5%	0.7%	4.9%	9.5%	0.3%	0.9%	0.0%	11	1422
M_14	Mahler	70.0%	10.8%	1.6%	1.7%	0.5%	4.5%	8.5%	0.4%	0.9%	0.0%	6	3326
M_15	Mahler	68.5%	12.7%	2.0%	1.0%	0.7%	4.7%	8.7%	0.1%	0.5%	0.0%	3	761
M_16	Mahler	67.5%	9.9%	1.9%	1.5%	0.7%	7.5%	8.9%	0.3%	0.9%	0.0%	11	1482
M_17	Mahler	67.7%	11.7%	1.8%	1.1%	0.7%	5.9%	9.3%	0.1%	0.6%	0.0%	4	1851
MA_02	Marina	68.7%	10.6%	2.1%	1.2%	0.5%	4.7%	10.5%	0.1%	0.9%	0.0%	58	363
MA_04	Marina	69.3%	11.3%	1.8%	1.0%	0.7%	4.9%	9.6%	0.1%	0.6%	0.0%	6	563
RI_017	Rock Island 3a	67.5%	11.8%	1.4%	0.9%	0.9%	5.8%	8.9%	0.1%	0.5%	0.0%	10	535
RI_033	Rock Island 3b	66.8%	13.0%	1.8%	1.4%	0.6%	4.7%	9.3%	0.1%	0.6%	0.0%	19	7357
RI_038	Rock Island 3b	65.6%	7.1%	1.9%	1.8%	0.7%	10.7%	10.3%	0.1%	1.0%	0.0%	5	843
RI_049	Rock Island 4	67.7%	11.8%	1.9%	1.4%	0.9%	4.2%	10.0%	0.0%	0.7%	0.0%	3	745
RI_056	Rock Island 4	67.5%	11.4%	1.9%	1.3%	1.0%	5.1%	9.8%	0.0%	0.8%	0.0%	2	635
RI_057	Rock Island 4	66.0%	10.9%	2.1%	1.9%	0.7%	4.1%	11.9%	0.1%	1.1%	0.0%	4	1381
RI_064	Rock Island 4	65.2%	12.0%	2.2%	1.7%	0.7%	5.9%	9.4%	0.6%	0.8%	0.0%	88	4024
RI_065	Rock Island 4	64.7%	12.5%	2.1%	1.7%	0.7%	5.9%	9.6%	0.6%	0.7%	0.0%	44	3377
RI_066	Rock Island 4	65.0%	12.2%	2.1%	1.7%	0.7%	5.8%	9.5%	0.6%	0.8%	0.0%	70	4229
RI_067	Rock Island 4	65.7%	12.1%	2.1%	1.6%	0.7%	5.8%	9.2%	0.6%	0.7%	0.0%	43	3324
RI_068	Rock Island 4	65.3%	12.3%	2.1%	1.6%	0.7%	5.9%	9.4%	0.6%	0.7%	0.0%	54	3032
RI_072	Rock Island 4	64.9%	12.5%	2.0%	2.2%	0.7%	5.9%	9.2%	0.1%	0.8%	0.0%	8	4752
RI_074	Rock Island 4	66.6%	11.5%	1.8%	1.5%	0.8%	7.2%	8.8%	0.1%	0.8%	0.0%	54	408
RI_075	Rock Island 4	67.5%	10.7%	1.7%	1.5%	0.8%	7.5%	8.6%	0.1%	0.8%	0.0%	99	342

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
CM_22	20	0	133	5	331	12	24	425	561	70	766	16	753	27	2
CM_25	21	1	121	4	322	12	24	465	501	96	789	12	801	23	2
CM_49	13	1	124	5	312	13	24	292	456	73	401	16	512	27	2
CM_50	18	0	135	3	242	9	16	464	722	123	1088	18	745	26	2
DI_3	22	0	108	2	77	14	11	393	462	67	539	13	717	27	2
DI_4	12	0	104	2	47	11	8	529	664	84	1044	17	363	21	2
DI_49	23	0	92	3	139	18	18	385	734	83	799	14	820	44	3
DI_5	21	0	108	2	70	14	11	402	509	79	707	13	672	24	2
DI_6	21	0	107	2	69	13	10	406	505	74	661	13	687	23	2
DI_7	20	0	109	2	73	13	10	406	494	69	653	13	700	24	2
DI_8	21	0	106	2	73	13	11	401	507	67	676	13	726	27	2
M_01	22	0	96	2	81	13	9	463	712	79	730	14	667	30	2
M_04	21	0	95	3	87	17	14	562	756	62	1000	15	691	36	3
M_05	21	0	96	3	91	17	15	580	785	64	1021	15	721	37	3
M_06	20	0	94	3	67	14	14	567	553	61	980	12	1075	25	2
M_07	21	0	99	2	56	13	10	462	495	63	862	14	823	24	2
M_13	21	0	106	3	72	14	10	489	564	68	752	14	844	29	2
M_14	23	0	89	3	74	15	11	375	428	70	811	15	761	30	2
M_15	14	0	110	2	45	9	7	362	597	768	959	16	545	23	2
M_16	19	0	106	3	72	14	11	477	560	69	759	39	865	32	2
M_17	17	0	95	2	53	9	9	393	673	62	904	22	774	21	2
MA_02	15	1	93	3	516	12	16	442	880	154	1412	24	676	25	2
MA_04	15	1	138	3	304	10	11	453	625	759	1031	21	581	25	2
RI_017	16	0	121	2	89	8	6	133	484	261	1163	17	961	20	1
RI_033	21	1	108	2	245	11	9	497	564	60	835	13	671	24	2
RI_038	19	0	122	3	396	16	18	377	683	72	724	47	718	41	3
RI_049	14	0	128	2	282	13	14	125	371	85	651	20	677	32	2
RI_056	15	0	125	3	242	14	14	124	361	116	758	19	611	30	2
RI_057	13	1	91	3	368	19	18	138	479	75	1346	16	736	39	3
RI_064	18	1	100	2	178	10	10	191	469	134	918	22	500	22	2
RI_065	19	1	102	2	169	9	8	137	461	156	753	23	500	21	2
RI_066	19	1	101	2	173	9	8	163	474	149	832	23	499	22	2
RI_067	18	1	106	2	162	9	8	135	454	152	720	22	482	20	2
RI_068	19	1	107	2	162	9	8	131	515	195	657	22	524	21	2
RI_072	25	2	105	2	199	12	9	189	614	82	1341	22	569	27	2
RI_074	20	1	127	2	214	12	10	484	587	95	774	22	734	34	2
RI_075	20	0	133	2	206	12	9	469	551	90	723	27	721	33	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
CM_22	0	1005	0	73	3	6	1	0	4	3	474	5	0	2	3
CM_25	1	1598	0	79	3	6	1	0	0	3	466	5	0	4	3
CM_49	3	736	0	121	4	8	1	0	2	3	384	2	0	3	4
CM_50	1	272	0	91	3	6	1	0	0	3	764	12	0	9	3
DI_3	0	912	0	109	4	8	1	0	0	3	449	8	0	4	4
DI_4	1	186	0	76	4	7	1	0	0	3	863	13	0	6	3
DI_49	0	384	0	367	6	12	2	0	0	11	456	47	0	3	5
DI_5	1	815	0	121	4	8	1	0	0	3	462	9	0	3	3
DI_6	0	830	0	121	4	8	1	0	0	3	426	8	0	3	3
DI_7	0	916	0	128	4	8	1	0	0	3	460	9	0	3	3
DI_8	0	909	0	130	4	9	1	0	0	3	456	9	0	3	4
M_01	0	1702	0	86	4	8	1	0	0	3	636	2	0	5	4
M_04	0	995	0	115	5	11	1	0	0	5	878	10	0	7	4
M_05	1	1076	0	116	5	11	1	0	0	5	958	11	0	6	5
M_06	1	245	0	101	4	8	1	0	0	3	425	3	0	4	3
M_07	1	62	0	89	4	8	1	0	0	3	554	6	0	4	3
M_13	0	195	0	92	4	8	1	0	0	3	415	3	0	5	4
M_14	0	63	0	107	5	10	1	0	0	3	491	6	0	5	4
M_15	1	74	0	63	3	6	1	0	0	8	425	113	1	24	3
M_16	0	194	0	97	4	9	1	0	0	4	444	4	0	5	4
M_17	0	456	0	255	3	6	1	0	0	5	505	10	0	4	3
MA_02	1	344	0	95	4	7	1	0	5	4	570	3	0	10	3
MA_04	1	148	0	83	3	6	1	0	1	7	555	122	1	20	3
RI_017	1	222	0	11950	2	5	1	0	0	3	91	3	0	6	2
RI_033	0	158	0	82	4	7	1	0	0	3	613	2	0	1	3
RI_038	0	299	0	315	5	10	1	0	0	10	493	40	0	2	4
RI_049	1	52	0	3878	4	9	1	0	0	4	32	4	0	5	4
RI_056	0	48	0	2714	4	8	1	0	0	4	27	3	0	5	4
RI_057	1	101	0	1712	5	10	1	0	0	5	23	2	0	5	4
RI_064	0	1796	0	94	4	7	1	0	0	4	225	13	0	8	3
RI_065	0	1491	0	87	4	7	1	0	0	4	213	10	0	10	3
RI_066	0	1742	0	93	4	7	1	0	0	4	229	13	0	9	3
RI_067	0	1496	0	84	3	7	1	0	0	4	204	10	0	10	3
RI_068	0	1501	0	91	3	7	1	0	0	4	174	11	0	10	3
RI_072	6	1515	0	88	4	8	1	0	0	5	235	137	1	15	4
RI_074	27	318	0	87	4	9	1	0	0	3	886	3	0	2	4
RI_075	25	331	0	90	4	8	1	0	0	3	849	2	0	2	4

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
CM_22	1	0	1	0	0	0	0	0	0	0	1	1
CM_25	1	0	1	0	0	0	0	0	0	0	1	1
CM_49	1	0	1	0	1	0	0	0	0	0	1	1
CM_50	1	0	1	0	1	0	0	0	0	0	1	1
DI_3	1	0	1	0	1	0	0	0	0	0	1	1
DI_4	1	0	1	0	1	0	0	0	0	0	1	1
DI_49	1	0	2	0	2	0	1	0	1	0	1	2
DI_5	1	0	1	0	1	0	0	0	0	0	1	1
DI_6	1	0	1	0	1	0	0	0	0	0	1	1
DI_7	1	0	1	0	1	0	0	0	0	0	1	1
DI_8	1	0	1	0	1	0	0	0	0	0	1	1
M_01	1	0	1	0	1	0	0	0	0	0	1	1
M_04	1	0	1	0	1	0	0	0	0	0	1	1
M_05	1	0	1	0	1	0	0	0	0	0	1	2
M_06	1	0	1	0	1	0	0	0	0	0	1	1
M_07	1	0	1	0	1	0	0	0	0	0	1	1
M_13	1	0	1	0	1	0	0	0	0	0	1	1
M_14	1	0	1	0	1	0	0	0	0	0	1	1
M_15	1	0	1	0	2	0	1	0	1	0	1	1
M_16	1	0	1	0	1	0	0	0	0	0	1	1
M_17	1	0	1	0	1	0	1	0	0	0	1	1
MA_02	1	0	1	0	1	0	0	0	0	0	1	1
MA_04	1	0	1	0	2	0	1	0	1	0	1	1
RI_017	0	0	0	0	1	0	0	0	0	0	1	1
RI_033	1	0	1	0	0	0	0	0	0	0	1	1
RI_038	1	0	2	0	2	0	1	0	1	0	1	2
RI_049	1	0	1	0	1	0	0	0	0	0	1	1
RI_056	1	0	1	0	1	0	0	0	0	0	1	1
RI_057	1	0	1	0	1	0	0	0	0	0	1	1
RI_064	1	0	1	0	1	0	0	0	0	0	1	1
RI_065	1	0	1	0	1	0	0	0	0	0	1	1
RI_066	1	0	1	0	1	0	0	0	0	0	1	1
RI_067	1	0	1	0	1	0	0	0	0	0	1	1
RI_068	1	0	1	0	1	0	0	0	0	0	1	1
RI_072	1	0	1	0	1	0	0	0	1	0	1	1
RI_074	1	0	1	0	1	0	0	0	0	0	1	1
RI_075	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
RI_076	Rock Island 4	67.8%	11.9%	1.7%	1.5%	0.8%	5.7%	8.7%	0.1%	0.8%	0.0%	42	404
RI_077	Rock Island 4	67.6%	10.8%	1.8%	1.5%	0.7%	7.3%	8.8%	0.1%	0.8%	0.0%	22	283
RI_078	Rock Island 4	68.1%	11.6%	1.8%	1.6%	0.7%	5.6%	8.8%	0.1%	0.8%	0.0%	10	317
RI_079	Rock Island 4	67.7%	12.5%	1.5%	1.6%	0.7%	4.3%	8.8%	0.3%	0.9%	0.0%	6	2935
RI_080	Rock Island 4	67.6%	12.6%	1.6%	1.6%	0.7%	4.4%	8.7%	0.3%	0.9%	0.0%	6	3109
RI_081	Rock Island 4	67.2%	12.9%	1.6%	1.7%	0.7%	4.4%	8.6%	0.3%	1.0%	0.0%	7	4046
RI_082	Rock Island 4	69.0%	12.8%	1.4%	1.0%	0.6%	5.2%	7.6%	0.3%	0.6%	0.0%	69	3820
RI_083	Rock Island 4	68.5%	12.6%	1.4%	1.1%	0.6%	5.4%	8.0%	0.2%	0.6%	0.0%	65	3583
RI_084	Rock Island 4	68.7%	12.9%	1.4%	1.0%	0.7%	5.0%	8.7%	0.0%	0.4%	0.0%	1	361
RI_085	Rock Island 4	67.3%	13.2%	1.5%	1.2%	0.7%	5.0%	9.2%	0.1%	0.6%	0.0%	3	2376
RI_086	Rock Island 4	68.4%	13.4%	1.5%	1.0%	0.7%	5.0%	8.4%	0.0%	0.4%	0.0%	1	293
RI_087	Rock Island 4	67.4%	13.5%	1.5%	1.2%	0.7%	5.0%	8.7%	0.1%	0.5%	0.0%	4	2203
RI_088	Rock Island 4	67.8%	13.5%	1.5%	1.1%	0.7%	4.9%	8.9%	0.1%	0.5%	0.0%	3	759
RI_116	Rock Island 3b	64.8%	13.5%	1.5%	1.2%	0.8%	5.7%	10.6%	0.2%	0.6%	0.0%	11	344
SJ_01	Fort St. Joseph	65.4%	11.8%	1.8%	1.5%	0.7%	6.0%	11.0%	0.2%	0.6%	0.0%	2	77
SJ_02	Fort St. Joseph	65.7%	11.6%	1.7%	1.4%	0.7%	6.1%	10.9%	0.2%	0.5%	0.0%	2	84
SJ_03	Fort St. Joseph	65.3%	11.7%	1.8%	1.5%	0.7%	6.1%	11.1%	0.2%	0.5%	0.0%	2	86
SJ_04	Fort St. Joseph	66.6%	11.5%	1.8%	1.5%	1.0%	5.4%	9.9%	0.3%	0.5%	0.0%	14	1951
SJ_05	Fort St. Joseph	65.3%	11.5%	1.6%	1.1%	0.7%	8.2%	9.5%	0.3%	0.5%	0.0%	73	2066
SJ_06	Fort St. Joseph	64.2%	14.3%	2.2%	1.6%	0.5%	5.8%	9.7%	0.0%	0.5%	0.1%	5	83
SJ_07	Fort St. Joseph	67.6%	11.7%	1.6%	1.5%	0.7%	5.1%	9.1%	0.2%	0.6%	0.0%	35	4287
SJ_08	Fort St. Joseph	66.9%	11.0%	1.8%	1.6%	0.9%	5.5%	9.6%	0.5%	0.6%	0.0%	16	2450
SJ_09	Fort St. Joseph	66.0%	11.4%	1.9%	1.8%	0.7%	4.9%	11.4%	0.1%	0.6%	0.0%	4	435
SJ_10	Fort St. Joseph	65.9%	13.4%	1.9%	1.1%	0.8%	4.4%	10.3%	0.1%	0.5%	0.0%	8	2208
SJ_12	Fort St. Joseph	67.9%	12.7%	1.6%	1.7%	0.7%	4.7%	8.9%	0.1%	0.7%	0.0%	2	34
SJ_16	Fort St. Joseph	68.2%	12.6%	1.6%	1.7%	0.6%	4.7%	8.8%	0.1%	0.5%	0.0%	3	31
SJ_18	Fort St. Joseph	67.9%	11.5%	1.9%	1.6%	0.7%	4.9%	10.4%	0.3%	0.6%	0.0%	9	500
SJ_19	Fort St. Joseph	67.3%	11.3%	1.7%	1.4%	0.7%	6.1%	10.9%	0.1%	0.5%	0.0%	5	82
SJ_22	Fort St. Joseph	69.7%	13.1%	1.5%	1.2%	0.7%	4.1%	9.0%	0.0%	0.5%	0.0%	3	372
SL_11_1	Fort St. Louis	70.9%	10.0%	1.5%	1.2%	0.9%	4.3%	9.4%	0.1%	0.7%	0.0%	10	7272
	Subgroup: Med P (n=27)												
DI_18	Doty Island Village	69.8%	11.5%	1.4%	0.9%	1.5%	5.4%	7.9%	0.1%	0.5%	0.0%	4	1296
DI_19	Doty Island Village	68.6%	10.9%	1.5%	1.3%	1.5%	5.6%	9.0%	0.1%	0.7%	0.0%	6	423
DI_20	Doty Island Village	69.0%	11.4%	1.5%	1.2%	1.5%	4.6%	9.2%	0.1%	0.6%	0.0%	2	239
DI_21	Doty Island Village	69.6%	12.3%	1.3%	1.1%	1.4%	5.1%	7.6%	0.1%	0.6%	0.0%	4	898

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
RI_076	20	0	138	2	207	12	9	430	503	99	630	15	704	32	2
RI_077	19	1	115	2	210	12	10	459	563	92	698	22	725	33	2
RI_078	17	1	115	2	212	12	9	424	501	67	577	14	757	35	2
RI_079	18	0	90	3	105	15	13	322	802	106	637	16	730	37	3
RI_080	17	0	93	3	105	15	12	307	766	98	627	15	739	39	3
RI_081	18	0	92	3	106	15	12	318	815	97	664	16	758	40	3
RI_082	19	0	87	2	51	7	6	510	872	84	843	16	665	21	1
RI_083	20	0	88	2	49	7	6	518	879	90	828	16	632	19	1
RI_084	22	0	104	2	44	7	6	576	885	74	751	12	751	16	1
RI_085	22	0	96	2	58	9	7	492	766	70	912	14	767	22	2
RI_086	22	0	102	2	45	7	5	549	845	65	743	12	811	19	1
RI_087	21	0	103	2	55	9	6	473	735	74	904	14	802	21	1
RI_088	23	0	109	2	48	8	12	512	793	75	775	13	801	19	1
RI_116	15	0	99	2	77	8	5	416	463	66	749	23	784	19	1
SJ_01	20	0	127	4	312	14	23	420	424	59	712	14	892	26	2
SJ_02	20	0	119	4	313	14	21	432	435	59	736	14	907	26	2
SJ_03	21	0	117	4	318	14	20	530	535	61	878	14	1006	27	2
SJ_04	18	0	130	4	393	13	22	418	487	63	682	12	751	27	2
SJ_05	19	0	106	4	232	8	17	531	861	81	984	31	807	23	1
SJ_06	23	0	110	3	366	12	16	652	753	61	1099	18	776	30	2
SJ_07	21	0	108	4	346	13	20	483	516	97	884	14	929	27	2
SJ_08	18	0	126	4	388	14	21	327	403	60	622	13	805	28	2
SJ_09	20	0	119	5	589	17	29	403	714	71	863	14	935	47	3
SJ_10	13	0	122	4	262	11	19	346	454	62	468	13	655	22	2
SJ_12	18	0	120	4	425	15	20	254	386	64	448	17	857	36	3
SJ_16	17	0	108	5	431	15	23	284	425	58	445	15	855	36	3
SJ_18	20	0	141	4	405	15	19	522	574	66	673	13	885	31	2
SJ_19	18	0	127	4	347	13	22	422	524	59	585	16	907	25	2
SJ_22	14	0	114	4	427	13	23	503	600	58	756	13	556	18	2
SL_11_1	12	1	105	2	209	10	0	113	682	77	982	15	456	63	2
	Subgroup: Med P (n=27)														
DI_18	17	0	78	2	48	8	6	1035	747	268	1390	12	760	18	1
DI_19	17	0	85	3	80	12	12	419	520	72	660	17	870	25	2
DI_20	14	0	89	2	58	11	9	430	660	63	723	17	676	19	2
DI_21	22	0	78	2	66	10	11	407	771	82	716	17	604	21	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
RI_076	5	424	0	82	4	8	1	0	0	3	769	2	0	2	3
RI_077	12	293	0	78	4	8	1	0	0	3	759	2	0	2	3
RI_078	3	395	0	83	4	8	1	0	0	3	767	2	0	2	4
RI_079	0	1034	0	299	5	9	1	0	0	14	366	44	0	2	4
RI_080	0	1035	0	300	5	10	1	0	0	14	389	46	0	2	4
RI_081	0	1075	0	322	5	10	1	0	0	15	431	52	0	3	5
RI_082	1	503	0	80	3	5	1	0	0	2	579	2	0	5	2
RI_083	1	438	0	72	2	5	1	0	0	2	547	2	0	4	2
RI_084	0	69	0	60	2	5	1	0	0	2	770	2	0	2	2
RI_085	0	210	0	71	3	6	1	0	0	2	703	2	0	2	3
RI_086	0	82	0	65	3	5	1	0	0	2	836	2	0	2	2
RI_087	0	188	0	72	3	6	1	0	0	2	717	2	0	2	3
RI_088	0	123	0	69	3	6	1	0	0	2	830	2	0	2	2
RI_116	0	482	0	169	3	6	1	0	0	3	337	2	0	3	2
SJ_01	1	106	0	98	4	7	1	0	0	3	497	5	0	4	3
SJ_02	1	90	0	99	4	7	1	0	0	3	492	5	0	4	3
SJ_03	1	95	0	109	4	7	1	0	0	3	620	6	0	4	3
SJ_04	0	1164	0	136	4	7	1	0	0	3	429	7	0	3	3
SJ_05	1	679	0	95	3	5	1	0	0	2	676	2	0	5	2
SJ_06	0	19	0	95	4	8	1	0	0	3	969	9	0	5	4
SJ_07	0	2068	0	105	4	8	1	0	0	3	658	7	0	4	4
SJ_08	1	1929	0	165	4	8	1	0	0	3	412	8	1	3	4
SJ_09	0	487	0	405	6	11	1	0	0	12	550	44	0	3	5
SJ_10	0	485	0	62	3	6	1	0	0	2	508	3	0	2	3
SJ_12	1	97	0	96	5	11	1	0	1	4	464	2	1	3	5
SJ_16	0	58	0	95	5	11	1	0	0	4	479	2	0	1	5
SJ_18	0	223	0	84	3	6	1	0	0	3	335	2	0	4	3
SJ_19	0	108	0	71	3	5	1	0	0	3	417	3	0	3	3
SJ_22	0	198	0	157	2	4	1	0	0	3	371	2	0	2	2
SL_11_1	0	464	0	145	5	10	1	0	0	4	303	3	0	5	5
	Subgroup: Med P (n=27)														
DI_18	2	103	0	78	3	5	1	0	0	5	394	43	0	12	2
DI_19	0	106	0	91	4	8	1	0	0	3	428	4	0	4	3
DI_20	0	39	0	68	3	6	1	0	0	3	556	3	0	4	3
DI_21	0	85	0	61	3	5	1	0	0	2	344	4	0	3	2

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
RI_076	1	0	1	0	1	0	0	0	0	0	1	1
RI_077	1	0	1	0	1	0	0	0	0	0	1	1
RI_078	1	0	1	0	1	0	0	0	0	0	1	1
RI_079	1	0	2	0	3	0	1	0	1	0	1	1
RI_080	1	0	2	0	3	1	1	0	1	0	1	1
RI_081	1	0	2	0	3	1	2	0	1	0	1	2
RI_082	1	0	0	0	0	0	0	0	0	0	1	1
RI_083	0	0	0	0	0	0	0	0	0	0	0	1
RI_084	0	0	0	0	0	0	0	0	0	0	0	1
RI_085	1	0	0	0	0	0	0	0	0	0	1	1
RI_086	0	0	0	0	0	0	0	0	0	0	1	1
RI_087	1	0	0	0	0	0	0	0	0	0	1	1
RI_088	0	0	0	0	0	0	0	0	0	0	1	1
RI_116	1	0	0	0	0	0	0	0	0	0	0	1
SJ_01	1	0	1	0	1	0	0	0	0	0	1	1
SJ_02	1	0	1	0	1	0	0	0	0	0	1	1
SJ_03	1	0	1	0	1	0	0	0	0	0	1	1
SJ_04	1	0	1	0	1	0	0	0	0	0	1	1
SJ_05	0	0	1	0	0	0	0	0	0	0	1	1
SJ_06	1	0	1	0	1	0	0	0	0	0	1	1
SJ_07	1	0	1	0	1	0	0	0	0	0	1	1
SJ_08	1	0	1	0	1	0	1	0	1	0	1	1
SJ_09	2	0	2	0	3	0	1	0	1	0	1	2
SJ_10	1	0	1	0	0	0	0	0	0	0	1	1
SJ_12	2	0	1	0	1	0	1	0	1	0	1	2
SJ_16	1	0	1	0	1	0	0	0	0	0	1	2
SJ_18	1	0	0	0	0	0	0	0	0	0	1	1
SJ_19	0	0	0	0	0	0	0	0	0	0	1	1
SJ_22	0	0	0	0	0	0	0	0	0	0	0	1
SL_11_1	1	0	1	0	1	0	0	0	0	0	2	1
	Subgroup: Med P (n=27)											
DI_18	1	0	1	0	1	0	1	0	0	0	0	1
DI_19	1	0	1	0	1	0	0	0	0	0	1	1
DI_20	1	0	0	0	0	0	0	0	0	0	0	1
DI_21	1	0	0	0	0	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
DI_23	Doty Island Village	66.6%	12.8%	1.5%	1.0%	1.4%	6.2%	8.6%	0.2%	0.6%	0.0%	17	2593
DI_24	Doty Island Village	68.0%	11.3%	1.7%	1.1%	1.6%	5.7%	9.0%	0.1%	0.6%	0.0%	3	862
DI_25	Doty Island Village	66.7%	11.7%	1.8%	1.4%	1.6%	5.7%	9.5%	0.1%	0.7%	0.0%	3	351
DI_26	Doty Island Village	67.4%	11.1%	1.7%	1.8%	1.4%	4.9%	9.8%	0.2%	0.8%	0.0%	5	425
DI_27	Doty Island Village	66.9%	11.6%	1.5%	1.3%	1.6%	5.8%	9.7%	0.1%	0.6%	0.0%	3	191
DI_28	Doty Island Village	66.5%	12.1%	1.7%	1.3%	1.5%	5.4%	9.7%	0.2%	0.6%	0.0%	6	425
DI_29	Doty Island Village	65.6%	10.9%	2.6%	1.5%	2.4%	4.7%	10.0%	0.3%	0.8%	0.0%	11	2378
DI_30	Doty Island Village	67.2%	12.0%	1.7%	1.1%	1.9%	4.8%	9.9%	0.1%	0.5%	0.0%	5	177
DI_31	Doty Island Village	67.0%	11.3%	1.8%	1.6%	1.9%	5.0%	9.0%	0.2%	0.8%	0.0%	19	2959
DI_33	Doty Island Village	66.4%	13.1%	1.6%	1.4%	1.8%	5.1%	8.7%	0.2%	0.7%	0.0%	6	1379
DI_34	Doty Island Village	66.8%	11.6%	1.8%	1.4%	2.0%	5.1%	8.7%	0.3%	0.7%	0.0%	22	4280
DI_35	Doty Island Village	67.0%	11.7%	1.8%	1.5%	2.0%	5.0%	8.6%	0.2%	0.8%	0.0%	21	3319
DI_36	Doty Island Village	67.4%	11.3%	1.7%	1.5%	1.9%	5.1%	8.8%	0.2%	0.8%	0.0%	20	3108
DI_37	Doty Island Village	66.2%	12.8%	1.6%	1.4%	1.9%	5.2%	9.0%	0.2%	0.7%	0.0%	4	1191
DI_38	Doty Island Village	66.2%	11.9%	1.7%	1.5%	1.4%	5.8%	9.8%	0.2%	0.6%	0.0%	2	161
DI_39	Doty Island Village	66.2%	12.3%	1.6%	1.1%	1.8%	5.1%	10.3%	0.1%	0.6%	0.0%	2	451
DI_41	Doty Island Village	67.6%	11.7%	1.6%	1.1%	1.5%	4.7%	10.2%	0.1%	0.6%	0.0%	3	110
DI_42	Doty Island Village	67.1%	11.9%	1.5%	1.2%	1.7%	5.8%	9.3%	0.1%	0.6%	0.0%	3	229
DI_43	Doty Island Village	67.0%	11.6%	1.7%	1.8%	1.5%	4.9%	9.5%	0.2%	0.8%	0.0%	3	519
DI_44	Doty Island Village	64.9%	11.1%	1.8%	1.7%	1.8%	6.4%	10.7%	0.1%	0.8%	0.0%	3	1314
DI_45	Doty Island Village	65.8%	10.6%	1.8%	1.8%	1.4%	6.6%	9.9%	0.1%	1.0%	0.0%	4	828
DI_46	Doty Island Village	66.5%	12.0%	1.7%	1.2%	1.5%	4.8%	10.8%	0.1%	0.6%	0.0%	3	137
DI_48	Doty Island Village	64.4%	11.5%	2.2%	1.8%	1.9%	5.1%	10.1%	0.8%	1.0%	0.0%	13	889
	Subgroup: Sn + Pb												
GL_03	Goose Lake Outlet #3	64.8%	10.2%	2.8%	2.1%	0.1%	4.9%	9.3%	0.2%	0.6%	0.0%	7150	31081
	Subgroup: Sn > 350 ppm (n=13)												
DB_6	Hanson	67.5%	14.2%	2.5%	1.3%	0.2%	4.0%	7.6%	0.7%	0.8%	0.1%	556	1496
H_C61_1	Hanson	68.4%	14.1%	2.4%	1.3%	0.2%	3.9%	8.1%	0.7%	0.3%	0.1%	515	806
H_C62_1	Hanson	68.6%	13.6%	2.4%	1.3%	0.2%	4.0%	8.0%	0.7%	0.3%	0.1%	739	1126
H_C63_1	Hanson	68.9%	13.7%	2.4%	1.2%	0.2%	3.9%	7.9%	0.7%	0.3%	0.1%	827	1253
H_C64_1	Hanson	69.4%	13.3%	2.3%	1.3%	0.2%	3.8%	8.0%	0.7%	0.3%	0.1%	698	1006
H_C65_1	Hanson	67.6%	14.6%	2.5%	1.3%	0.2%	3.9%	8.2%	0.7%	0.2%	0.0%	563	903
H_C66_1	Hanson	67.5%	14.6%	2.5%	1.3%	0.2%	3.9%	8.3%	0.7%	0.2%	0.0%	581	919
H_C67_1	Hanson	67.3%	14.7%	2.5%	1.3%	0.2%	4.1%	8.2%	0.7%	0.3%	0.1%	649	970
FV_03	Farley Village	65.7%	11.9%	2.9%	1.6%	0.3%	7.6%	8.3%	0.3%	0.5%	0.0%	1520	1108

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
DI_23	21	0	86	2	57	7	6	489	905	102	974	15	771	24	1
DI_24	14	0	83	2	76	11	11	535	634	61	805	18	579	23	2
DI_25	17	0	93	2	96	14	15	395	559	71	655	20	751	29	2
DI_26	21	0	88	3	100	16	12	585	688	65	836	20	730	31	2
DI_27	19	0	98	2	73	12	9	322	661	63	660	17	803	23	2
DI_28	19	0	98	2	66	11	8	381	561	58	539	15	744	23	2
DI_29	19	0	110	2	81	13	12	379	522	64	489	16	738	26	2
DI_30	11	0	103	2	56	10	7	465	575	76	860	15	349	21	2
DI_31	20	0	102	2	92	13	10	401	458	60	531	12	701	25	2
DI_33	21	0	96	2	74	12	9	576	709	85	694	13	802	25	2
DI_34	21	0	103	2	86	12	10	400	495	68	626	13	718	24	2
DI_35	20	0	105	2	91	13	11	407	467	77	577	13	702	25	2
DI_36	21	0	104	2	91	14	11	400	445	71	502	12	677	24	2
DI_37	22	0	101	2	78	12	9	596	720	81	693	13	763	23	2
DI_38	22	0	93	2	74	14	9	426	450	59	648	14	838	26	2
DI_39	11	0	96	2	57	10	7	488	598	80	883	16	366	22	2
DI_41	15	0	93	2	56	11	9	461	717	78	716	16	668	17	1
DI_42	19	0	99	2	68	11	9	284	645	69	634	18	813	22	2
DI_43	22	0	91	3	99	15	12	515	614	68	755	18	723	33	3
DI_44	27	0	115	2	94	15	11	368	579	68	615	16	834	36	2
DI_45	23	0	104	3	130	17	17	393	728	94	804	18	827	42	3
DI_46	16	0	85	2	58	10	8	498	764	72	816	16	729	18	2
DI_48	20	0	94	2	116	15	13	154	479	80	749	26	602	48	2
	Subgroup: Sn + Pb														
GL_03	35	1	50	4	417	17	22	960	1738	183	7307	37	410	53	3
	Subgroup: Sn > 350 ppm (n=13)														
DB_6	29	1	63	2	403	11	10	297	806	213	2129	21	370	206	5
H_C61_1	26	1	61	2	502	11	10	300	832	206	2173	20	380	205	5
H_C62_1	25	1	64	2	505	11	11	335	925	219	2505	22	388	206	5
H_C63_1	24	1	63	2	479	11	9	344	974	228	2504	22	396	193	5
H_C64_1	26	1	62	2	490	11	8	314	858	205	2226	22	388	192	5
H_C65_1	32	1	66	2	510	11	8	378	872	173	2192	20	382	199	5
H_C66_1	29	1	61	2	506	11	8	305	878	173	2094	20	385	201	5
H_C67_1	27	1	59	2	511	11	8	320	912	174	2215	24	391	200	5
FV_03	42	1	84	4	377	14	22	252	1196	118	3084	46	281	47	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
DI_23	1	363	0	88	3	6	1	0	0	2	588	3	0	5	3
DI_24	0	125	0	70	4	7	1	0	0	3	474	4	0	4	3
DI_25	0	179	0	86	4	9	1	0	0	3	458	4	0	4	3
DI_26	0	220	0	88	5	10	1	0	0	4	507	3	0	4	4
DI_27	0	151	0	81	3	7	1	0	0	3	385	5	0	5	3
DI_28	0	98	0	87	3	7	1	0	0	3	394	2	0	3	3
DI_29	0	912	0	145	4	9	1	0	0	3	426	2	0	4	4
DI_30	1	193	0	83	3	7	1	0	0	3	693	11	0	5	3
DI_31	0	1020	0	114	4	8	1	0	0	3	406	8	0	3	3
DI_33	0	66	0	92	4	8	1	0	0	3	570	5	0	4	3
DI_34	0	918	0	130	4	8	1	0	0	3	405	9	0	3	3
DI_35	0	1053	0	121	4	9	1	0	0	3	458	9	0	3	4
DI_36	0	957	0	114	4	8	1	0	0	3	387	8	0	3	3
DI_37	0	60	0	94	4	8	1	0	0	3	536	5	0	3	3
DI_38	1	64	0	98	4	8	1	0	0	3	457	6	0	5	3
DI_39	1	187	0	82	4	7	1	0	0	3	732	11	0	5	3
DI_41	0	38	0	70	3	7	1	0	0	3	664	4	0	4	3
DI_42	0	129	0	84	3	7	1	0	0	3	383	6	0	5	3
DI_43	0	253	0	96	5	10	1	0	0	4	535	3	0	4	4
DI_44	0	72	0	102	5	10	1	0	0	3	501	2	0	4	4
DI_45	0	373	0	350	6	12	1	0	0	10	452	45	0	3	5
DI_46	0	41	0	70	4	7	1	0	0	3	725	4	0	4	3
DI_48	0	2362	0	251	6	11	1	0	0	5	130	4	0	4	5
	Subgroup: Sn + Pb														
GL_03	35	26	3	238	8	15	2	0	1	6	1855	28	4	24	7
	Subgroup: Sn > 350 ppm (n=13)														
DB_6	1	5	0	363	5	10	1	0	0	8	198	3	6	8	5
H_C61_1	1	5	0	325	4	9	1	0	0	8	144	2	5	8	5
H_C62_1	1	6	0	335	6	13	2	0	0	8	210	3	6	9	6
H_C63_1	1	6	0	352	5	10	1	0	0	7	195	3	6	9	5
H_C64_1	1	6	0	342	5	10	1	0	0	7	166	3	6	8	5
H_C65_1	1	5	0	307	4	9	1	0	0	8	166	3	5	8	5
H_C66_1	1	5	0	320	4	9	1	0	0	8	153	3	5	8	5
H_C67_1	1	5	0	334	4	9	1	0	0	7	174	3	5	9	5
FV_03	145	3	1	144	4	7	1	0	0	4	366	5	2	15	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
DI_23	1	0	0	0	0	0	0	0	0	0	1	1
DI_24	1	0	1	0	0	0	0	0	0	0	1	1
DI_25	1	0	1	0	1	0	0	0	0	0	1	1
DI_26	1	0	1	0	1	0	0	0	0	0	1	1
DI_27	1	0	0	0	0	0	0	0	0	0	1	1
DI_28	1	0	1	0	0	0	0	0	0	0	1	1
DI_29	1	0	1	0	1	0	0	0	0	0	1	1
DI_30	1	0	1	0	0	0	0	0	0	0	1	1
DI_31	1	0	1	0	1	0	0	0	0	0	1	1
DI_33	1	0	1	0	1	0	0	0	0	0	1	1
DI_34	1	0	1	0	1	0	0	0	0	0	1	1
DI_35	1	0	1	0	1	0	0	0	0	0	1	1
DI_36	1	0	1	0	1	0	0	0	0	0	1	1
DI_37	1	0	1	0	0	0	0	0	0	0	1	1
DI_38	1	0	1	0	1	0	0	0	0	0	1	1
DI_39	1	0	1	0	1	0	0	0	0	0	1	1
DI_41	1	0	1	0	0	0	0	0	0	0	0	1
DI_42	1	0	1	0	0	0	0	0	0	0	1	1
DI_43	1	0	1	0	1	0	0	0	0	0	1	2
DI_44	1	0	1	0	1	0	0	0	0	0	1	1
DI_45	1	0	2	0	2	0	1	0	1	0	1	2
DI_46	1	0	1	0	1	0	0	0	0	0	0	1
DI_48	1	0	1	0	1	0	0	0	0	0	1	2
	Subgroup: Sn + Pb											
GL_03	1	0	1	0	1	0	1	0	1	0	2	2
	Subgroup: Sn > 350 ppm (n=13)											
DB_6	1	0	1	0	1	0	1	0	1	0	6	3
H_C61_1	1	0	1	0	1	0	1	0	1	0	5	2
H_C62_1	1	0	1	0	1	0	1	0	1	0	6	2
H_C63_1	1	0	1	0	1	0	1	0	1	0	6	2
H_C64_1	1	0	1	0	1	0	1	0	1	0	5	2
H_C65_1	1	0	1	0	1	0	1	0	1	0	5	2
H_C66_1	1	0	1	0	1	0	1	0	1	0	5	2
H_C67_1	1	0	1	0	1	0	1	0	1	0	5	2
FV_03	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
GL_02	Goose Lake Outlet #3	62.7%	15.1%	3.3%	1.4%	0.3%	3.7%	10.1%	0.5%	0.6%	0.1%	7070	6097
RB_11	Red Banks	65.4%	12.7%	2.6%	1.9%	0.2%	6.2%	8.6%	0.1%	1.0%	0.1%	2267	4263
RB_17	Red Banks	62.9%	11.3%	2.9%	1.9%	0.3%	9.1%	8.8%	0.3%	1.0%	0.1%	2622	6988
RB_18	Red Banks	63.2%	11.7%	2.8%	1.7%	0.2%	8.4%	8.9%	0.2%	1.1%	0.1%	2395	7763
	Subgroup: High Na												
MM_058	Marquette Mission	66.3%	19.6%	2.1%	3.5%	0.2%	0.9%	5.3%	0.5%	0.8%	0.0%	646	886
	Subgroup: High Pb												
DI_22	Doty Island Village	62.8%	15.7%	3.1%	1.5%	0.5%	1.2%	8.7%	0.6%	0.8%	0.1%	162	35570
	Subgroup: Med Pb +Sb (n=5)												
IV_13	Iliniwek Village	63.9%	16.7%	2.9%	1.6%	0.2%	1.0%	9.7%	0.8%	0.5%	0.1%	202	18611
IV_21	Iliniwek Village	63.8%	16.4%	2.8%	1.6%	0.2%	1.0%	9.8%	0.8%	0.5%	0.1%	231	21496
ML_02_1	Milford	65.1%	15.7%	3.3%	1.6%	0.2%	1.2%	7.8%	0.9%	0.8%	0.1%	218	20372
ML_05_1	Milford	65.7%	15.3%	3.2%	1.5%	0.2%	1.2%	8.0%	0.8%	0.9%	0.1%	204	18435
MM_044	Marquette Mission	65.4%	17.1%	2.9%	1.7%	0.2%	0.9%	8.3%	0.8%	0.3%	0.1%	245	14621
	5.2.2 Cobalt-colored, antimony opacified blue small beads (IIa46/47)												
	Subgroup: Mg-low-P (n=55)												
BL_27_1	La Belle Shipwreck	65.6%	17.2%	2.5%	0.8%	0.2%	2.4%	8.0%	0.8%	0.4%	0.0%	11	359
BL_52_1	La Belle Shipwreck	66.0%	12.9%	3.6%	1.1%	0.2%	2.2%	11.5%	0.1%	0.5%	0.0%	62	247
BL_53_1	La Belle Shipwreck	65.4%	12.0%	3.9%	1.5%	0.3%	2.4%	11.4%	0.2%	0.8%	0.0%	34	458
BL_54_1	La Belle Shipwreck	65.6%	13.2%	3.6%	1.1%	0.2%	2.2%	11.5%	0.1%	0.5%	0.0%	22	265
BL_55_1	La Belle Shipwreck	64.5%	12.2%	4.0%	1.5%	0.3%	2.6%	11.7%	0.2%	0.8%	0.0%	20	483
CHK_3_1	Chickadee	63.8%	10.9%	3.5%	1.3%	0.3%	5.7%	10.1%	0.2%	0.6%	0.1%	32	808
CHK_5_1	Chickadee	64.4%	13.3%	3.5%	1.3%	0.3%	2.4%	10.5%	0.2%	0.6%	0.1%	32	830
DI_15	Doty Island Village	63.3%	11.3%	3.1%	1.2%	0.2%	4.2%	9.6%	0.1%	0.6%	0.1%	11	6024
GG_12_1	Gillett Grove	63.3%	14.4%	3.6%	1.4%	0.3%	2.7%	9.5%	0.2%	0.7%	0.1%	39	842
IV_48	Iliniwek Village	64.8%	12.6%	3.6%	2.0%	0.3%	2.2%	11.6%	0.1%	0.5%	0.0%	8	747
IV_49	Iliniwek Village	64.5%	12.7%	3.6%	2.0%	0.3%	2.3%	11.8%	0.1%	0.5%	0.0%	9	752
IV_50	Iliniwek Village	64.5%	12.7%	3.6%	2.0%	0.3%	2.2%	11.7%	0.1%	0.5%	0.0%	9	771
IV_51	Iliniwek Village	64.6%	12.6%	3.6%	2.0%	0.3%	2.1%	11.8%	0.1%	0.5%	0.0%	8	748
IV_53	Iliniwek Village	64.3%	12.9%	3.7%	2.0%	0.3%	2.2%	11.7%	0.1%	0.6%	0.0%	10	776
IV_54	Iliniwek Village	64.2%	13.0%	3.7%	2.0%	0.3%	2.1%	11.7%	0.1%	0.6%	0.0%	9	874
IV_55	Iliniwek Village	64.5%	12.9%	3.7%	2.0%	0.3%	2.1%	11.6%	0.1%	0.5%	0.0%	9	770

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
GL_02	19	1	93	4	461	11	22	294	780	123	2648	20	568	101	3
RB_11	21	1	52	2	120	12	10	542	1807	78	2444	36	382	38	2
RB_17	38	1	51	2	138	13	12	288	1942	127	3526	50	504	57	2
RB_18	34	1	47	2	126	12	10	350	1371	120	3430	46	505	53	2
	Subgroup: High Na														
MM_058	14	2	98	4	817	18	26	374	1347	100	766	10	248	43	4
	Subgroup: High Pb														
DI_22	14	0	63	2	69	9	9	169	652	55	568	12	507	21	1
	Subgroup: Med Pb +Sb (n=5)														
IV_13	12	1	82	4	290	10	21	169	765	38	793	8	414	22	1
IV_21	12	1	76	4	295	10	20	175	772	40	812	11	447	24	2
ML_02_1	12	1	83	2	125	9	7	126	459	35	460	12	506	22	2
ML_05_1	12	1	82	1	116	8	7	133	494	34	497	11	464	21	1
MM_044	16	1	72	2	297	9	10	164	713	38	721	9	415	22	1
	5.2.2 Cobalt-colored, antimony opacified blue small beads (IIa46/47)														
	Subgroup: Mg-low-P (n=55)														
BL_27_1	10	0	91	2	102	8	10	164	166	33	432	11	599	10	1
BL_52_1	9	0	89	2	155	7	0	150	423	37	810	9	618	14	1
BL_53_1	8	0	96	3	275	10	1	110	447	50	747	11	451	29	2
BL_54_1	9	0	95	2	153	7	0	141	485	34	884	9	620	13	1
BL_55_1	9	0	94	3	278	10	0	110	458	42	767	11	462	29	2
CHK_3_1	12	0	86	2	265	8	9	300	793	59	1423	28	589	14	1
CHK_5_1	14	1	90	2	261	9	8	334	866	57	1565	14	608	14	1
DI_15	19	0	48	2	55	8	6	262	561	59	1116	24	674	25	1
GG_12_1	17	1	90	1	101	9	6	337	894	60	1642	15	630	17	1
IV_48	10	1	97	4	299	10	20	189	895	48	1198	15	638	29	2
IV_49	9	1	98	4	298	10	20	189	895	47	1144	16	626	28	2
IV_50	10	1	93	4	299	10	21	187	882	46	1153	15	629	28	2
IV_51	10	1	97	4	300	10	20	189	888	45	1194	14	633	29	2
IV_53	10	1	100	3	300	10	19	199	863	51	1136	16	636	30	2
IV_54	10	1	102	3	311	11	20	192	870	47	1144	15	651	30	2
IV_55	10	1	95	3	297	10	19	186	861	48	1104	17	644	29	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
GL_02	0	9	0	214	4	8	1	0	0	5	329	4	5	15	4
RB_11	5	2	1	174	6	12	1	0	0	5	706	10	1	25	5
RB_17	10	7	1	232	7	13	2	0	0	6	537	3	5	15	6
RB_18	9	7	1	188	6	12	2	0	0	5	475	6	3	18	5
	Subgroup: High Na														
MM_058	0	208	0	35	6	11	1	0	1	7	968	9	0	2	5
	Subgroup: High Pb														
DI_22	1	883	0	101	3	7	1	0	0	3	88	1	0	13	3
	Subgroup: Med Pb +Sb (n=5)														
IV_13	0	1412	0	98	3	6	1	0	1	3	104	1	0	14	3
IV_21	0	1602	0	116	4	7	1	0	0	4	124	1	0	16	3
ML_02_1	1	1236	0	100	4	7	1	0	0	4	68	1	0	10	3
ML_05_1	0	1181	0	96	3	6	1	0	0	3	75	1	0	11	3
MM_044	1	1205	0	35	3	6	1	0	2	3	117	1	0	14	3
	5.2.2 Cobalt-colored, antimony opacified blue small beads (IIa46/47)														
	Subgroup: Mg-low-P (n=55)														
BL_27_1	0	6513	0	93	2	4	0	0	0	2	119	8	0	1	2
BL_52_1	0	10841	0	80	2	4	0	0	0	3	138	1	0	2	2
BL_53_1	0	12752	0	69	3	5	1	0	0	3	72	1	0	4	2
BL_54_1	0	11634	0	80	2	4	0	0	0	3	110	1	0	2	2
BL_55_1	0	14297	0	70	3	6	1	0	0	3	77	1	0	4	3
CHK_3_1	0	19487	0	99	3	5	1	0	0	3	270	6	0	19	2
CHK_5_1	1	18868	0	95	3	5	1	0	0	3	304	7	0	20	2
DI_15	1	19974	1	87	4	8	1	0	0	3	844	1	0	13	3
GG_12_1	1	18162	0	81	3	5	1	0	0	3	339	9	0	21	3
IV_48	0	12698	0	122	4	7	1	0	0	4	447	3	0	7	3
IV_49	0	11617	0	122	4	7	1	0	0	4	434	3	0	7	3
IV_50	0	13193	0	121	4	7	1	0	0	4	452	3	0	7	3
IV_51	0	13173	0	121	4	7	1	0	0	4	464	3	0	7	4
IV_53	0	12564	0	127	4	7	1	0	0	4	466	3	0	7	4
IV_54	0	12365	0	131	4	8	1	0	0	5	468	3	0	7	4
IV_55	0	11843	0	132	4	8	1	0	0	4	458	3	0	7	4

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
GL_02	1	0	1	0	1	0	1	0	1	0	3	1
RB_11	1	0	1	0	1	0	0	0	0	0	1	2
RB_17	1	0	1	0	1	0	1	0	1	0	2	2
RB_18	1	0	1	0	1	0	0	0	1	0	2	2
	Subgroup: High Na											
MM_058	1	0	1	0	2	0	1	0	1	0	1	2
	Subgroup: High Pb											
DI_22	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: Med Pb +Sb (n=5)											
IV_13	1	0	1	0	1	0	0	0	1	0	1	1
IV_21	1	0	1	0	1	0	0	0	0	0	1	1
ML_02_1	1	0	1	0	1	0	0	0	0	0	1	1
ML_05_1	1	0	1	0	1	0	0	0	0	0	1	1
MM_044	1	0	1	0	1	0	1	0	1	0	1	1
	5.2.2 Cobalt-colored, antimony opacified blue small beads (IIa46/47)											
	Subgroup: Mg-low-P (n=55)											
BL_27_1	0	0	0	0	0	0	0	0	0	0	0	1
BL_52_1	0	0	0	0	0	0	0	0	0	0	0	0
BL_53_1	1	0	0	0	0	0	0	0	0	0	1	1
BL_54_1	0	0	0	0	0	0	0	0	0	0	0	0
BL_55_1	1	0	1	0	0	0	0	0	0	0	1	1
CHK_3_1	0	0	0	0	0	0	0	0	0	0	0	1
CHK_5_1	0	0	0	0	1	0	0	0	0	0	0	1
DI_15	1	0	1	0	1	0	0	0	0	0	1	1
GG_12_1	1	0	1	0	1	0	0	0	0	0	0	1
IV_48	1	0	1	0	1	0	0	0	0	0	1	1
IV_49	1	0	1	0	1	0	0	0	0	0	1	1
IV_50	1	0	1	0	1	0	0	0	0	0	1	1
IV_51	1	0	1	0	1	0	0	0	0	0	1	1
IV_53	1	0	1	0	1	0	0	0	0	0	1	1
IV_54	1	0	1	0	1	0	0	0	0	0	1	1
IV_55	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
IV_63	Iliniwek Village	63.7%	14.8%	3.1%	1.7%	0.3%	2.1%	9.7%	0.2%	0.5%	0.0%	32	1155
IV_64	Iliniwek Village	62.8%	14.9%	3.6%	1.2%	0.3%	2.7%	9.7%	0.2%	0.5%	0.0%	8	1029
IV_65	Iliniwek Village	62.5%	14.6%	3.5%	1.4%	0.3%	2.6%	11.0%	0.2%	0.5%	0.1%	32	735
IV_66	Iliniwek Village	64.8%	15.2%	3.2%	1.5%	0.3%	2.1%	9.9%	0.2%	0.5%	0.0%	8	338
IV_67	Iliniwek Village	64.3%	12.9%	3.4%	1.2%	0.4%	2.2%	11.2%	0.1%	0.5%	0.0%	4	400
IV_68	Iliniwek Village	63.4%	15.2%	3.3%	1.0%	0.3%	2.4%	9.6%	0.2%	0.4%	0.0%	7	754
IV_69	Iliniwek Village	64.3%	12.7%	3.7%	2.0%	0.3%	2.3%	11.3%	0.1%	0.5%	0.0%	8	585
IV_70	Iliniwek Village	61.4%	14.5%	4.1%	2.3%	0.3%	2.0%	12.2%	0.1%	0.6%	0.0%	6	380
MM_037	Marquette Mission	65.6%	12.3%	3.4%	2.0%	0.3%	2.0%	11.3%	0.3%	0.4%	0.0%	16	549
MM_038	Marquette Mission	64.9%	14.1%	3.4%	1.3%	0.3%	2.4%	8.7%	0.2%	0.4%	0.1%	9	723
MM_039	Marquette Mission	64.6%	15.3%	3.1%	1.8%	0.3%	2.0%	9.1%	0.1%	0.4%	0.0%	20	279
MM_045	Marquette Mission	65.2%	12.7%	3.4%	1.2%	0.3%	2.3%	10.7%	0.1%	0.3%	0.0%	10	313
MM_047	Marquette Mission	65.0%	13.3%	3.3%	1.6%	0.4%	2.3%	9.9%	0.1%	0.4%	0.0%	7	207
MM_051	Marquette Mission	63.3%	14.5%	3.5%	1.4%	0.3%	2.4%	10.2%	0.2%	0.3%	0.1%	36	493
MM_057	Marquette Mission	63.9%	15.4%	3.3%	2.1%	0.3%	2.1%	9.5%	0.1%	0.5%	0.0%	28	355
MM_063	Marquette Mission	63.4%	15.2%	3.6%	1.2%	0.3%	2.5%	8.9%	0.2%	0.4%	0.0%	11	604
MM_064	Marquette Mission	63.3%	14.5%	3.5%	1.5%	0.3%	2.4%	10.2%	0.2%	0.4%	0.1%	40	509
MM_065	Marquette Mission	62.5%	14.3%	3.4%	1.5%	0.3%	2.4%	10.5%	0.2%	0.5%	0.1%	42	520
MM_079	Marquette Mission	64.3%	14.3%	3.4%	1.2%	0.3%	2.5%	9.3%	0.2%	0.2%	0.0%	10	1112
RI_009	Rock Island 3a	62.6%	13.7%	4.0%	1.8%	0.3%	1.9%	11.4%	0.1%	0.6%	0.0%	53	2453
RI_011	Rock Island 3a	63.5%	14.2%	4.1%	1.7%	0.3%	1.9%	10.9%	0.1%	0.6%	0.0%	8	1601
RI_014	Rock Island 3a	63.4%	14.1%	4.1%	1.7%	0.3%	2.0%	11.0%	0.1%	0.6%	0.0%	8	1684
RI_015	Rock Island 3a	62.8%	14.1%	3.5%	1.3%	0.3%	2.4%	10.4%	0.2%	0.6%	0.1%	36	1810
SL_01_1	Fort St. Louis	64.0%	13.0%	3.8%	1.3%	0.3%	2.0%	11.5%	0.2%	0.8%	0.0%	8	1935
SL_07_1	Fort St. Louis	63.9%	13.1%	3.8%	1.3%	0.3%	2.0%	11.6%	0.3%	0.8%	0.0%	8	2011
SL_12_1	Fort St. Louis	64.0%	10.8%	2.7%	1.1%	0.4%	2.1%	11.9%	0.1%	0.7%	0.0%	4	1189
ZM_39	Zimmerman	63.1%	15.3%	3.7%	1.5%	0.3%	2.7%	9.9%	0.2%	0.4%	0.1%	31	770
ZM_48	Zimmerman	60.5%	15.2%	3.6%	1.5%	0.3%	2.6%	11.9%	0.2%	0.5%	0.1%	50	1156
ZM_50	Zimmerman	61.1%	15.1%	3.6%	1.5%	0.3%	2.6%	11.3%	0.2%	0.4%	0.1%	45	1165
ZM_52	Zimmerman	61.7%	15.0%	3.6%	1.5%	0.3%	2.6%	11.2%	0.2%	0.4%	0.1%	40	1115
ZM_53	Zimmerman	61.6%	14.8%	3.5%	1.5%	0.3%	2.6%	11.3%	0.2%	0.5%	0.1%	42	1129
ZM_56	Zimmerman	61.7%	14.6%	3.5%	1.4%	0.3%	2.5%	11.4%	0.2%	0.4%	0.1%	42	1127
ZM_57	Zimmerman	62.2%	14.5%	3.4%	1.5%	0.3%	2.6%	11.1%	0.2%	0.4%	0.1%	43	1173
ZM_58	Zimmerman	62.8%	14.2%	3.4%	1.5%	0.3%	2.4%	10.9%	0.2%	0.5%	0.1%	41	1095
ZM_61	Zimmerman	62.9%	14.2%	3.4%	1.4%	0.3%	2.5%	10.9%	0.2%	0.5%	0.2%	41	1063
ZM_62	Zimmerman	62.8%	13.9%	3.4%	1.5%	0.3%	2.8%	10.7%	0.2%	0.5%	0.1%	66	1166
ZM_63	Zimmerman	60.1%	15.1%	3.6%	1.5%	0.3%	2.9%	11.8%	0.2%	0.3%	0.1%	53	1330

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
IV_63	12	1	107	4	366	14	30	160	528	54	793	18	431	22	2
IV_64	11	1	115	3	188	7	16	240	963	53	2096	16	505	11	1
IV_65	13	1	106	4	238	10	21	339	879	56	1543	14	589	14	1
IV_66	13	1	104	4	301	11	27	170	431	45	848	16	421	16	2
IV_67	9	0	107	4	361	13	27	161	718	42	1397	11	528	18	2
IV_68	9	0	107	4	204	8	19	216	1052	41	1765	13	453	10	1
IV_69	9	1	107	4	321	10	22	188	864	45	1023	15	549	26	2
IV_70	12	1	109	3	288	9	20	248	998	44	598	16	647	24	2
MM_037	10	1	92	3	359	11	18	163	626	40	742	15	645	28	2
MM_038	11	1	98	3	186	6	15	227	909	60	2160	17	504	11	1
MM_039	12	1	101	2	295	10	16	131	336	50	607	18	429	19	2
MM_045	11	1	92	2	319	11	16	158	809	43	1636	10	540	17	1
MM_047	10	0	90	3	545	15	17	197	501	38	1648	11	523	23	2
MM_051	15	1	96	2	233	9	14	280	741	55	1306	14	580	15	1
MM_057	13	1	94	3	323	11	21	131	353	47	594	19	432	21	2
MM_063	12	1	94	2	183	6	16	229	842	68	1842	16	493	11	1
MM_064	13	1	89	2	232	9	17	281	746	62	1340	14	584	15	1
MM_065	15	1	97	3	233	9	18	326	820	76	1553	14	587	15	1
MM_079	10	1	95	1	196	6	11	235	920	56	2066	16	541	11	1
RI_009	12	1	97	2	115	8	9	241	1026	54	573	16	651	25	2
RI_011	12	1	99	2	111	8	9	243	1062	42	593	15	635	23	2
RI_014	13	1	101	2	116	9	9	240	1044	42	568	15	635	22	2
RI_015	13	1	93	2	93	9	9	294	827	53	1338	14	625	15	1
SL_01_1	11	1	98	2	212	10	0	162	406	62	1159	14	659	23	2
SL_07_1	11	1	98	2	219	11	0	140	357	53	952	14	684	23	2
SL_12_1	9	1	91	2	176	10	0	444	553	56	1234	11	653	19	2
ZM_39	20	1	112	3	268	10	19	364	935	74	1770	15	604	14	1
ZM_48	14	1	96	3	267	11	21	362	945	69	1931	16	734	16	1
ZM_50	13	1	93	3	264	10	21	347	912	68	1838	16	736	16	1
ZM_52	15	1	94	3	253	10	19	355	916	68	1926	16	724	17	1
ZM_53	17	1	94	3	249	10	19	354	925	69	1927	16	724	17	2
ZM_56	16	1	92	3	261	10	19	321	865	80	1745	16	723	16	2
ZM_57	15	1	97	2	252	10	16	350	908	72	1925	17	739	17	2
ZM_58	16	1	95	3	243	10	20	290	785	64	1621	16	700	16	2
ZM_61	15	1	85	4	244	10	22	290	817	85	1663	18	715	16	2
ZM_62	13	1	90	4	254	9	24	290	788	63	1578	16	702	16	2
ZM_63	14	1	100	2	291	10	18	326	885	70	1853	17	780	18	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
IV_63	0	17173	0	90	3	6	1	0	0	4	148	1	0	4	3
IV_64	1	19181	0	72	2	3	0	0	0	2	376	3	0	6	2
IV_65	1	15527	0	88	2	4	1	0	0	3	254	6	0	19	2
IV_66	0	8578	0	81	3	5	1	0	0	3	162	1	0	4	2
IV_67	0	16105	0	101	3	5	1	0	0	3	224	2	0	4	2
IV_68	1	19503	0	73	2	3	0	0	0	2	230	2	0	5	2
IV_69	0	11690	0	95	3	6	1	0	0	4	305	2	0	6	3
IV_70	1	9829	0	102	3	6	1	0	0	4	122	1	0	12	3
MM_037	1	9006	0	37	4	7	1	0	2	4	106	1	0	12	4
MM_038	1	18140	0	26	2	4	0	0	1	2	445	3	0	6	2
MM_039	0	12722	0	28	3	7	1	0	1	4	165	1	1	3	4
MM_045	0	15828	0	35	3	6	1	0	1	3	350	3	0	4	3
MM_047	1	15490	0	30	4	7	1	0	1	4	335	2	0	4	3
MM_051	1	15571	0	31	3	5	1	0	2	3	271	7	0	19	3
MM_057	0	10399	0	28	4	7	1	0	1	4	153	1	0	3	3
MM_063	1	17865	0	25	2	4	1	0	0	2	488	3	1	7	2
MM_064	1	15138	0	32	3	5	1	0	1	3	256	6	1	19	2
MM_065	2	18137	0	32	3	5	1	0	1	3	323	8	1	20	3
MM_079	1	21113	0	89	2	4	1	0	2	2	497	3	0	7	2
RI_009	0	11847	0	100	3	7	1	0	0	4	155	1	0	7	3
RI_011	0	8360	0	99	3	6	1	0	0	3	151	1	0	7	3
RI_014	0	8775	0	98	3	6	1	0	0	3	124	1	0	6	3
RI_015	1	15757	0	99	3	5	1	0	0	3	224	5	0	19	2
SL_01_1	1	17525	0	157	4	8	1	0	0	4	206	7	0	6	4
SL_07_1	0	16776	0	166	4	8	1	0	0	4	181	6	0	5	4
SL_12_1	1	38596	0	152	4	8	1	0	0	4	375	3	0	5	4
ZM_39	0	15499	0	89	2	5	1	0	0	3	286	7	0	20	2
ZM_48	0	20962	0	129	4	7	1	0	0	4	429	11	0	24	3
ZM_50	0	21460	0	130	3	6	1	0	0	3	395	10	0	23	3
ZM_52	0	19563	0	121	3	6	1	0	0	3	406	10	0	24	3
ZM_53	0	20483	0	120	3	6	1	0	0	3	409	10	1	24	3
ZM_56	0	21442	0	122	3	6	1	0	0	3	354	8	0	22	3
ZM_57	1	20948	1	123	3	6	1	0	38	4	423	12	1	25	4
ZM_58	0	21808	1	120	3	6	1	0	3	3	331	9	1	21	4
ZM_61	0	20294	1	122	3	6	1	0	1	3	333	9	1	22	3
ZM_62	1	21531	0	140	3	6	1	0	182	3	353	9	1	22	4
ZM_63	1	22955	0	149	4	7	1	0	2	4	460	10	1	25	4

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
IV_63	1	0	1	0	1	0	0	0	0	0	1	1
IV_64	0	0	1	0	1	0	0	0	0	0	0	0
IV_65	1	0	1	0	0	0	0	0	0	0	0	1
IV_66	1	0	0	0	0	0	0	0	0	0	0	1
IV_67	1	0	1	0	0	0	0	0	0	0	0	1
IV_68	0	0	0	0	0	0	0	0	0	0	0	0
IV_69	1	0	1	0	1	0	0	0	0	0	1	1
IV_70	1	0	1	0	1	0	1	0	1	0	1	1
MM_037	1	0	1	0	1	0	0	0	0	0	1	1
MM_038	0	0	0	0	0	0	0	0	0	0	0	1
MM_039	2	0	1	0	1	0	1	0	1	0	1	1
MM_045	1	0	1	0	1	0	0	0	0	0	1	1
MM_047	1	0	1	0	1	0	0	0	0	0	1	1
MM_051	1	0	1	0	1	0	0	0	0	0	0	1
MM_057	1	0	1	0	1	0	0	0	0	0	1	1
MM_063	1	0	1	0	1	0	1	0	1	0	1	1
MM_064	1	0	1	0	1	0	0	0	1	0	1	1
MM_065	1	0	1	0	1	0	0	0	1	0	1	1
MM_079	1	0	0	0	0	0	0	0	0	0	0	1
RI_009	1	0	1	0	1	0	0	0	0	0	1	1
RI_011	1	0	1	0	1	0	0	0	0	0	1	1
RI_014	1	0	1	0	1	0	0	0	0	0	1	1
RI_015	1	0	1	0	1	0	0	0	0	0	0	1
SL_01_1	1	0	1	0	1	0	0	0	0	0	1	1
SL_07_1	1	0	1	0	1	0	0	0	0	0	1	1
SL_12_1	1	0	1	0	1	0	0	0	0	0	1	1
ZM_39	1	0	1	0	0	0	0	0	0	0	0	1
ZM_48	1	0	1	0	1	0	0	0	0	0	1	1
ZM_50	1	0	1	0	1	0	0	0	0	0	1	1
ZM_52	1	0	1	0	1	0	0	0	0	0	1	1
ZM_53	1	0	1	0	1	0	0	0	0	0	1	1
ZM_56	1	0	1	0	1	0	0	0	0	0	1	1
ZM_57	2	0	1	0	1	0	1	0	1	0	1	1
ZM_58	2	0	2	0	1	0	1	0	1	0	1	1
ZM_61	1	0	1	0	1	0	1	0	1	0	1	1
ZM_62	1	0	1	0	1	0	1	0	0	0	1	1
ZM_63	2	0	2	0	1	0	1	0	1	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
ZM_64	Zimmerman	60.9%	15.0%	3.5%	1.5%	0.3%	2.5%	11.2%	0.2%	0.5%	0.1%	46	1270
ZM_65	Zimmerman	60.3%	15.0%	3.5%	1.5%	0.3%	2.5%	11.5%	0.2%	0.5%	0.1%	46	1272
	Subgroup: P-low-Mg (n=23)												
CM_51	Fort Michilimackinac	61.2%	11.0%	1.7%	1.3%	0.6%	4.6%	10.3%	0.3%	0.5%	0.0%	17	1325
CM_52	Fort Michilimackinac	59.9%	15.1%	1.7%	1.3%	0.8%	4.3%	10.9%	0.3%	0.4%	0.0%	26	1152
CM_53	Fort Michilimackinac	61.7%	11.7%	1.5%	1.4%	0.8%	4.9%	11.6%	0.1%	0.4%	0.0%	3	469
CM_54	Fort Michilimackinac	60.7%	11.1%	1.8%	1.3%	0.6%	4.8%	10.5%	0.3%	0.4%	0.0%	20	1389
CM_55	Fort Michilimackinac	60.4%	11.0%	1.9%	1.6%	0.9%	6.7%	11.8%	0.3%	0.5%	0.0%	5	1524
CM_57	Fort Michilimackinac	62.8%	13.2%	1.6%	1.2%	0.8%	3.4%	9.6%	0.1%	0.5%	0.0%	6	1032
CM_58	Fort Michilimackinac	60.6%	14.7%	1.7%	1.3%	0.7%	4.2%	10.7%	0.3%	0.4%	0.0%	26	1136
DI_14	Doty Island Village	66.1%	10.9%	1.4%	1.5%	0.8%	4.9%	9.6%	0.1%	0.7%	0.0%	4	571
M_18	Mahler	64.7%	11.5%	2.0%	1.2%	0.7%	5.4%	9.3%	0.2%	0.6%	0.0%	2	893
M_19	Mahler	64.8%	11.4%	2.0%	1.3%	0.7%	5.2%	9.2%	0.2%	0.6%	0.0%	3	1002
M_20	Mahler	63.1%	12.0%	2.0%	1.3%	0.7%	5.4%	9.1%	0.4%	0.7%	0.0%	7	1060
M_21	Mahler	64.1%	11.7%	1.6%	0.9%	0.7%	4.8%	8.7%	0.2%	0.6%	0.0%	8	5661
RI_089	Rock Island 4	65.5%	11.7%	1.9%	1.7%	0.6%	4.3%	8.9%	0.0%	0.8%	0.0%	3	4858
RI_091	Rock Island 4	64.4%	13.3%	2.4%	1.3%	0.6%	4.0%	8.6%	0.1%	0.7%	0.0%	3	3305
RI_092	Rock Island 4	64.6%	13.4%	2.4%	1.3%	0.6%	3.9%	8.5%	0.1%	0.6%	0.0%	3	3089
RI_093	Rock Island 4	62.5%	12.4%	1.9%	1.5%	0.8%	4.8%	10.0%	0.1%	0.8%	0.0%	14	7540
RI_108	Rock Island 3b	63.5%	12.3%	1.7%	1.2%	0.8%	3.8%	9.7%	0.4%	0.7%	0.0%	15	4301
SJ_17	Fort St. Joseph	64.5%	12.0%	1.6%	1.2%	0.8%	5.2%	9.6%	0.1%	0.5%	0.0%	33	293
SJ_42	Fort St. Joseph	62.3%	13.1%	2.5%	1.4%	0.7%	4.6%	11.1%	0.1%	0.3%	0.0%	5	2803
SJ_43	Fort St. Joseph	61.2%	15.3%	1.7%	1.4%	0.7%	4.4%	10.4%	0.3%	0.5%	0.0%	27	1148
SJ_44	Fort St. Joseph	63.8%	11.7%	2.2%	1.3%	0.7%	5.2%	10.8%	0.1%	0.6%	0.0%	2	571
SJ_45	Fort St. Joseph	64.4%	12.0%	2.1%	1.3%	0.7%	4.6%	10.7%	0.1%	0.6%	0.0%	2	570
SL_10_1	Fort St. Louis	64.8%	10.8%	1.8%	1.2%	0.7%	3.0%	9.3%	0.3%	0.7%	0.0%	26	8168
	Subgroup: Med P (n=4)												
DI_52	Doty Island Village	64.2%	13.2%	2.3%	1.3%	1.3%	4.0%	8.6%	0.1%	0.6%	0.0%	6	3557
DI_53	Doty Island Village	63.7%	11.3%	1.8%	1.3%	1.4%	4.8%	9.4%	0.1%	0.6%	0.0%	3	1861
DI_54	Doty Island Village	61.4%	13.5%	1.9%	1.6%	1.4%	4.0%	9.6%	0.3%	0.8%	0.0%	10	2605
DI_55	Doty Island Village	62.2%	13.4%	1.5%	1.2%	1.9%	4.2%	8.4%	0.2%	0.6%	0.0%	7	2177
	Subgroup: Pb												
DI_13	Doty Island Village	60.6%	13.2%	2.0%	1.3%	0.6%	3.6%	8.7%	0.1%	0.8%	0.1%	241	19235

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
ZM_64	14	1	90	3	260	10	19	346	906	70	1910	16	764	17	2
ZM_65	13	1	92	3	267	10	18	352	908	69	1958	18	777	18	2
	Subgroup: P-low-Mg (n=23)														
CM_51	20	1	124	4	302	10	18	819	863	151	1378	14	963	33	2
CM_52	19	0	140	4	300	10	18	233	438	247	549	20	797	25	2
CM_53	12	0	147	4	338	11	20	658	723	97	880	22	704	33	2
CM_54	21	0	124	4	309	10	20	844	883	148	1369	15	976	34	2
CM_55	25	0	118	4	371	14	23	169	217	109	329	15	1211	28	2
CM_57	12	0	119	4	338	12	22	650	761	129	1293	16	613	22	2
CM_58	18	0	140	4	289	10	19	228	426	233	544	20	787	25	2
DI_14	16	0	106	2	62	13	9	490	810	84	1293	21	536	27	2
M_18	21	0	98	2	53	10	8	252	294	71	415	10	799	21	2
M_19	22	0	97	2	52	10	7	233	271	68	385	11	828	22	2
M_20	22	0	104	2	59	11	9	181	203	72	303	11	830	27	2
M_21	16	0	96	2	41	7	6	210	321	98	487	18	690	18	1
RI_089	23	0	124	3	95	14	11	480	552	187	648	20	654	43	3
RI_091	23	0	135	2	75	9	7	408	472	122	523	17	615	45	2
RI_092	24	0	141	2	74	9	7	393	457	121	509	18	602	43	2
RI_093	18	0	118	2	74	11	13	436	503	145	685	21	780	32	2
RI_108	12	0	100	2	71	11	11	364	532	135	1085	21	565	21	2
SJ_17	19	0	109	4	269	10	19	747	892	81	1015	13	850	23	2
SJ_42	24	0	171	2	377	11	7	479	527	129	586	15	822	52	2
SJ_43	20	0	141	3	316	10	16	225	431	225	504	20	838	27	2
SJ_44	19	1	128	4	295	11	16	142	185	200	211	15	934	28	2
SJ_45	19	0	125	4	287	11	15	144	185	199	207	14	929	27	2
SL_10_1	15	0	114	2	173	9	0	155	589	68	1194	11	449	32	2
	Subgroup: Med P (n=4)														
DI_52	25	0	133	2	77	10	8	392	451	121	457	13	642	41	2
DI_53	18	0	103	2	64	11	8	202	305	148	317	15	693	24	2
DI_54	20	0	103	2	88	13	10	239	322	111	461	14	706	26	2
DI_55	18	0	111	2	62	9	7	201	251	162	323	12	756	19	2
	Subgroup: Pb														
DI_13	18	0	80	2	61	10	10	732	536	126	1033	17	635	22	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
ZM_64	0	23998	0	136	4	7	1	0	0	4	444	12	1	24	3
ZM_65	0	25806	0	136	4	7	1	0	0	4	453	12	0	25	4
	Subgroup: P-low-Mg (n=23)														
CM_51	0	41248	0	195	4	7	1	0	0	3	1280	3	0	3	4
CM_52	0	21772	0	195	4	7	1	0	2	7	365	22	1	4	4
CM_53	1	28600	0	142	4	8	1	0	1	4	1038	20	0	3	4
CM_54	0	41649	0	201	4	7	1	0	0	3	1222	3	0	3	3
CM_55	65	20794	0	130	5	9	1	0	0	4	264	2	0	2	4
CM_57	2	30812	0	158	4	7	1	0	2	3	699	21	1	6	4
CM_58	1	22085	0	195	4	7	1	0	1	7	348	21	1	4	4
DI_14	1	12635	0	67	4	9	1	0	0	4	704	7	0	9	4
M_18	0	14071	0	76	3	6	1	0	0	3	242	2	0	2	3
M_19	0	14937	0	77	3	7	1	0	0	3	226	2	0	3	3
M_20	0	17166	0	96	4	8	1	0	0	3	181	2	0	2	3
M_21	0	20847	0	107	3	5	1	0	0	3	221	15	0	4	2
RI_089	1	12089	0	83	5	11	1	0	0	4	405	3	0	3	4
RI_091	0	14316	0	77	4	8	1	0	0	3	355	4	0	2	4
RI_092	1	13986	0	75	4	8	1	0	0	3	348	4	0	1	3
RI_093	1	13785	0	119	4	8	1	0	0	3	403	3	0	2	4
RI_108	0	18207	0	120	3	7	1	0	0	3	500	4	0	3	3
SJ_17	1	20671	0	118	3	7	1	0	1	3	928	3	0	3	3
SJ_42	0	22613	0	109	4	9	1	0	0	4	433	4	0	2	4
SJ_43	2	23884	0	208	4	8	1	0	0	8	365	23	0	4	4
SJ_44	0	21049	0	83	4	7	1	0	0	3	227	1	0	2	3
SJ_45	0	20343	0	84	4	7	1	0	0	3	228	2	0	1	3
SL_10_1	1	39912	0	566	5	9	1	0	0	4	532	4	0	5	5
	Subgroup: Med P (n=4)														
DI_52	1	13709	0	83	4	8	1	0	0	3	299	4	0	1	3
DI_53	0	19631	0	80	4	7	1	0	0	3	275	1	0	2	3
DI_54	1	18560	0	207	5	9	1	0	0	4	239	5	0	3	4
DI_55	1	22765	0	211	3	7	1	0	0	3	156	2	0	2	3
	Subgroup: Pb														
DI_13	1	23570	0	132	3	7	1	0	0	4	416	22	0	6	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
ZM_64	1	0	1	0	1	0	0	0	0	0	1	1
ZM_65	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: P-low-Mg (n=23)											
CM_51	1	0	1	0	1	0	0	0	1	0	1	1
CM_52	2	0	2	0	2	0	1	0	1	0	1	1
CM_53	1	0	1	0	1	0	1	0	1	0	1	1
CM_54	1	0	1	0	1	0	0	0	0	0	1	1
CM_55	1	0	1	0	1	0	1	0	1	0	1	1
CM_57	1	0	1	0	1	0	0	0	1	0	1	1
CM_58	1	0	1	0	2	0	1	0	1	0	1	1
DI_14	1	0	1	0	1	0	0	0	0	0	1	1
M_18	1	0	0	0	1	0	0	0	0	0	1	1
M_19	1	0	0	0	1	0	0	0	0	0	1	1
M_20	1	0	1	0	1	0	0	0	0	0	1	1
M_21	1	0	0	0	1	0	0	0	0	0	1	1
RI_089	1	0	1	0	1	0	0	0	0	0	1	1
RI_091	1	0	1	0	1	0	0	0	0	0	1	1
RI_092	1	0	1	0	1	0	0	0	0	0	1	1
RI_093	1	0	1	0	1	0	0	0	0	0	1	1
RI_108	1	0	1	0	1	0	0	0	0	0	1	1
SJ_17	1	0	1	0	1	0	0	0	0	0	1	1
SJ_42	1	0	1	0	1	0	0	0	0	0	1	1
SJ_43	1	0	1	0	2	0	1	0	1	0	1	1
SJ_44	1	0	1	0	1	0	0	0	0	0	1	1
SJ_45	1	0	1	0	1	0	0	0	0	0	1	1
SL_10_1	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: Med P (n=4)											
DI_52	1	0	1	0	1	0	0	0	0	0	1	1
DI_53	1	0	0	0	1	0	0	0	0	0	1	1
DI_54	1	0	1	0	1	0	0	0	0	0	1	1
DI_55	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: Pb											
DI_13	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	Subgroup: Med Pb												
RI_090	Rock Island 4	62.9%	12.0%	1.8%	1.5%	0.8%	4.9%	9.6%	0.2%	0.9%	0.0%	8	11859
	Subgroup: Sn+Pb+Sb												
ZM_54	Zimmerman	59.8%	17.6%	3.0%	1.7%	0.2%	2.0%	9.1%	0.4%	0.4%	0.1%	10155	10499
	Subgroup: Pb-low-Sb												
ZM_46	Zimmerman	61.0%	10.9%	3.1%	1.6%	0.3%	7.5%	11.8%	0.5%	0.5%	0.1%	646	7590
	Subgroup: Med-low Sn + Pb												
ZM_49	Zimmerman	61.1%	15.6%	3.5%	1.2%	0.3%	2.7%	10.8%	0.3%	0.4%	0.1%	852	1581
	Subgroup: Med Sn + Pb (n=3)												
MM_085	Marquette Mission	62.0%	14.3%	3.0%	1.8%	0.3%	2.3%	9.6%	0.8%	0.4%	0.1%	9248	9350
ZM_11	Zimmerman	61.0%	17.0%	3.0%	1.6%	0.2%	1.9%	9.0%	0.4%	0.5%	0.1%	9373	7295
ZM_13	Zimmerman	60.7%	16.9%	3.0%	1.7%	0.2%	2.0%	9.0%	0.4%	0.5%	0.0%	9277	7374
	5.2.3 Copper-colored, turquoise blue opaque beads (IIa31 & IIa40/41)												
	Subgroup: Mg-low-P (n=127)												
AR_02	Arrowsmith	64.8%	18.2%	1.9%	0.9%	0.1%	1.8%	7.8%	0.0%	0.3%	1.6%	93	517
B_026	Bell	69.3%	13.9%	2.4%	1.3%	0.2%	1.6%	8.5%	0.1%	0.6%	1.1%	143	1471
B_027	Bell	69.5%	14.3%	2.3%	1.0%	0.3%	2.6%	7.3%	0.0%	0.5%	0.9%	61	1598
B2040	Bell	66.7%	15.2%	2.4%	0.9%	0.3%	2.0%	9.4%	0.0%	0.6%	0.9%	65	1664
B649	Bell	67.9%	15.3%	1.7%	0.8%	0.1%	2.6%	7.8%	0.0%	0.4%	1.3%	160	1327
CHK_1_1	Chickadee	68.3%	16.9%	2.3%	0.8%	0.2%	2.6%	6.6%	0.0%	0.6%	1.2%	10	61
CHK_2_1	Chickadee	69.3%	15.0%	2.1%	0.9%	0.2%	3.6%	6.7%	0.1%	0.5%	1.2%	20	40
CHK_4_1	Chickadee	67.6%	17.2%	2.3%	0.7%	0.2%	2.8%	6.6%	0.0%	0.4%	1.4%	23	214
CHK_6_1	Chickadee	67.3%	15.7%	2.6%	1.0%	0.3%	4.4%	6.5%	0.0%	0.5%	1.2%	21	93
CHK_7_1	Chickadee	68.9%	16.3%	2.2%	1.1%	0.2%	2.0%	7.0%	0.1%	0.6%	1.2%	21	128
CHK_8_1	Chickadee	70.2%	16.9%	1.8%	1.0%	0.1%	1.9%	6.0%	0.0%	0.5%	1.0%	14	147
DI_12	Doty Island Village	65.8%	17.1%	2.5%	1.0%	0.3%	2.8%	6.5%	0.2%	0.6%	1.9%	702	2736
GG_06_1	Gillett Grove	69.1%	15.2%	2.0%	0.9%	0.1%	3.2%	5.5%	0.1%	1.3%	1.4%	21	84
GG_07_1	Gillett Grove	68.2%	15.0%	2.3%	1.2%	0.2%	3.2%	6.1%	0.0%	1.3%	1.3%	19	83
GG_09_1	Gillett Grove	67.1%	16.9%	2.3%	1.2%	0.1%	2.1%	6.5%	0.1%	0.8%	1.5%	23	281
GG_14_1	Gillett Grove	64.8%	18.8%	2.7%	0.8%	0.2%	1.9%	7.7%	0.2%	0.4%	1.5%	17	20
GG_15_1	Gillett Grove	65.7%	17.9%	1.9%	0.9%	0.2%	3.4%	6.8%	0.0%	0.5%	1.5%	26	70
IV_24	Iliniwek Village	65.7%	18.1%	1.7%	0.9%	0.1%	1.9%	5.8%	0.0%	0.4%	1.6%	33	95

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	Subgroup: Med Pb														
RI_090	18	0	111	2	76	11	9	423	491	140	624	21	767	33	2
	Subgroup: Sn+Pb+Sb														
ZM_54	13	1	90	3	362	14	19	467	748	78	2636	16	573	24	2
	Subgroup: Pb-low-Sb														
ZM_46	26	1	69	3	1042	14	20	297	500	478	1877	31	616	210	5
	Subgroup: Med-low Sn + Pb														
ZM_49	12	0	92	3	248	9	20	238	1106	52	2027	15	697	15	1
	Subgroup: Med Sn + Pb (n=3)														
MM_085	17	1	86	3	328	13	19	773	948	93	2643	19	537	21	2
ZM_11	11	1	84	4	313	13	23	423	678	70	2369	14	497	22	2
ZM_13	11	1	80	4	306	12	24	441	700	67	2329	15	503	22	2
	5.2.3 Copper-colored, turquoise blue opaque beads (IIa31 & IIa40/41)														
	Subgroup: Mg-low-P (n=127)														
AR_02	16	0	68	3	198	8	18	111	87	27	265	13	303	16	1
B_026	12	1	114	3	107	8	9	62	157	31	163	12	444	19	1
B_027	8	0	104	3	111	10	12	45	107	29	225	11	342	14	1
B2040	7	0	88	2	83	10	24	45	119	24	275	10	388	17	1
B649	10	0	65	2	37	7	6	81	59	134	158	11	341	14	1
CHK_1_1	11	1	90	2	197	7	9	68	379	39	814	15	381	8	1
CHK_2_1	10	1	99	2	308	10	12	107	357	28	555	15	348	13	1
CHK_4_1	9	0	100	2	173	7	6	117	299	23	525	13	333	9	1
CHK_6_1	10	1	101	2	246	7	7	184	274	43	281	14	339	15	1
CHK_7_1	10	1	98	2	324	11	14	111	362	36	518	15	363	14	1
CHK_8_1	10	0	89	2	303	11	12	87	286	35	398	14	304	15	1
DI_12	8	0	127	2	41	9	7	91	177	85	509	15	420	15	1
GG_06_1	11	1	74	1	80	7	12	220	381	24	319	13	280	20	1
GG_07_1	12	1	66	2	95	8	8	216	312	32	330	13	317	22	1
GG_09_1	13	1	70	1	83	8	4	162	250	25	351	12	328	15	1
GG_14_1	11	0	94	1	66	6	4	55	46	22	99	8	400	10	1
GG_15_1	17	0	54	1	77	6	4	143	207	28	447	15	549	16	1
IV_24	6	0	83	3	187	8	13	397	275	38	566	9	349	20	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	Subgroup: Med Pb														
RI_090	0	12851	0	123	4	8	1	0	0	3	376	3	0	2	4
	Subgroup: Sn+Pb+Sb														
ZM_54	0	18641	0	140	4	8	1	0	0	4	250	43	1	6	4
	Subgroup: Pb-low-Sb														
ZM_46	0	9790	1	345	6	12	2	1	0	8	245	6	3	9	6
	Subgroup: Med-low Sn + Pb														
ZM_49	0	22397	0	130	3	5	1	0	1	3	207	6	0	36	3
	Subgroup: Med Sn + Pb (n=3)														
MM_085	2	16040	1	134	4	7	1	0	1	4	405	37	1	11	3
ZM_11	1	16562	0	81	3	6	1	0	1	4	202	36	1	6	3
ZM_13	0	17205	0	82	4	6	1	0	634	4	205	38	1	6	3
	5.2.3 Copper-colored, turquoise blue opaque beads (IIa31 & IIa40/41)														
	Subgroup: Mg-low-P (n=127)														
AR_02	2	511	0	26	2	3	0	0	0	2	104	2	0	1	2
B_026	1	127	0	89	3	6	1	0	0	3	74	1	0	1	2
B_027	1	509	0	95	2	5	1	0	0	2	142	1	0	2	2
B2040	1	639	0	93	4	6	1	0	0	3	183	2	0	2	4
B649	2	979	0	38	2	5	1	0	0	2	41	1	0	1	2
CHK_1_1	4	196	0	64	2	3	0	0	0	2	248	1	0	2	1
CHK_2_1	1	20	0	81	2	4	1	0	0	2	201	1	0	2	2
CHK_4_1	4	1852	0	94	2	3	0	0	0	2	191	0	0	3	1
CHK_6_1	0	116	0	68	2	4	1	0	0	2	215	28	0	1	2
CHK_7_1	2	18	0	82	2	5	1	0	0	2	213	1	0	3	2
CHK_8_1	1	28	0	72	2	4	1	0	0	2	185	1	0	1	2
DI_12	4	186	0	77	3	6	1	0	0	3	113	1	0	3	2
GG_06_1	4	63	0	95	2	3	0	0	0	2	187	3	0	1	2
GG_07_1	2	135	0	134	4	4	1	0	0	3	642	3	0	2	3
GG_09_1	2	99	0	49	2	4	0	0	0	2	159	21	0	2	2
GG_14_1	1	57	0	56	2	3	0	0	0	2	21	1	0	1	2
GG_15_1	3	27	0	95	2	4	1	0	0	2	111	1	0	2	2
IV_24	1	27	0	138	2	4	1	0	1	2	138	3	1	2	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	Subgroup: Med Pb											
RI_090	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: Sn+Pb+Sb											
ZM_54	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: Pb-low-Sb											
ZM_46	1	0	1	0	1	0	1	0	1	0	6	3
	Subgroup: Med-low Sn + Pb											
ZM_49	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: Med Sn + Pb (n=3)											
MM_085	1	0	1	0	1	0	0	0	0	0	1	1
ZM_11	1	0	1	0	1	0	1	0	1	0	1	1
ZM_13	1	0	1	0	1	0	0	0	0	0	1	1
	5.2.3 Copper-colored, turquoise blue opaque beads (IIa31 & IIa40/41)											
	Subgroup: Mg-low-P (n=127)											
AR_02	0	0	0	0	0	0	0	0	0	0	0	1
B_026	1	0	0	0	0	0	0	0	0	0	1	1
B_027	0	0	0	0	0	0	0	0	0	0	0	1
B2040	1	0	1	0	1	0	0	0	0	0	1	1
B649	0	0	0	0	0	0	0	0	0	0	0	1
CHK_1_1	0	0	0	0	0	0	0	0	0	0	0	0
CHK_2_1	0	0	0	0	0	0	0	0	0	0	0	1
CHK_4_1	0	0	0	0	0	0	0	0	0	0	0	0
CHK_6_1	0	0	0	0	0	0	0	0	0	0	0	0
CHK_7_1	0	0	0	0	0	0	0	0	0	0	0	1
CHK_8_1	0	0	0	0	0	0	0	0	0	0	0	1
DI_12	1	0	0	0	1	0	0	0	0	0	0	1
GG_06_1	0	0	0	0	0	0	0	0	0	0	1	1
GG_07_1	1	0	1	0	1	0	0	0	0	0	1	1
GG_09_1	0	0	0	0	0	0	0	0	0	0	0	1
GG_14_1	0	0	0	0	0	0	0	0	0	0	0	0
GG_15_1	1	0	0	0	0	0	0	0	0	0	0	1
IV_24	1	0	1	0	1	0	0	0	1	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
IV_25	Iliniwek Village	66.1%	16.0%	2.1%	0.9%	0.2%	3.2%	6.6%	0.0%	0.5%	1.3%	22	127
IV_26	Iliniwek Village	66.3%	16.8%	2.0%	1.1%	0.1%	1.7%	6.4%	0.1%	0.4%	1.6%	23	187
IV_27	Iliniwek Village	66.0%	17.6%	2.4%	0.6%	0.2%	2.1%	7.0%	0.0%	0.3%	1.1%	35	405
IV_28	Iliniwek Village	65.1%	15.5%	2.3%	1.3%	0.1%	2.0%	9.2%	0.1%	0.2%	1.2%	182	1121
IV_29	Iliniwek Village	63.9%	16.4%	2.5%	1.2%	0.2%	2.6%	7.5%	0.0%	0.5%	1.6%	20	175
IV_30	Iliniwek Village	65.0%	15.5%	2.5%	1.6%	0.2%	1.7%	9.5%	0.1%	0.6%	1.0%	162	923
IV_31	Iliniwek Village	66.7%	18.0%	1.9%	1.1%	0.1%	1.9%	6.1%	0.0%	0.5%	1.1%	17	23
IV_32	Iliniwek Village	66.3%	16.9%	2.0%	1.1%	0.1%	1.7%	6.4%	0.1%	0.4%	1.5%	22	196
IV_33	Iliniwek Village	66.1%	16.2%	2.5%	0.9%	0.2%	2.4%	7.2%	0.0%	0.4%	1.1%	11	376
IV_34	Iliniwek Village	62.6%	18.5%	2.5%	1.1%	0.2%	2.3%	7.6%	0.0%	0.3%	1.4%	27	53
IV_35	Iliniwek Village	65.3%	17.0%	2.5%	0.8%	0.2%	2.6%	7.2%	0.0%	0.5%	1.1%	11	355
IV_36	Iliniwek Village	64.1%	17.5%	2.5%	1.2%	0.2%	2.2%	7.4%	0.0%	0.5%	1.3%	30	86
IV_37	Iliniwek Village	65.0%	18.1%	2.1%	1.0%	0.2%	2.1%	6.7%	0.0%	0.4%	1.3%	26	59
IV_38	Iliniwek Village	64.5%	17.5%	2.5%	1.1%	0.2%	2.3%	7.6%	0.0%	0.4%	1.2%	27	135
IV_39	Iliniwek Village	65.7%	15.5%	2.2%	1.2%	0.1%	1.8%	8.7%	0.1%	0.5%	1.2%	160	854
IV_40	Iliniwek Village	67.2%	17.5%	1.9%	1.1%	0.1%	1.9%	6.3%	0.0%	0.5%	1.0%	17	23
IV_41	Iliniwek Village	66.9%	15.7%	2.0%	0.7%	0.2%	3.0%	6.2%	0.1%	0.4%	1.5%	24	54
IV_43	Iliniwek Village	64.7%	15.9%	1.9%	1.6%	0.2%	3.7%	7.1%	0.0%	0.5%	1.3%	340	320
IV_44	Iliniwek Village	65.2%	14.5%	1.8%	1.1%	0.1%	6.2%	6.4%	0.1%	0.4%	1.2%	1008	1303
IV_45	Iliniwek Village	64.8%	17.7%	2.0%	1.0%	0.1%	2.3%	6.8%	0.0%	0.4%	1.4%	27	284
IV_46	Iliniwek Village	62.9%	18.4%	2.3%	1.0%	0.1%	1.7%	8.1%	0.0%	0.5%	1.5%	36	63
IV_47	Iliniwek Village	65.1%	16.3%	2.2%	1.1%	0.1%	2.0%	8.2%	0.0%	0.5%	1.3%	21	62
M_10	Mahler	69.1%	14.7%	2.3%	0.9%	0.3%	2.8%	7.2%	0.0%	0.5%	0.9%	28	642
MA_15	La Point (surface)	66.3%	18.5%	2.1%	0.7%	0.2%	2.3%	6.9%	0.0%	0.4%	1.2%	44	1244
MA_16	La Point (surface)	64.0%	19.3%	2.6%	0.8%	0.2%	2.4%	7.1%	0.1%	0.5%	1.3%	54	2869
MM_053	Marquette Mission	66.9%	16.3%	2.9%	0.7%	0.2%	4.3%	6.8%	0.0%	0.3%	1.1%	7	112
MM_072	Marquette Mission	66.5%	15.0%	2.4%	1.4%	0.2%	4.0%	8.8%	0.1%	0.2%	1.2%	16	63
MM_073	Marquette Mission	67.4%	14.7%	2.6%	1.4%	0.2%	4.0%	8.2%	0.0%	0.3%	1.0%	14	44
MM_074	Marquette Mission	71.2%	15.3%	1.7%	0.9%	0.2%	3.3%	5.5%	0.0%	0.3%	1.3%	20	131
MM_081	Marquette Mission	68.9%	15.6%	2.3%	1.2%	0.2%	1.9%	8.0%	0.1%	0.3%	1.2%	164	1176
MM_082	Marquette Mission	66.7%	16.1%	2.8%	1.5%	0.2%	2.5%	8.4%	0.0%	0.4%	1.2%	46	382
MM_083	Marquette Mission	66.4%	16.8%	2.7%	1.3%	0.2%	2.5%	8.3%	0.0%	0.4%	1.1%	42	364
MM_084	Marquette Mission	66.6%	16.2%	2.8%	1.6%	0.3%	2.5%	8.4%	0.0%	0.3%	1.1%	45	362
MM_087	Marquette Mission	67.2%	16.4%	2.5%	1.2%	0.3%	1.9%	8.1%	0.2%	0.4%	1.6%	370	448
MM_088	Marquette Mission	68.1%	15.8%	2.6%	1.0%	0.3%	2.2%	8.4%	0.0%	0.5%	1.0%	30	132
MM_089	Marquette Mission	68.0%	16.9%	2.9%	0.8%	0.2%	2.7%	6.9%	0.0%	0.1%	1.3%	18	155
MM_090	Marquette Mission	67.5%	17.8%	1.9%	1.0%	0.2%	3.3%	6.6%	0.0%	0.2%	1.3%	30	102

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
IV_25	10	1	91	3	192	7	14	236	329	43	573	15	385	22	1
IV_26	10	1	99	3	208	13	21	198	299	40	520	11	335	17	1
IV_27	9	0	84	3	140	5	14	92	181	24	324	11	339	12	1
IV_28	15	1	89	1	253	8	7	65	156	43	214	19	493	20	2
IV_29	12	1	87	3	148	6	17	107	278	29	491	19	446	10	1
IV_30	12	1	84	3	269	10	19	65	154	42	201	15	528	23	2
IV_31	12	1	89	3	267	11	23	88	274	24	452	12	318	15	1
IV_32	10	1	98	3	211	14	23	196	302	42	523	10	333	17	1
IV_33	9	1	91	3	146	6	17	156	195	32	712	15	408	9	1
IV_34	13	0	96	2	191	7	13	176	258	38	515	11	410	14	1
IV_35	8	0	97	3	140	6	17	152	190	30	722	15	397	9	1
IV_36	14	1	91	3	216	8	18	166	257	39	318	14	363	18	1
IV_37	13	0	96	3	172	7	15	153	236	33	410	12	341	16	1
IV_38	12	1	88	3	192	8	18	151	232	60	414	17	382	14	1
IV_39	10	1	82	3	241	9	18	62	153	39	213	17	473	20	1
IV_40	11	0	94	3	247	11	19	90	281	26	448	13	324	15	1
IV_41	11	0	89	3	180	7	14	225	258	35	595	15	347	23	1
IV_43	14	1	63	4	207	8	16	46	69	27	109	20	352	19	1
IV_44	9	1	46	3	184	7	14	63	91	29	225	25	223	21	1
IV_45	11	1	91	3	185	9	18	221	225	43	211	19	371	13	1
IV_46	9	0	97	3	210	9	16	178	198	40	498	12	451	12	1
IV_47	10	0	106	3	265	12	24	55	79	49	146	22	432	16	1
M_10	9	0	77	2	44	9	11	42	155	28	404	12	376	11	1
MA_15	14	0	76	2	250	6	11	135	180	53	91	7	360	23	1
MA_16	17	1	86	2	167	6	11	263	249	60	541	13	372	10	1
MM_053	9	0	103	2	103	5	11	71	250	29	699	14	342	6	1
MM_072	12	1	71	2	309	8	15	76	191	24	212	21	421	25	2
MM_073	11	1	85	2	208	6	16	65	156	30	152	20	371	16	1
MM_074	8	1	104	1	207	7	10	224	384	35	531	15	338	22	1
MM_081	10	1	93	2	260	8	15	67	159	38	208	14	435	18	1
MM_082	9	1	102	3	224	8	19	93	185	36	364	15	470	14	1
MM_083	10	1	109	3	220	8	18	92	187	35	370	15	473	13	1
MM_084	11	1	105	2	241	8	16	92	184	38	360	16	480	13	1
MM_087	9	1	87	3	251	8	25	82	169	49	456	10	433	19	1
MM_088	11	1	93	3	234	9	22	93	238	42	526	12	444	14	1
MM_089	9	1	99	1	126	4	9	101	207	71	683	15	422	7	1
MM_090	16	1	61	2	184	6	8	139	205	34	440	13	539	14	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
IV_25	1	187	0	70	2	4	1	0	1	2	771	4	0	3	2
IV_26	2	139	0	63	3	5	1	0	0	3	299	37	0	2	3
IV_27	1	590	0	65	2	3	0	0	0	2	122	0	0	1	2
IV_28	1	461	0	97	3	6	1	0	0	3	95	1	0	1	3
IV_29	1	191	0	71	2	4	1	0	0	2	115	1	0	2	2
IV_30	2	208	0	113	4	7	1	0	1	4	93	1	0	1	3
IV_31	0	34	0	102	3	5	1	0	0	3	233	1	0	1	3
IV_32	1	134	0	65	3	5	1	0	4	3	312	40	0	2	3
IV_33	0	262	0	113	2	4	1	0	0	2	162	1	0	2	2
IV_34	0	42	0	71	2	4	1	0	6	3	262	34	0	2	2
IV_35	1	256	0	67	2	3	0	0	1	2	156	1	0	2	2
IV_36	2	36	0	82	3	5	1	0	0	3	180	33	0	2	3
IV_37	0	30	0	67	2	4	1	0	0	2	236	24	0	1	2
IV_38	0	39	0	76	3	5	1	0	27	3	228	27	0	1	3
IV_39	2	380	0	97	3	6	1	0	0	3	91	1	0	1	3
IV_40	1	33	0	81	3	5	1	0	0	3	229	1	0	1	2
IV_41	2	288	0	61	2	3	0	0	0	2	685	0	0	2	2
IV_43	0	21	0	112	3	6	1	0	2	3	79	1	0	1	3
IV_44	0	18	0	138	3	5	1	0	1	2	48	1	2	1	2
IV_45	2	32	0	89	2	4	1	0	0	2	86	3	0	1	2
IV_46	2	32	0	103	2	5	1	0	0	3	119	3	0	2	2
IV_47	0	52	0	109	3	5	1	0	0	3	36	1	0	1	2
M_10	1	154	0	100	2	5	1	0	0	2	115	1	0	2	2
MA_15	9	25	0	72	2	3	0	0	1	2	147	1	0	1	1
MA_16	11	330	0	59	1	3	0	0	1	2	109	3	0	1	1
MM_053	1	67	0	17	1	2	0	0	0	1	107	1	0	2	1
MM_072	1	69	0	84	3	7	1	0	0	3	26	0	0	2	3
MM_073	1	23	0	83	3	5	1	0	0	2	14	1	0	3	2
MM_074	2	65	0	67	2	3	0	0	1	2	226	3	1	1	2
MM_081	2	381	0	86	3	5	1	0	0	3	83	1	0	1	2
MM_082	2	160	0	104	3	5	1	0	5	3	96	1	0	1	2
MM_083	2	148	0	101	3	5	1	0	0	3	94	1	0	1	2
MM_084	2	152	0	110	3	5	1	0	1	3	93	1	0	1	3
MM_087	4	183	0	128	3	5	1	0	0	3	98	1	0	1	3
MM_088	3	335	0	91	2	5	1	0	0	2	31	1	0	1	2
MM_089	4	96	0	70	2	3	0	0	0	2	115	0	0	1	1
MM_090	3	27	0	71	2	4	1	0	1	2	111	1	1	2	2

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
IV_25	1	0	1	0	1	0	0	0	0	0	1	1
IV_26	1	0	1	0	1	0	0	0	0	0	1	1
IV_27	1	0	0	0	0	0	0	0	0	0	1	0
IV_28	1	0	1	0	1	0	0	0	1	0	1	1
IV_29	1	0	1	0	1	0	0	0	0	0	1	1
IV_30	1	0	1	0	1	0	0	0	1	0	1	1
IV_31	1	0	1	0	0	0	0	0	0	0	1	1
IV_32	1	0	1	0	1	0	0	0	0	0	1	1
IV_33	1	0	0	0	0	0	0	0	0	0	0	1
IV_34	1	0	1	0	1	0	0	0	0	0	1	1
IV_35	0	0	0	0	0	0	0	0	0	0	0	0
IV_36	1	0	1	0	1	0	0	0	0	0	1	1
IV_37	0	0	0	0	0	0	0	0	0	0	1	1
IV_38	1	0	0	0	1	0	0	0	0	0	0	1
IV_39	1	0	1	0	1	0	0	0	0	0	1	1
IV_40	1	0	1	0	1	0	0	0	0	0	1	1
IV_41	1	0	0	0	0	0	0	0	0	0	1	0
IV_43	1	0	1	0	1	0	0	0	0	0	1	1
IV_44	1	0	0	0	0	0	0	0	0	0	1	1
IV_45	0	0	0	0	0	0	0	0	0	0	0	1
IV_46	0	0	0	0	0	0	0	0	0	0	0	1
IV_47	1	0	0	0	0	0	0	0	0	0	1	1
M_10	0	0	0	0	0	0	0	0	0	0	0	1
MA_15	1	0	0	0	0	0	0	0	0	0	1	1
MA_16	0	0	0	0	0	0	0	0	0	0	0	0
MM_053	0	0	0	0	0	0	0	0	0	0	0	0
MM_072	1	0	1	0	1	0	0	0	0	0	1	1
MM_073	1	0	1	0	1	0	0	0	0	0	1	1
MM_074	1	0	1	0	0	0	0	0	0	0	1	1
MM_081	1	0	1	0	1	0	0	0	0	0	1	1
MM_082	1	0	1	0	1	0	0	0	0	0	0	1
MM_083	0	0	0	0	1	0	0	0	0	0	0	1
MM_084	1	0	1	0	1	0	0	0	0	0	0	1
MM_087	1	0	1	0	1	0	0	0	0	0	1	1
MM_088	1	0	1	0	0	0	0	0	0	0	0	1
MM_089	0	0	0	0	0	0	0	0	0	0	0	0
MM_090	1	0	0	0	0	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
MM_091	Marquette Mission	65.9%	16.9%	2.8%	1.1%	0.3%	2.2%	8.6%	0.1%	0.3%	1.6%	52	225
MM_092	Marquette Mission	67.1%	18.0%	1.9%	0.9%	0.2%	3.3%	6.7%	0.0%	0.3%	1.4%	25	80
MM_093	Marquette Mission	66.8%	14.1%	2.8%	1.3%	0.3%	4.7%	8.3%	0.0%	0.3%	1.1%	30	324
MM_094	Marquette Mission	66.6%	15.4%	2.4%	1.2%	0.2%	5.0%	7.3%	0.1%	0.3%	1.4%	33	330
MM_095	Marquette Mission	66.9%	15.6%	2.9%	1.0%	0.3%	2.3%	9.4%	0.0%	0.3%	1.1%	18	218
MM_096	Marquette Mission	66.9%	17.1%	2.7%	1.2%	0.2%	2.7%	7.3%	0.0%	0.4%	1.2%	13	56
MM_097	Marquette Mission	66.1%	15.4%	2.7%	1.4%	0.2%	4.1%	8.3%	0.0%	0.4%	1.2%	17	75
MM_098	Marquette Mission	67.6%	17.4%	2.4%	0.8%	0.2%	2.2%	7.3%	0.1%	0.5%	1.2%	58	217
MM_099	Marquette Mission	66.0%	16.8%	3.4%	0.6%	0.3%	2.9%	8.3%	0.1%	0.1%	1.2%	17	1241
MM_100	Marquette Mission	66.1%	15.4%	2.7%	1.5%	0.2%	3.9%	8.4%	0.0%	0.4%	1.2%	18	87
MM_101	Marquette Mission	66.9%	16.4%	2.7%	0.7%	0.2%	2.2%	9.5%	0.0%	0.4%	0.8%	12	29
MM_102	Marquette Mission	64.4%	15.7%	2.7%	1.4%	0.2%	5.3%	8.4%	0.0%	0.5%	1.1%	17	77
MM_103	Marquette Mission	67.7%	17.3%	2.3%	1.2%	0.2%	2.2%	7.2%	0.1%	0.5%	1.2%	23	75
MM_104	Marquette Mission	66.6%	16.0%	2.4%	1.5%	0.2%	3.6%	7.9%	0.0%	0.3%	1.3%	16	59
MM_105	Marquette Mission	65.5%	15.7%	2.6%	1.4%	0.2%	4.1%	8.6%	0.1%	0.4%	1.1%	15	53
MM_106	Marquette Mission	69.7%	16.6%	2.1%	1.1%	0.2%	1.9%	6.3%	0.1%	0.5%	1.5%	22	198
MM_107	Marquette Mission	69.5%	17.6%	1.8%	1.0%	0.1%	2.2%	5.8%	0.0%	0.5%	1.3%	23	50
MM_108	Marquette Mission	69.4%	17.5%	1.8%	1.1%	0.1%	2.2%	5.9%	0.0%	0.5%	1.3%	22	46
MM_110	Marquette Mission	67.7%	16.2%	2.7%	1.1%	0.2%	2.5%	7.4%	0.1%	0.3%	1.6%	63	129
MM_111	Marquette Mission	68.7%	17.1%	2.2%	0.8%	0.2%	2.0%	7.3%	0.2%	0.4%	0.9%	116	273
MM_112	Marquette Mission	68.8%	17.1%	2.2%	0.8%	0.2%	1.8%	7.4%	0.2%	0.5%	0.9%	120	283
MM_113	Marquette Mission	67.0%	15.5%	3.0%	1.0%	0.2%	2.4%	9.3%	0.0%	0.6%	0.8%	23	195
MM_114	Marquette Mission	68.5%	17.0%	2.2%	0.8%	0.2%	1.9%	7.4%	0.2%	0.6%	0.9%	118	289
MM_115	Marquette Mission	68.5%	14.9%	2.8%	0.9%	0.2%	2.4%	8.7%	0.0%	0.3%	0.9%	24	164
MM_117	Marquette Mission	66.0%	17.2%	2.9%	0.9%	0.2%	2.6%	7.7%	0.2%	0.4%	1.3%	27	281
MM_118	Marquette Mission	67.6%	17.2%	2.2%	1.2%	0.2%	1.8%	6.7%	0.0%	0.6%	2.0%	34	44
MM_119	Marquette Mission	67.2%	18.0%	1.8%	0.8%	0.1%	3.2%	6.4%	0.0%	0.5%	1.4%	24	79
MM_120	Marquette Mission	66.7%	17.5%	2.1%	0.9%	0.2%	2.6%	7.4%	0.1%	0.6%	1.6%	27	57
MP_01	Mormon Print Shop	68.4%	17.0%	1.1%	1.1%	0.2%	2.0%	6.9%	0.0%	0.3%	1.5%	8	964
MP_02	Mormon Print Shop	69.1%	13.9%	1.5%	1.4%	0.4%	2.9%	7.4%	0.1%	0.5%	1.4%	192	305
NL_02	New Lenox	64.5%	15.1%	2.9%	1.0%	0.4%	3.1%	10.3%	0.1%	0.4%	1.2%	169	143
NL_03	New Lenox	63.1%	18.1%	1.6%	3.8%	0.2%	4.9%	5.7%	0.1%	0.1%	1.1%	870	757
NL_12	New Lenox	62.5%	15.4%	2.7%	1.9%	0.2%	4.9%	9.6%	0.1%	0.5%	0.8%	517	1970
NV_01	Norge Village	66.3%	17.6%	2.3%	1.0%	0.2%	2.1%	6.9%	0.0%	0.3%	1.4%	25	54
PP_08	Peshtigo Point	62.5%	18.6%	2.6%	0.8%	0.2%	3.1%	7.4%	0.0%	0.4%	1.5%	11	48
PP_09	Peshtigo Point	66.5%	16.0%	2.8%	1.1%	0.2%	2.6%	7.6%	0.1%	0.5%	1.5%	63	158
PP_10	Peshtigo Point	62.4%	18.1%	2.9%	1.3%	0.2%	3.1%	8.5%	0.1%	0.2%	1.6%	35	313

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
MM_091	13	1	85	2	196	7	18	88	256	55	433	9	471	15	1
MM_092	15	1	61	2	181	6	13	141	205	30	430	12	526	14	1
MM_093	11	1	98	3	221	8	18	107	280	45	741	14	435	14	1
MM_094	10	1	114	2	207	9	18	342	352	36	752	15	374	12	1
MM_095	11	1	94	3	153	7	19	193	270	64	473	9	626	8	1
MM_096	13	1	95	3	183	6	20	101	229	30	172	13	356	13	1
MM_097	17	2	73	3	225	7	20	96	234	27	207	19	346	18	1
MM_098	10	1	99	3	145	7	20	104	135	39	285	11	410	9	1
MM_099	11	1	94	1	107	4	11	120	183	43	1040	14	474	5	1
MM_100	17	1	73	3	226	7	18	99	244	36	245	19	348	18	1
MM_101	8	1	110	3	161	8	20	231	217	37	933	9	478	11	1
MM_102	17	2	72	3	230	7	24	100	246	28	224	20	349	18	1
MM_103	14	1	101	3	297	11	25	117	356	36	529	15	365	15	1
MM_104	22	2	75	2	239	7	13	98	246	34	183	18	317	20	1
MM_105	19	1	73	3	285	9	21	79	179	42	178	20	390	21	1
MM_106	13	1	105	3	235	13	25	192	300	53	477	12	330	16	1
MM_107	15	1	89	4	246	11	26	101	318	34	330	16	291	13	1
MM_108	14	1	94	4	251	11	26	97	317	32	331	15	294	13	1
MM_110	11	1	104	2	285	9	15	89	186	41	222	12	420	19	1
MM_111	10	1	83	3	174	7	20	45	61	36	173	10	364	10	1
MM_112	10	1	84	3	172	7	22	43	60	33	154	10	367	9	1
MM_113	12	1	81	4	222	8	26	89	173	46	533	12	492	12	1
MM_114	10	1	80	5	171	8	26	47	62	42	145	9	367	9	1
MM_115	12	1	88	2	216	7	10	87	181	45	587	13	520	13	1
MM_117	10	1	101	2	180	7	11	157	301	47	396	12	497	9	1
MM_118	12	1	92	2	354	11	19	141	464	34	637	11	379	17	1
MM_119	16	1	58	2	185	6	9	146	209	27	439	13	553	14	1
MM_120	12	1	83	2	173	7	11	194	307	41	785	11	408	13	1
MP_01	18	0	109	2	298	8	15	140	217	57	202	25	551	37	2
MP_02	23	0	172	3	297	11	22	74	71	64	181	13	696	32	2
NL_02	14	0	108	4	269	11	32	45	44	41	180	12	468	14	1
NL_03	15	1	98	2	314	10	8	64	166	38	189	59	279	30	2
NL_12	10	0	72	4	312	11	26	39	65	166	188	28	397	32	2
NV_01	11	1	105	3	186	7	17	186	271	41	332	10	270	15	1
PP_08	12	1	87	3	126	7	19	82	468	41	1291	14	440	8	1
PP_09	11	0	102	3	222	9	20	87	179	42	238	16	451	20	1
PP_10	12	0	122	1	176	10	15	157	263	53	569	15	449	13	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
MM_091	3	78	0	109	2	4	1	0	1	2	86	1	1	2	2
MM_092	2	21	0	74	2	4	0	0	0	2	104	1	0	2	2
MM_093	1	106	0	103	2	5	1	0	0	2	104	0	0	2	2
MM_094	2	105	0	75	2	4	0	0	1	2	170	6	0	2	2
MM_095	3	25	0	107	2	3	0	0	6	2	247	6	0	5	2
MM_096	1	140	0	73	2	4	1	0	2	2	24	1	0	2	2
MM_097	2	40	0	93	3	5	1	0	1	2	23	0	0	4	2
MM_098	2	95	0	82	2	3	0	0	3	2	184	1	0	1	2
MM_099	6	119	0	66	1	2	0	0	0	1	160	5	1	5	1
MM_100	2	42	0	87	3	5	1	0	2	2	28	0	1	4	2
MM_101	2	16	0	102	2	3	0	0	0	2	206	10	0	2	2
MM_102	1	38	1	85	2	5	1	0	0	2	25	0	0	5	3
MM_103	4	17	0	84	3	5	1	0	0	3	219	1	0	2	2
MM_104	2	27	0	79	3	6	1	0	3	3	21	1	1	2	3
MM_105	2	55	0	71	3	6	1	0	2	3	21	1	1	2	3
MM_106	3	113	0	57	3	5	1	0	3	3	256	32	1	2	3
MM_107	3	72	0	75	2	4	1	0	2	2	131	1	1	1	2
MM_108	3	77	0	77	2	4	1	0	2	2	136	1	1	1	2
MM_110	2	73	0	79	3	5	1	0	5	3	62	1	2	2	2
MM_111	2	92	0	93	2	3	1	0	4	2	55	1	2	1	2
MM_112	2	94	0	93	2	3	0	0	1	2	56	1	1	1	2
MM_113	2	154	0	125	2	4	1	0	2	3	151	1	1	2	3
MM_114	3	92	0	97	2	3	0	0	1	2	59	1	1	1	2
MM_115	2	185	0	124	2	4	1	0	1	3	152	0	0	2	2
MM_117	2	110	0	97	2	3	0	0	0	2	133	2	0	2	2
MM_118	2	32	0	97	3	5	1	0	1	3	309	1	0	2	3
MM_119	2	24	0	65	2	4	1	0	4	2	107	0	0	2	2
MM_120	1	73	0	62	2	4	0	0	0	2	246	34	0	3	2
MP_01	2181	473	1	59	3	6	1	0	7	3	297	4	0	1	3
MP_02	1	525	0	121	4	7	1	0	13	3	82	2	0	1	3
NL_02	1	27	0	44	3	6	1	0	0	3	10	1	0	2	3
NL_03	2	13	1	164	4	9	1	0	1	4	21	2	1	2	4
NL_12	2	12	0	88	4	7	1	0	0	3	39	1	0	2	3
NV_01	1	134	0	42	2	3	0	0	0	2	151	17	0	1	1
PP_08	6	179	0	63	2	3	0	0	2	2	360	1	0	4	2
PP_09	503	90	0	74	3	5	1	0	0	3	64	1	0	2	3
PP_10	8	122	0	79	3	5	1	0	1	3	222	35	1	3	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
MM_091	1	0	1	0	1	0	0	0	0	0	1	1
MM_092	0	0	1	0	0	0	0	0	0	0	0	1
MM_093	1	0	1	0	0	0	0	0	0	0	0	1
MM_094	1	0	1	0	0	0	0	0	0	0	0	1
MM_095	0	0	1	0	0	0	0	0	0	0	1	1
MM_096	0	0	0	0	0	0	0	0	0	0	0	1
MM_097	1	0	1	0	1	0	0	0	0	0	1	1
MM_098	0	0	0	0	0	0	0	0	0	0	1	0
MM_099	0	0	0	0	0	0	0	0	0	0	0	0
MM_100	1	0	1	0	1	0	0	0	0	0	1	1
MM_101	1	0	1	0	0	0	0	0	0	0	0	0
MM_102	1	0	1	0	1	0	0	0	0	0	1	1
MM_103	1	0	0	0	1	0	0	0	0	0	1	1
MM_104	1	0	1	0	1	0	0	0	0	0	1	1
MM_105	1	0	1	0	1	0	1	0	1	0	1	1
MM_106	1	0	1	0	1	0	0	0	1	0	1	1
MM_107	1	0	1	0	0	0	1	0	1	0	1	1
MM_108	1	0	1	0	0	0	0	0	1	0	1	1
MM_110	1	0	3	0	1	0	0	0	1	0	1	1
MM_111	1	0	1	0	1	0	0	0	1	0	2	1
MM_112	1	0	1	0	1	0	0	0	1	0	1	1
MM_113	1	0	1	0	1	0	1	0	1	0	1	1
MM_114	1	0	1	0	1	0	0	0	1	0	1	1
MM_115	0	0	0	0	0	0	0	0	0	0	0	1
MM_117	0	0	0	0	0	0	0	0	0	0	0	1
MM_118	1	0	0	0	1	0	0	0	0	0	1	1
MM_119	0	0	0	0	0	0	0	0	0	0	0	1
MM_120	1	0	0	0	0	0	0	0	0	0	0	1
MP_01	1	0	1	0	1	0	0	0	0	0	1	1
MP_02	1	0	1	0	0	0	0	0	0	0	1	1
NL_02	1	0	0	0	0	0	0	0	0	0	0	1
NL_03	1	0	1	0	1	0	1	0	1	0	1	2
NL_12	1	0	1	0	1	0	0	0	0	0	1	1
NV_01	0	0	0	0	0	0	0	0	0	0	0	0
PP_08	0	0	0	0	0	0	0	0	0	0	0	0
PP_09	0	0	0	0	0	0	0	0	0	0	1	1
PP_10	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
PP_11	Peshtigo Point	66.0%	18.6%	2.0%	0.8%	0.1%	3.6%	4.9%	0.0%	0.4%	2.0%	25	84
RB_05	Red Banks	64.7%	15.1%	2.0%	1.1%	0.4%	2.6%	11.4%	0.0%	0.7%	1.2%	68	298
RB_09	Red Banks	68.0%	17.1%	2.0%	1.1%	0.2%	2.2%	6.5%	0.0%	0.6%	1.3%	27	73
RI_002b	Rock Island 3a	68.8%	15.0%	2.2%	0.8%	0.3%	2.1%	7.9%	0.0%	0.4%	1.0%	26	431
RI_010	Rock Island 3a	66.6%	15.6%	2.5%	0.8%	0.3%	2.3%	9.2%	0.0%	0.5%	1.0%	59	1635
SJ_26	Fort St. Joseph	67.5%	15.4%	2.8%	0.7%	0.2%	2.1%	9.6%	0.0%	0.5%	0.9%	24	379
SJ_31	Fort St. Joseph	69.6%	16.1%	1.9%	0.9%	0.1%	1.7%	7.3%	0.0%	0.5%	1.6%	175	661
SJ_41	Fort St. Joseph	66.0%	16.9%	1.8%	0.8%	0.5%	2.6%	10.2%	0.0%	0.1%	0.9%	60	759
SL_06_1	Fort St. Louis	67.5%	16.6%	2.9%	0.8%	0.2%	2.3%	7.6%	0.0%	0.4%	1.6%	16	330
ZM_23	Zimmerman	67.4%	15.0%	2.5%	1.3%	0.2%	3.7%	8.2%	0.0%	0.4%	1.1%	16	56
ZM_24	Zimmerman	69.2%	16.6%	2.0%	0.8%	0.2%	3.2%	5.9%	0.0%	0.5%	1.4%	19	47
ZM_25	Zimmerman	68.1%	17.9%	2.2%	1.0%	0.2%	1.8%	6.8%	0.0%	0.4%	1.5%	23	37
ZM_26	Zimmerman	66.5%	18.1%	2.6%	1.1%	0.2%	2.2%	7.3%	0.0%	0.3%	1.5%	33	53
ZM_27	Zimmerman	66.9%	18.2%	2.5%	1.1%	0.2%	2.2%	6.9%	0.0%	0.5%	1.5%	22	40
ZM_28	Zimmerman	68.5%	16.8%	2.4%	1.1%	0.2%	2.1%	6.8%	0.0%	0.5%	1.6%	23	60
ZM_29	Zimmerman	67.2%	15.3%	2.5%	1.3%	0.2%	3.6%	8.0%	0.0%	0.6%	1.2%	12	52
ZM_30	Zimmerman	68.7%	18.6%	2.0%	0.8%	0.2%	1.9%	5.6%	0.1%	0.5%	1.5%	30	195
ZM_31	Zimmerman	68.2%	17.0%	2.2%	1.1%	0.2%	2.4%	6.8%	0.1%	0.4%	1.6%	18	130
ZM_32	Zimmerman	69.1%	18.0%	1.9%	1.3%	0.2%	2.0%	5.4%	0.0%	0.5%	1.6%	28	196
ZM_33	Zimmerman	67.1%	17.8%	2.1%	1.0%	0.2%	3.4%	6.3%	0.0%	0.5%	1.4%	16	42
ZM_34	Zimmerman	66.3%	15.2%	2.6%	1.4%	0.2%	3.8%	8.8%	0.0%	0.5%	1.2%	12	75
ZM_35	Zimmerman	68.2%	18.6%	2.1%	0.6%	0.2%	2.9%	5.5%	0.0%	0.4%	1.3%	53	90
ZM_36	Zimmerman	68.5%	17.5%	2.1%	1.0%	0.2%	2.4%	6.4%	0.0%	0.5%	1.4%	20	226
ZM_37	Zimmerman	68.4%	17.2%	1.8%	0.8%	0.1%	3.2%	6.7%	0.0%	0.4%	1.3%	16	54
ZM_38	Zimmerman	68.6%	16.7%	2.8%	0.6%	0.2%	2.7%	7.2%	0.0%	0.4%	0.9%	5	137
ZM_40	Zimmerman	65.9%	20.0%	2.3%	0.6%	0.2%	3.1%	5.9%	0.0%	0.3%	1.4%	60	99
ZM_41	Zimmerman	61.9%	20.2%	3.3%	0.7%	0.3%	2.7%	9.3%	0.0%	0.3%	1.2%	18	309
ZM_42	Zimmerman	65.4%	20.3%	2.3%	0.6%	0.2%	3.2%	6.0%	0.0%	0.3%	1.5%	61	110
ZM_43	Zimmerman	63.8%	16.7%	3.0%	1.3%	0.3%	4.4%	9.0%	0.0%	0.4%	1.1%	12	35
ZM_44	Zimmerman	63.6%	16.6%	3.0%	1.4%	0.3%	4.4%	9.1%	0.0%	0.4%	1.1%	12	34
ZM_45	Zimmerman	64.2%	19.7%	2.7%	0.9%	0.2%	2.1%	8.3%	0.2%	0.2%	1.5%	19	26
ZM_51	Zimmerman	68.2%	17.4%	2.0%	0.7%	0.2%	3.1%	5.9%	0.0%	0.4%	1.9%	28	81
ZM_55	Zimmerman	68.2%	17.7%	2.0%	0.9%	0.2%	2.8%	5.9%	0.0%	0.4%	1.7%	48	148
ZM_59	Zimmerman	66.9%	17.7%	2.2%	1.0%	0.1%	2.5%	7.6%	0.0%	0.6%	1.1%	30	265
ZM_60	Zimmerman	69.4%	17.1%	2.2%	1.1%	0.1%	1.7%	6.2%	0.1%	0.5%	1.6%	24	223

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
PP_11	9	0	86	3	137	6	16	145	132	28	242	15	235	11	1
RB_05	12	0	99	2	73	11	15	171	220	117	268	20	519	18	1
RB_09	12	0	81	2	90	12	13	98	308	53	318	11	330	16	1
RI_002b	13	0	99	2	166	9	10	42	151	30	422	12	360	11	1
RI_010	10	0	91	2	112	9	10	49	124	31	264	11	412	16	1
SJ_26	9	1	87	4	141	6	17	65	179	77	446	10	469	9	1
SJ_31	15	0	73	4	163	9	12	85	60	23	186	10	365	16	1
SJ_41	13	0	113	1	193	7	5	87	131	105	191	18	1042	18	1
SL_06_1	11	1	83	1	89	5	0	139	291	29	866	15	564	9	1
ZM_23	15	1	82	4	217	7	22	99	244	26	238	18	329	17	1
ZM_24	11	0	103	4	209	7	20	260	364	49	572	14	322	20	1
ZM_25	11	0	103	4	220	9	22	121	295	29	446	9	349	13	1
ZM_26	15	1	106	2	216	7	18	177	278	41	496	12	354	13	1
ZM_27	14	1	100	3	204	8	21	158	232	39	419	12	333	12	1
ZM_28	14	1	103	4	225	8	23	170	258	40	307	11	309	15	1
ZM_29	15	1	81	3	210	7	24	94	233	25	223	17	305	16	1
ZM_30	8	0	92	4	159	9	21	180	217	36	337	8	283	9	1
ZM_31	10	0	96	4	192	10	22	156	186	37	357	13	313	11	1
ZM_32	12	1	90	4	166	7	23	276	270	31	715	9	263	11	1
ZM_33	9	0	101	3	216	7	19	257	364	49	545	13	309	19	1
ZM_34	21	1	80	4	218	7	24	93	238	60	214	25	303	15	1
ZM_35	9	0	96	4	93	6	21	87	225	24	352	11	265	5	0
ZM_36	15	0	92	4	215	8	23	344	320	42	774	18	292	17	1
ZM_37	16	0	59	4	179	7	21	142	202	25	426	14	467	12	1
ZM_38	10	0	99	3	112	5	20	69	255	28	697	14	320	5	0
ZM_40	12	0	109	3	100	6	14	93	246	22	400	14	292	5	0
ZM_41	13	0	126	3	169	7	21	123	241	65	677	19	396	9	1
ZM_42	10	0	107	3	100	6	15	96	251	26	428	12	301	6	0
ZM_43	13	1	97	3	219	7	21	73	175	27	160	19	348	15	1
ZM_44	14	1	99	3	232	7	22	74	174	27	164	19	358	16	1
ZM_45	14	0	109	1	188	7	10	60	48	30	125	16	451	11	1
ZM_51	12	0	92	3	199	6	15	265	368	49	663	16	360	23	1
ZM_55	12	1	94	3	208	7	17	286	441	49	592	17	361	21	1
ZM_59	13	0	88	4	243	11	22	136	410	58	429	26	407	16	1
ZM_60	11	1	97	4	230	14	26	195	302	59	577	12	365	17	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
PP_11	117	39	0	41	2	3	0	0	0	2	64	2	1	2	2
RB_05	12	33	0	100	3	8	1	0	2	3	167	6	0	1	3
RB_09	5	37	0	78	3	6	1	0	2	3	121	1	0	1	2
RI_002b	1	145	0	94	2	4	1	0	0	2	113	0	0	2	2
RI_010	1	723	0	89	3	5	1	0	0	3	140	1	0	2	2
SJ_26	1	80	0	110	2	3	0	0	0	2	149	0	0	3	2
SJ_31	2	1340	0	56	3	5	1	0	2	2	47	1	0	1	3
SJ_41	1	199	0	38	2	4	1	0	1	2	77	5	0	2	2
SL_06_1	3	344	0	79	2	4	1	0	0	2	181	1	0	2	2
ZM_23	1	38	0	71	2	4	1	0	0	2	21	0	0	3	2
ZM_24	8	247	0	66	2	3	1	0	5	2	690	1	0	2	1
ZM_25	0	63	0	62	2	4	0	0	0	2	170	5	0	2	2
ZM_26	2	30	0	61	2	4	0	0	1	2	205	27	0	1	2
ZM_27	0	32	0	55	2	3	1	0	0	2	178	21	0	1	2
ZM_28	0	29	0	51	2	4	0	0	0	2	131	22	0	4	2
ZM_29	0	35	0	61	2	4	1	0	1	2	20	0	0	4	2
ZM_30	0	1545	0	51	2	3	0	0	7	2	137	21	0	1	1
ZM_31	0	198	0	74	2	3	0	0	0	2	125	4	0	2	2
ZM_32	2	89	0	48	2	3	0	0	5	2	162	5	0	2	1
ZM_33	1	217	0	62	1	3	0	0	0	2	616	1	1	2	1
ZM_34	1	32	1	58	2	4	0	0	0	2	18	0	0	3	2
ZM_35	1	286	0	44	1	2	0	0	0	1	114	0	0	1	1
ZM_36	0	71	0	48	1	3	0	0	249	2	121	3	0	1	1
ZM_37	0	18	0	47	2	3	0	0	1	1	74	0	0	1	1
ZM_38	1	44	0	41	1	2	0	0	1	1	74	0	0	1	1
ZM_40	1	309	0	50	1	2	0	0	0	1	126	0	0	1	1
ZM_41	2	257	0	56	1	2	0	0	0	2	192	1	0	3	1
ZM_42	1	337	0	50	1	2	0	0	0	1	132	0	0	1	1
ZM_43	0	23	0	65	2	4	1	0	0	2	12	0	0	2	2
ZM_44	0	22	0	75	2	4	1	0	0	2	13	0	0	2	2
ZM_45	1	25	0	77	2	4	1	0	0	2	25	1	1	1	2
ZM_51	1	266	0	63	2	3	0	0	0	2	811	1	0	4	2
ZM_55	2	302	0	84	2	4	1	0	1	2	767	5	0	3	2
ZM_59	1	290	0	96	3	5	1	0	0	2	224	1	0	2	3
ZM_60	0	148	0	69	3	6	1	0	2	3	323	41	0	2	3

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
PP_11	1	0	1	0	0	0	0	0	0	0	0	0
RB_05	1	0	1	0	0	0	0	0	0	0	1	1
RB_09	0	0	0	0	0	0	0	0	0	0	0	1
RI_002b	0	0	0	0	0	0	0	0	0	0	0	0
RI_010	1	0	0	0	0	0	0	0	0	0	0	0
SJ_26	0	0	0	0	0	0	0	0	0	0	0	0
SJ_31	1	0	1	0	1	0	0	0	0	0	1	1
SJ_41	1	0	0	0	0	0	0	0	0	0	1	1
SL_06_1	0	0	0	0	0	0	0	0	0	0	0	1
ZM_23	1	0	0	0	0	0	0	0	0	0	0	1
ZM_24	0	0	0	0	0	0	0	0	0	0	1	0
ZM_25	0	0	0	0	0	0	0	0	0	0	0	1
ZM_26	0	0	0	0	0	0	0	0	0	0	0	0
ZM_27	0	0	0	0	0	0	0	0	0	0	0	0
ZM_28	0	0	0	0	0	0	0	0	0	0	0	0
ZM_29	0	0	0	0	0	0	0	0	0	0	0	1
ZM_30	0	0	0	0	0	0	0	0	0	0	0	0
ZM_31	0	0	0	0	0	0	0	0	0	0	0	0
ZM_32	0	0	0	0	0	0	0	0	0	0	0	0
ZM_33	0	0	0	0	0	0	0	0	0	0	1	0
ZM_34	0	0	0	0	0	0	0	0	0	0	0	1
ZM_35	0	0	0	0	0	0	0	0	0	0	0	0
ZM_36	0	0	0	0	0	0	0	0	0	0	0	0
ZM_37	0	0	0	0	0	0	0	0	0	0	0	0
ZM_38	0	0	0	0	0	0	0	0	0	0	0	0
ZM_40	0	0	0	0	0	0	0	0	0	0	0	0
ZM_41	0	0	0	0	0	0	0	0	0	0	0	0
ZM_42	0	0	0	0	0	0	0	0	0	0	0	0
ZM_43	0	0	0	0	0	0	0	0	0	0	0	1
ZM_44	0	0	0	0	0	0	0	0	0	0	0	1
ZM_45	1	0	1	0	0	0	0	0	0	0	1	1
ZM_51	0	0	0	0	0	0	0	0	0	0	1	1
ZM_55	0	0	0	0	0	0	0	0	0	0	1	1
ZM_59	0	0	0	0	0	0	0	0	0	0	1	1
ZM_60	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	Subgroup: P-low-Mg (n=104)												
CAD_1_1	Cadotte	68.2%	14.1%	1.1%	1.0%	0.5%	3.6%	8.7%	0.1%	0.6%	1.5%	53	657
CM_24	Fort Michilimackinac	67.3%	10.6%	1.5%	1.1%	0.7%	8.1%	7.7%	0.0%	0.4%	0.8%	33	265
CM_26	Fort Michilimackinac	66.3%	15.4%	1.4%	0.9%	0.7%	4.0%	7.2%	0.0%	0.3%	1.1%	28	74
CM_27	Fort Michilimackinac	67.0%	15.1%	1.4%	0.8%	0.7%	3.6%	7.0%	0.0%	0.4%	1.1%	25	58
CM_28	Fort Michilimackinac	67.5%	14.1%	1.2%	0.9%	0.8%	4.3%	6.9%	0.0%	0.4%	1.2%	27	25
CM_29	Fort Michilimackinac	64.3%	16.7%	1.4%	0.8%	0.8%	4.2%	8.5%	0.0%	0.4%	0.8%	12	151
CM_30	Fort Michilimackinac	65.9%	15.7%	1.3%	0.8%	0.7%	3.7%	7.2%	0.0%	0.4%	1.2%	25	28
CM_31	Fort Michilimackinac	67.3%	15.0%	1.3%	0.6%	1.0%	3.4%	7.2%	0.0%	0.4%	1.2%	53	463
CM_32	Fort Michilimackinac	65.4%	14.8%	1.3%	1.0%	0.7%	4.8%	7.5%	0.0%	0.4%	1.1%	27	30
CM_33	Fort Michilimackinac	66.4%	14.6%	1.3%	1.0%	0.8%	4.8%	7.6%	0.0%	0.4%	1.1%	28	26
CM_34	Fort Michilimackinac	64.6%	15.9%	1.4%	0.9%	0.6%	4.0%	8.0%	0.0%	0.4%	0.9%	48	593
CM_35	Fort Michilimackinac	65.1%	15.8%	1.4%	0.9%	0.7%	4.2%	7.6%	0.0%	0.4%	1.2%	49	30
CM_36	Fort Michilimackinac	65.8%	15.9%	1.4%	0.7%	0.7%	3.8%	7.5%	0.0%	0.4%	1.3%	34	56
CM_37	Fort Michilimackinac	65.3%	15.0%	1.3%	0.8%	0.6%	3.7%	8.1%	0.0%	0.4%	1.1%	56	369
CM_38	Fort Michilimackinac	66.7%	14.7%	1.2%	0.6%	1.1%	4.1%	7.6%	0.1%	0.3%	1.2%	46	32
CM_39	Fort Michilimackinac	65.4%	15.8%	1.3%	0.8%	0.7%	3.7%	7.3%	0.0%	0.4%	1.4%	32	62
CM_40	Fort Michilimackinac	65.6%	16.0%	1.3%	1.0%	0.7%	3.5%	8.1%	0.0%	0.4%	1.1%	50	145
CM_41	Fort Michilimackinac	65.5%	16.4%	1.3%	0.6%	0.7%	3.6%	7.1%	0.0%	0.3%	1.4%	39	85
CM_42	Fort Michilimackinac	66.3%	15.3%	1.3%	0.6%	0.9%	3.6%	7.2%	0.0%	0.3%	1.4%	78	755
CM_43	Fort Michilimackinac	66.7%	15.2%	1.4%	0.9%	0.7%	3.9%	7.4%	0.0%	0.3%	1.4%	32	198
CM_44	Fort Michilimackinac	63.7%	17.0%	1.4%	0.8%	0.7%	4.3%	8.7%	0.0%	0.4%	1.0%	27	329
CM_45	Fort Michilimackinac	64.9%	16.6%	1.4%	0.7%	0.7%	4.1%	8.3%	0.0%	0.4%	0.9%	27	287
CM_46	Fort Michilimackinac	64.5%	16.6%	1.5%	0.7%	0.7%	4.2%	8.5%	0.0%	0.4%	1.0%	28	342
CM_47	Fort Michilimackinac	66.3%	14.1%	1.6%	1.2%	0.7%	4.8%	8.2%	0.0%	0.4%	1.0%	125	412
CM_48	Fort Michilimackinac	65.5%	16.1%	1.4%	0.9%	0.7%	4.2%	7.5%	0.0%	0.4%	1.2%	32	69
CM_56	Fort Michilimackinac	63.7%	15.0%	1.9%	0.9%	0.8%	4.7%	8.8%	0.1%	0.3%	1.8%	69	212
DI_09	Doty Island Village	65.8%	14.0%	1.3%	0.9%	0.8%	5.5%	7.8%	0.1%	0.5%	1.5%	93	1049
DI_10	Doty Island Village	68.2%	15.5%	1.4%	0.9%	0.7%	3.7%	6.5%	0.0%	0.4%	1.4%	103	604
DI_11	Doty Island Village	66.6%	14.4%	1.9%	0.8%	0.8%	4.6%	7.3%	0.1%	0.5%	1.7%	64	988
M_08	Mahler	70.2%	13.4%	1.2%	0.9%	0.8%	4.5%	6.3%	0.0%	0.5%	1.0%	25	93
M_09	Mahler	68.5%	9.8%	1.2%	1.2%	0.6%	8.7%	7.4%	0.1%	0.6%	0.7%	143	133
M_11	Mahler	69.5%	12.0%	1.2%	1.2%	0.6%	5.4%	7.4%	0.1%	0.6%	0.9%	142	205
M_12	Mahler	70.0%	13.7%	1.2%	0.7%	1.2%	3.9%	6.5%	0.1%	0.4%	1.3%	49	149
M_22	Mahler	68.4%	15.2%	1.4%	0.9%	0.7%	3.7%	7.3%	0.0%	0.6%	1.1%	24	50
M_23	Mahler	68.5%	15.6%	1.4%	0.9%	0.6%	3.7%	6.9%	0.0%	0.7%	1.2%	39	53
MA_05	Marina	69.4%	14.1%	1.2%	0.9%	0.7%	3.5%	7.7%	0.0%	0.4%	1.1%	48	121

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	Subgroup: P-low-Mg (n=104)														
CAD_1_1	16	1	179	2	362	10	11	82	91	51	192	26	512	25	1
CM_24	19	0	121	4	216	10	21	136	161	60	173	54	700	16	1
CM_26	20	1	125	3	160	7	15	49	42	68	52	13	660	12	1
CM_27	17	0	127	4	148	7	19	56	68	72	89	14	598	11	1
CM_28	19	0	108	4	162	8	22	65	47	59	60	8	502	13	1
CM_29	14	0	136	4	151	6	20	44	89	74	97	14	606	11	1
CM_30	17	0	125	4	160	7	20	55	60	67	69	15	538	11	1
CM_31	13	1	122	4	133	6	21	83	59	68	99	14	455	8	1
CM_32	21	0	104	4	185	8	17	48	32	62	55	10	615	16	1
CM_33	22	1	110	4	186	8	18	49	33	60	51	11	624	17	1
CM_34	22	1	119	4	176	8	17	76	115	71	174	12	714	13	1
CM_35	18	0	122	4	183	7	19	59	65	71	86	16	652	14	1
CM_36	17	1	118	4	142	6	20	65	64	103	82	18	676	11	1
CM_37	19	0	115	4	173	7	19	87	136	66	119	24	597	16	1
CM_38	10	0	146	2	143	5	12	100	91	72	162	17	576	11	1
CM_39	17	0	135	3	161	7	15	58	63	81	81	17	677	13	1
CM_40	17	0	145	4	198	8	16	74	117	90	143	17	708	15	1
CM_41	14	0	127	3	124	5	14	63	60	92	73	18	648	10	1
CM_42	12	0	122	3	134	5	14	90	63	72	120	16	570	10	1
CM_43	17	0	125	4	182	8	16	60	74	81	120	13	740	15	1
CM_44	16	0	135	3	147	6	14	57	114	80	150	18	772	13	1
CM_45	16	0	123	3	140	6	17	54	109	77	135	17	727	12	1
CM_46	15	1	127	4	145	6	17	56	111	79	143	17	739	12	1
CM_47	28	1	118	4	232	11	19	143	171	69	186	17	846	19	2
CM_48	22	0	113	4	170	7	19	52	46	76	51	14	733	13	2
CM_56	23	0	120	3	182	8	13	216	337	66	1132	8	807	18	1
DI_09	16	0	125	2	39	9	7	58	68	73	165	12	422	18	1
DI_10	15	0	107	2	33	8	4	66	78	140	74	11	808	14	1
DI_11	20	0	92	2	34	7	5	195	321	78	1075	8	672	16	1
M_08	18	0	92	2	34	8	6	44	32	57	52	10	515	13	1
M_09	21	0	82	2	49	11	10	56	62	57	97	53	621	20	2
M_11	27	0	85	2	48	11	11	57	68	56	108	19	615	19	2
M_12	8	0	107	2	28	5	6	91	90	66	138	15	499	10	1
M_22	17	1	118	3	166	6	13	50	50	82	35	10	681	13	1
M_23	20	1	101	3	157	7	18	68	70	88	55	10	650	13	1
MA_05	14	1	150	2	181	5	7	50	62	135	97	26	704	13	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	Subgroup: P-low-Mg (n=104)														
CAD_1_1	3	796	0	54	3	5	1	0	0	2	77	2	0	1	2
CM_24	0	582	0	50	2	4	1	0	0	2	122	1	0	1	2
CM_26	32	244	0	42	2	3	0	0	249	2	48	1	0	2	2
CM_27	77	67	0	35	2	3	0	0	6	1	62	1	0	1	2
CM_28	2	366	0	46	2	3	0	0	19	2	40	1	0	1	2
CM_29	21	117	0	61	2	3	0	0	1	3	40	5	0	1	1
CM_30	5	41	0	34	2	3	0	0	7	1	47	1	0	1	1
CM_31	2	231	0	35	1	2	0	0	2	1	42	0	0	1	1
CM_32	1	450	0	57	3	4	1	0	1	2	34	1	0	1	2
CM_33	1	449	0	54	3	4	1	0	3	2	34	1	2	1	2
CM_34	21	379	0	91	2	4	1	0	0	3	80	12	0	2	2
CM_35	128	71	0	109	3	6	1	0	1	2	73	1	2	2	3
CM_36	3	79	0	47	2	3	0	0	1	2	65	2	0	1	2
CM_37	3	2091	0	56	2	4	0	0	2	2	124	1	0	1	2
CM_38	6	231	0	51	2	3	0	0	7	1	126	1	0	1	2
CM_39	3	57	0	45	2	4	1	0	6	2	71	1	0	1	2
CM_40	14	96	0	95	3	5	1	0	10	4	84	8	0	1	2
CM_41	14	69	0	61	2	3	0	0	26	1	68	1	0	1	2
CM_42	63	339	0	53	2	3	0	0	48	1	69	1	0	1	2
CM_43	91	92	0	60	3	5	1	0	129	2	87	1	0	1	2
CM_44	3	144	0	103	2	4	1	0	0	3	89	11	0	2	2
CM_45	2	139	0	98	2	4	1	0	3	3	83	10	2	2	2
CM_46	2	145	0	107	2	4	1	0	0	3	82	10	2	3	2
CM_47	416	820	4	105	5	9	3	1	0	2	188	4	2	1	4
CM_48	22	316	0	53	2	4	1	0	4	2	60	1	1	2	2
CM_56	4	64	0	59	3	5	1	0	4	2	259	3	0	2	3
DI_09	4	167	0	59	2	5	1	0	0	2	72	2	0	1	2
DI_10	4	132	0	43	3	5	1	0	0	2	107	1	0	1	2
DI_11	3	39	0	52	2	5	1	0	0	2	216	2	0	1	2
M_08	1	297	0	44	2	4	1	0	0	2	28	1	0	1	2
M_09	1	658	0	91	3	6	1	0	0	2	43	1	0	1	2
M_11	1	689	0	96	3	6	1	0	0	2	54	1	0	1	2
M_12	2	150	0	50	2	3	0	0	0	1	107	1	0	1	1
M_22	1	38	0	42	2	4	1	0	3	2	51	1	1	1	3
M_23	1	236	0	47	2	4	1	0	1	2	59	3	1	1	2
MA_05	3	57	0	73	3	4	1	0	0	2	73	4	0	1	2

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	Subgroup: P-low-Mg (n=104)											
CAD_1_1	0	0	0	0	0	0	0	0	0	0	1	1
CM_24	0	0	0	0	0	0	0	0	0	0	0	1
CM_26	1	0	1	0	0	0	0	0	0	0	1	1
CM_27	0	0	0	0	0	0	0	0	0	0	0	1
CM_28	0	0	0	0	0	0	0	0	0	0	0	1
CM_29	0	0	0	0	0	0	0	0	0	0	0	0
CM_30	0	0	0	0	0	0	0	0	0	0	0	0
CM_31	0	0	0	0	0	0	0	0	0	0	0	0
CM_32	1	0	1	0	0	0	0	0	0	0	1	1
CM_33	1	0	0	0	0	0	0	0	0	0	1	1
CM_34	1	0	1	0	1	0	0	0	0	0	0	1
CM_35	1	0	1	0	1	0	0	0	0	0	0	1
CM_36	0	0	0	0	0	0	0	0	0	0	0	1
CM_37	0	0	0	0	0	0	0	0	0	0	1	1
CM_38	0	0	0	0	0	0	0	0	0	0	0	1
CM_39	1	0	0	0	0	0	0	0	0	0	0	1
CM_40	1	0	1	0	1	0	0	0	0	0	1	1
CM_41	0	0	0	0	0	0	0	0	0	0	0	1
CM_42	0	0	0	0	0	0	0	0	0	0	0	1
CM_43	1	0	1	0	0	0	0	0	0	0	0	1
CM_44	1	0	1	0	1	0	0	0	0	0	0	1
CM_45	1	0	1	0	1	0	0	0	0	0	0	1
CM_46	1	0	1	0	1	0	0	0	0	0	0	1
CM_47	2	1	1	1	1	0	1	0	1	1	1	1
CM_48	0	0	0	0	0	0	0	0	0	0	1	1
CM_56	1	0	1	0	1	0	0	0	0	0	1	1
DI_09	0	0	0	0	0	0	0	0	0	0	1	1
DI_10	0	0	0	0	0	0	0	0	0	0	0	1
DI_11	0	0	0	0	0	0	0	0	0	0	0	1
M_08	0	0	0	0	0	0	0	0	0	0	0	1
M_09	0	0	0	0	0	0	0	0	0	0	1	1
M_11	0	0	0	0	0	0	0	0	0	0	1	1
M_12	0	0	0	0	0	0	0	0	0	0	0	1
M_22	1	0	2	0	1	0	1	0	1	0	1	1
M_23	1	0	2	0	2	0	0	0	2	0	1	1
MA_05	1	0	1	0	1	0	0	0	0	0	0	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
MA_06	Marina	70.2%	12.8%	1.0%	0.9%	0.8%	5.2%	6.6%	0.0%	0.5%	1.2%	49	51
MA_07	Marina	69.0%	14.5%	1.3%	0.9%	0.7%	4.0%	7.1%	0.0%	0.5%	1.2%	40	121
MA_08	Marina	70.2%	14.4%	1.2%	0.5%	1.0%	3.4%	6.8%	0.0%	0.3%	1.2%	181	427
MA_09	Marina	68.1%	14.4%	1.2%	0.7%	1.2%	4.2%	7.6%	0.1%	0.4%	1.4%	80	61
MA_10	Marina	69.9%	14.8%	1.2%	0.5%	1.0%	3.6%	6.6%	0.0%	0.3%	1.2%	80	301
MA_11	Marina	68.3%	16.2%	1.2%	0.7%	0.7%	3.3%	7.0%	0.0%	0.3%	1.0%	38	85
MA_17	La Point (surface)	66.2%	13.1%	1.3%	0.9%	0.8%	6.1%	8.6%	0.0%	0.4%	1.2%	155	4150
RI_007	Rock Island 3b	67.2%	15.8%	1.3%	0.8%	0.7%	3.4%	7.9%	0.0%	0.4%	1.2%	39	118
RI_016	Rock Island 3b	67.9%	14.8%	1.2%	0.6%	1.1%	3.8%	7.8%	0.1%	0.3%	1.1%	40	68
RI_018	Rock Island 2	67.9%	15.5%	1.3%	0.7%	0.7%	3.8%	7.2%	0.0%	0.4%	1.3%	28	164
RI_019	Rock Island 2	68.0%	15.3%	1.3%	0.8%	0.7%	3.9%	7.3%	0.0%	0.4%	1.2%	29	175
RI_020	Rock Island 2	67.6%	15.7%	1.3%	0.7%	0.7%	3.8%	7.4%	0.0%	0.4%	1.2%	29	179
RI_021	Rock Island 2	67.2%	15.9%	1.4%	0.7%	0.7%	3.8%	7.1%	0.0%	0.4%	1.2%	29	195
RI_034	Rock Island 3b	67.5%	14.4%	1.2%	1.0%	0.9%	4.9%	7.3%	0.0%	0.4%	1.1%	27	202
RI_035	Rock Island 3b	66.8%	13.9%	1.3%	0.7%	1.2%	5.5%	7.4%	0.0%	0.4%	1.2%	141	649
RI_036	Rock Island 3b	66.8%	15.5%	1.4%	0.9%	0.8%	4.1%	7.4%	0.0%	0.4%	1.3%	36	286
RI_037	Rock Island 3b	68.0%	15.3%	1.3%	0.8%	0.7%	4.1%	6.9%	0.0%	0.4%	1.3%	29	141
RI_039	Rock Island 3b	66.3%	15.4%	1.5%	0.9%	0.9%	5.1%	7.0%	0.0%	0.4%	1.3%	40	443
RI_040	Rock Island 3b	68.0%	15.2%	1.3%	0.7%	1.0%	3.6%	7.2%	0.0%	0.3%	1.2%	119	599
RI_041	Rock Island 3b	68.4%	14.9%	1.4%	0.6%	1.1%	3.5%	7.2%	0.0%	0.4%	1.2%	139	668
RI_042	Rock Island 3b	68.0%	14.2%	1.3%	0.9%	0.8%	4.7%	7.3%	0.0%	0.5%	1.0%	28	56
RI_043	Rock Island 3b	68.6%	14.8%	1.3%	0.9%	0.7%	3.8%	7.2%	0.0%	0.4%	1.2%	25	65
RI_044	Rock Island 3b	67.9%	14.7%	1.4%	0.7%	1.1%	3.7%	7.5%	0.0%	0.3%	1.3%	116	618
RI_045	Rock Island 3b	68.2%	15.4%	1.4%	0.8%	0.8%	3.8%	7.2%	0.0%	0.4%	1.0%	27	58
RI_046	Rock Island 3b	67.8%	15.3%	1.4%	0.8%	0.7%	4.0%	7.5%	0.0%	0.4%	1.0%	29	122
RI_047	Rock Island 3b	68.2%	14.9%	1.4%	0.6%	1.1%	3.5%	7.3%	0.0%	0.4%	1.2%	143	688
RI_048	Rock Island 3b	67.5%	15.3%	1.4%	0.6%	1.1%	3.6%	7.5%	0.0%	0.3%	1.3%	123	653
RI_059	Rock Island 4	64.9%	16.8%	1.4%	0.8%	0.7%	4.2%	7.8%	0.0%	0.4%	0.9%	33	205
RI_060	Rock Island 4	65.6%	16.4%	1.3%	0.8%	0.7%	4.4%	7.6%	0.0%	0.4%	1.0%	34	107
RI_061	Rock Island 4	66.2%	16.1%	1.2%	0.8%	0.7%	4.2%	7.5%	0.0%	0.4%	1.0%	32	100
RI_062	Rock Island 4	67.7%	14.9%	1.3%	0.8%	0.7%	4.3%	7.9%	0.0%	0.4%	0.9%	34	163
RI_063	Rock Island 4	66.6%	15.6%	1.4%	0.8%	0.7%	4.1%	8.0%	0.0%	0.4%	1.0%	35	138
RI_094	Rock Island 1 or 3b	65.6%	16.9%	1.4%	0.8%	0.8%	3.9%	7.0%	0.0%	0.5%	1.4%	30	51
RI_095	Rock Island 1 or 3b	65.9%	16.7%	1.4%	0.8%	0.7%	3.7%	7.0%	0.0%	0.4%	1.4%	30	48
RI_096	Rock Island 1 or 3b	64.8%	17.2%	1.3%	0.8%	0.7%	3.8%	7.2%	0.0%	0.4%	1.4%	30	50
RI_097	Rock Island 1 or 3b	65.9%	16.8%	1.4%	0.8%	0.7%	3.8%	7.0%	0.0%	0.4%	1.3%	31	48
RI_098	Rock Island 1 or 3b	66.2%	16.4%	1.4%	0.8%	0.7%	3.8%	7.0%	0.0%	0.4%	1.4%	31	48

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
MA_06	20	1	109	2	209	7	8	64	47	273	69	13	505	16	1
MA_07	23	1	120	3	195	6	10	53	40	347	48	15	592	12	1
MA_08	14	1	120	2	138	3	10	55	40	122	52	15	482	9	1
MA_09	15	1	124	2	193	5	12	67	53	84	83	13	515	12	1
MA_10	12	0	120	2	130	3	8	49	34	136	63	15	474	9	1
MA_11	15	1	133	2	151	5	7	43	52	154	71	20	649	11	1
MA_17	39	1	103	2	220	7	11	58	64	63	173	20	1253	15	1
RI_007	15	0	139	2	70	6	5	53	89	91	140	20	601	12	1
RI_016	14	0	119	2	56	5	5	99	103	64	154	20	525	10	1
RI_018	20	0	123	2	60	5	5	52	42	65	60	13	601	10	1
RI_019	21	0	119	2	63	5	5	51	43	65	56	16	617	11	1
RI_020	21	0	111	2	61	6	4	52	43	64	60	16	614	11	1
RI_021	21	0	118	2	62	5	5	50	42	67	64	14	595	11	1
RI_034	21	0	109	2	134	7	5	52	42	57	63	10	563	15	1
RI_035	11	0	136	2	102	4	5	66	54	68	98	21	503	9	1
RI_036	18	0	126	2	115	6	5	58	49	64	63	13	614	11	1
RI_037	21	0	116	2	109	6	5	51	47	59	57	13	603	10	1
RI_039	20	0	126	2	135	6	6	54	59	64	59	8	579	12	1
RI_040	11	0	129	1	92	4	4	65	52	63	97	14	498	9	1
RI_041	11	0	130	2	97	4	5	66	53	64	96	14	491	9	1
RI_042	18	0	91	2	131	7	6	43	31	55	53	9	583	15	1
RI_043	18	0	108	2	126	6	5	48	55	69	74	14	586	12	1
RI_044	10	0	115	1	98	4	5	64	54	67	92	15	553	10	1
RI_045	17	0	109	1	118	6	5	48	55	65	70	13	588	12	1
RI_046	20	0	100	1	117	6	5	45	41	71	47	13	646	12	1
RI_047	12	0	126	1	92	5	4	66	55	64	97	15	508	9	1
RI_048	10	0	125	2	93	4	5	64	54	64	96	14	516	9	1
RI_059	17	0	124	2	109	6	5	42	75	79	89	18	617	13	1
RI_060	18	0	136	2	100	6	4	41	68	80	82	18	608	12	1
RI_061	19	0	136	2	98	6	5	40	67	84	81	17	556	11	1
RI_062	18	0	126	2	100	6	4	38	68	97	61	18	633	12	1
RI_063	19	0	129	2	99	6	4	39	70	92	71	19	632	12	1
RI_094	19	0	106	2	43	6	5	53	60	88	117	14	576	11	1
RI_095	18	0	102	2	35	6	5	51	58	84	120	13	587	11	1
RI_096	16	0	102	2	39	6	4	51	57	79	114	13	596	11	1
RI_097	17	0	105	2	36	6	5	51	56	86	116	14	593	11	1
RI_098	17	0	109	2	36	5	3	48	55	82	118	13	595	11	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
MA_06	3	242	0	74	3	5	1	0	0	2	63	1	0	1	3
MA_07	3	105	0	72	2	3	0	0	1	2	39	1	0	1	2
MA_08	4	129	0	39	1	2	0	0	1	1	40	1	0	1	1
MA_09	3	274	0	53	2	3	1	0	1	2	60	1	0	1	2
MA_10	3	288	0	39	1	2	0	0	0	1	36	1	1	1	1
MA_11	3	44	0	41	2	3	0	0	0	2	47	3	0	1	2
MA_17	10	412	0	76	2	4	0	0	0	2	74	2	0	1	2
RI_007	2	69	0	57	2	4	0	0	0	3	51	4	0	1	2
RI_016	2	316	0	36	2	3	0	0	0	1	89	1	0	1	1
RI_018	2	94	0	38	2	3	0	0	0	1	32	1	0	1	1
RI_019	2	99	0	41	2	4	0	0	0	1	34	1	0	1	2
RI_020	2	103	0	40	2	3	0	0	0	1	35	1	0	1	1
RI_021	3	102	0	41	2	3	0	0	0	1	37	1	0	1	2
RI_034	2	311	0	49	3	5	1	0	0	2	45	1	0	1	2
RI_035	1	274	0	40	1	3	0	0	0	1	50	1	0	1	1
RI_036	2	154	0	37	2	4	0	0	0	1	63	1	0	1	2
RI_037	2	126	0	36	2	3	0	0	0	1	58	1	0	1	2
RI_039	2	255	0	38	2	4	0	0	0	1	74	1	0	1	2
RI_040	2	263	0	40	1	3	0	0	0	1	53	1	0	1	1
RI_041	2	275	0	40	1	3	0	0	0	1	54	1	0	1	1
RI_042	1	332	0	52	2	5	1	0	0	2	32	1	0	1	2
RI_043	3	52	0	39	2	4	0	0	0	2	57	1	0	1	2
RI_044	2	279	0	45	2	3	0	0	0	1	57	1	0	1	1
RI_045	1	53	0	36	2	4	0	0	0	1	58	1	0	1	2
RI_046	1	188	0	39	2	4	1	0	0	1	51	1	0	1	2
RI_047	2	285	0	39	1	3	0	0	0	1	54	1	0	1	1
RI_048	2	283	0	42	2	3	0	0	0	1	59	1	0	1	1
RI_059	5	60	0	58	2	4	1	0	0	3	51	5	0	1	2
RI_060	4	53	0	55	2	4	1	0	0	3	46	5	0	1	2
RI_061	2	51	0	50	2	4	0	0	0	2	42	4	0	1	2
RI_062	2	55	0	56	2	4	1	0	0	2	44	5	0	1	2
RI_063	3	56	0	56	2	4	1	0	0	3	47	5	0	1	2
RI_094	2	48	0	42	2	4	0	0	0	1	54	1	0	1	2
RI_095	2	43	0	37	2	4	0	0	0	1	53	1	0	1	2
RI_096	2	44	0	35	2	4	0	0	0	1	56	1	0	1	2
RI_097	2	67	0	36	2	4	0	0	0	1	56	1	0	1	2
RI_098	1	46	0	37	2	4	0	0	0	1	56	1	0	1	2

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
MA_06	1	0	0	0	0	0	0	0	0	0	1	1
MA_07	0	0	0	0	0	0	0	0	0	0	1	1
MA_08	1	0	1	0	0	0	0	0	1	0	1	0
MA_09	1	0	1	0	0	0	0	0	0	0	0	1
MA_10	0	0	0	0	0	0	0	0	0	0	0	0
MA_11	0	0	0	0	0	0	0	0	0	0	0	1
MA_17	0	0	1	0	0	0	0	0	0	0	1	1
RI_007	0	0	0	0	0	0	0	0	0	0	0	0
RI_016	0	0	0	0	0	0	0	0	0	0	0	0
RI_018	0	0	0	0	0	0	0	0	0	0	0	0
RI_019	0	0	0	0	0	0	0	0	0	0	0	0
RI_020	0	0	0	0	0	0	0	0	0	0	0	0
RI_021	0	0	0	0	0	0	0	0	0	0	0	0
RI_034	0	0	0	0	0	0	0	0	0	0	0	1
RI_035	0	0	0	0	0	0	0	0	0	0	0	0
RI_036	0	0	0	0	0	0	0	0	0	0	0	1
RI_037	0	0	0	0	0	0	0	0	0	0	0	0
RI_039	0	0	0	0	0	0	0	0	0	0	0	1
RI_040	0	0	0	0	0	0	0	0	0	0	0	0
RI_041	0	0	0	0	0	0	0	0	0	0	0	0
RI_042	0	0	0	0	0	0	0	0	0	0	0	1
RI_043	0	0	0	0	0	0	0	0	0	0	0	1
RI_044	0	0	0	0	0	0	0	0	0	0	0	0
RI_045	0	0	0	0	0	0	0	0	0	0	0	1
RI_046	0	0	0	0	0	0	0	0	0	0	0	1
RI_047	0	0	0	0	0	0	0	0	0	0	0	0
RI_048	0	0	0	0	0	0	0	0	0	0	0	0
RI_059	0	0	0	0	1	0	0	0	0	0	0	1
RI_060	0	0	0	0	0	0	0	0	0	0	0	1
RI_061	0	0	0	0	0	0	0	0	0	0	0	1
RI_062	0	0	0	0	0	0	0	0	0	0	0	1
RI_063	0	0	0	0	1	0	0	0	0	0	0	1
RI_094	0	0	0	0	0	0	0	0	0	0	0	1
RI_095	0	0	0	0	0	0	0	0	0	0	0	1
RI_096	0	0	0	0	0	0	0	0	0	0	0	1
RI_097	0	0	0	0	0	0	0	0	0	0	0	1
RI_098	0	0	0	0	0	0	0	0	0	0	0	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
RI_099	Rock Island 1 or 3b	67.6%	15.6%	1.3%	0.8%	0.7%	4.0%	6.6%	0.0%	0.4%	1.4%	30	143
RI_100	Rock Island 1 or 3b	65.9%	16.6%	1.3%	0.8%	0.7%	3.9%	7.0%	0.0%	0.4%	1.4%	32	49
RI_101	Rock Island 1 or 3b	66.1%	16.7%	1.3%	0.8%	0.7%	3.7%	7.1%	0.0%	0.4%	1.3%	31	46
RI_102	Rock Island 1 or 3b	61.6%	18.7%	1.3%	0.7%	0.7%	4.0%	6.4%	0.0%	0.4%	1.4%	28	42
RI_103	Rock Island 1 or 3b	65.5%	15.2%	1.2%	1.0%	0.8%	5.2%	6.5%	0.0%	0.5%	1.0%	30	57
RI_119	Rock Island 3b	66.9%	15.1%	1.4%	0.9%	0.7%	4.9%	6.8%	0.0%	0.5%	1.3%	51	234
RI_120	Rock Island 3b	66.7%	15.7%	1.4%	0.8%	0.7%	4.6%	7.0%	0.0%	0.4%	1.5%	33	69
RI_121	Rock Island 3b	66.0%	16.0%	1.3%	0.8%	0.7%	4.9%	6.8%	0.0%	0.4%	1.5%	31	62
RI_122	Rock Island 3b	67.2%	15.6%	1.3%	0.6%	0.5%	3.8%	8.0%	0.0%	0.4%	1.1%	51	800
RI_124	Rock Island	66.2%	16.0%	1.6%	0.9%	0.6%	3.9%	7.6%	0.0%	0.4%	1.3%	26	47
RI_125	Rock Island	66.8%	15.2%	1.5%	0.6%	1.0%	3.7%	7.7%	0.0%	0.4%	1.3%	142	292
RI_126	Rock Island	66.4%	15.4%	1.5%	0.6%	1.0%	3.7%	7.9%	0.0%	0.4%	1.3%	145	306
RI_127	Rock Island	66.8%	15.3%	1.3%	0.5%	1.0%	4.1%	7.0%	0.0%	0.3%	1.5%	73	328
RI_128	Rock Island	66.7%	15.6%	1.4%	0.5%	1.0%	3.7%	7.7%	0.0%	0.3%	1.4%	88	364
SJ_23	Fort St. Joseph	68.3%	15.9%	1.3%	0.7%	0.7%	3.4%	7.9%	0.0%	0.4%	1.3%	21	146
SJ_24	Fort St. Joseph	68.7%	13.5%	1.3%	1.2%	0.8%	5.3%	7.4%	0.1%	0.3%	1.5%	27	24
SJ_25	Fort St. Joseph	67.4%	16.1%	1.6%	1.0%	0.7%	3.3%	7.5%	0.1%	0.6%	1.5%	106	1382
SJ_27	Fort St. Joseph	68.5%	15.0%	1.5%	0.6%	1.0%	3.6%	7.7%	0.0%	0.4%	1.4%	117	283
SJ_28	Fort St. Joseph	67.9%	16.1%	1.4%	0.8%	0.7%	3.8%	7.4%	0.0%	0.4%	1.4%	27	99
SJ_29	Fort St. Joseph	68.4%	15.9%	1.4%	0.8%	0.7%	3.7%	7.3%	0.0%	0.4%	1.3%	28	44
SJ_30	Fort St. Joseph	68.5%	15.4%	1.4%	0.5%	1.0%	3.6%	7.5%	0.0%	0.5%	1.4%	107	424
SJ_32	Fort St. Joseph	70.6%	15.0%	1.3%	0.7%	0.8%	2.7%	7.3%	0.1%	0.4%	1.0%	16	68
SJ_33	Fort St. Joseph	68.2%	15.9%	1.6%	0.9%	0.7%	3.2%	7.3%	0.1%	0.4%	1.4%	124	1736
SJ_34	Fort St. Joseph	68.3%	16.1%	1.4%	0.8%	0.7%	3.2%	7.7%	0.0%	0.4%	1.3%	42	67
SJ_35	Fort St. Joseph	68.0%	16.3%	1.3%	0.8%	0.7%	3.4%	7.7%	0.0%	0.4%	1.3%	42	68
SJ_36	Fort St. Joseph	67.6%	16.2%	1.5%	0.8%	0.7%	3.8%	7.4%	0.0%	0.5%	1.5%	32	48
SJ_37	Fort St. Joseph	71.0%	14.7%	1.4%	0.8%	0.8%	2.6%	7.3%	0.1%	0.5%	0.9%	17	157
SJ_38	Fort St. Joseph	71.2%	14.4%	1.3%	0.7%	0.8%	2.6%	7.1%	0.1%	0.5%	1.2%	24	117
SJ_39	Fort St. Joseph	70.7%	15.0%	1.4%	0.8%	0.8%	2.6%	7.4%	0.1%	0.4%	1.0%	19	74
SJ_40	Fort St. Joseph	68.9%	15.1%	1.4%	0.8%	0.7%	4.3%	7.0%	0.0%	0.5%	1.2%	30	113
SL_08_1	Fort St. Louis	68.0%	13.1%	1.4%	1.0%	0.9%	4.0%	9.3%	0.0%	0.5%	1.6%	35	1508
	Subgroup Med P (n=2)												
DI_50	Doty Island Village	68.3%	13.6%	1.2%	0.9%	1.4%	5.0%	6.1%	0.1%	0.5%	1.2%	383	4189
DI_51	Doty Island Village	66.7%	14.8%	1.3%	1.0%	1.5%	4.7%	6.0%	0.1%	0.5%	1.2%	134	2281

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
RI_099	23	1	96	2	36	6	5	50	48	74	88	16	618	11	1
RI_100	17	0	106	2	35	5	5	50	56	84	116	14	586	11	1
RI_101	17	0	105	2	35	6	4	49	56	75	111	14	593	12	1
RI_102	16	0	97	1	33	5	4	46	53	72	112	14	553	11	1
RI_103	19	0	91	2	43	7	6	40	30	57	86	10	539	14	1
RI_119	23	0	100	2	57	7	5	50	71	61	80	13	659	12	1
RI_120	17	0	108	2	49	5	3	51	56	68	67	13	610	11	1
RI_121	17	0	111	2	48	5	4	49	56	63	66	13	601	11	1
RI_122	12	0	118	2	35	4	2	68	59	51	72	17	738	8	1
RI_124	19	0	116	3	165	7	17	57	62	84	101	13	737	14	1
RI_125	10	0	115	3	116	5	18	69	54	78	99	16	554	10	1
RI_126	9	0	111	3	120	6	19	69	55	77	99	14	573	10	1
RI_127	11	0	115	3	103	5	18	84	56	75	88	18	502	9	1
RI_128	10	0	112	3	104	5	17	56	39	74	87	17	536	9	1
SJ_23	13	0	153	4	140	6	15	59	87	97	119	18	621	10	1
SJ_24	32	0	118	3	217	10	11	74	64	68	128	17	951	15	1
SJ_25	14	0	130	4	174	8	15	82	78	83	132	12	624	13	1
SJ_27	10	0	128	3	134	6	13	72	58	66	112	13	559	10	1
SJ_28	18	0	127	4	162	7	13	59	65	75	84	16	656	12	1
SJ_29	19	0	119	4	166	7	14	59	66	79	85	15	658	13	1
SJ_30	9	0	133	3	113	5	11	58	42	69	98	15	565	10	1
SJ_32	9	0	133	4	145	6	13	48	55	94	106	13	594	12	1
SJ_33	14	0	122	4	171	8	12	81	76	79	150	14	666	14	1
SJ_34	13	0	121	4	161	7	13	58	96	88	151	16	701	14	1
SJ_35	13	0	127	4	162	7	13	58	94	89	155	17	700	13	1
SJ_36	17	0	134	3	166	7	10	60	65	81	95	17	720	14	1
SJ_37	11	0	132	3	154	6	13	50	58	97	103	14	618	13	1
SJ_38	9	0	128	4	145	6	11	92	115	100	148	12	602	12	1
SJ_39	11	0	130	4	149	6	11	54	64	94	107	14	622	13	1
SJ_40	18	0	104	3	155	7	11	49	44	86	58	11	724	13	1
SL_08_1	15	0	106	2	153	7	0	32	57	61	69	10	443	35	2
	Subgroup Med P (n=2)														
DI_50	26	0	74	2	43	7	6	56	44	69	82	9	790	13	1
DI_51	29	0	89	2	55	9	14	57	43	103	115	13	524	17	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
RI_099	2	131	0	39	2	4	0	0	0	1	55	1	0	1	2
RI_100	2	58	0	36	2	4	0	0	0	1	55	1	0	1	2
RI_101	2	46	0	34	2	4	0	0	0	1	56	1	0	1	2
RI_102	3	37	0	32	2	3	0	0	0	1	51	1	0	1	2
RI_103	2	337	0	51	2	4	1	0	0	2	31	1	0	1	2
RI_119	2	130	0	56	2	4	1	0	0	2	43	4	0	1	2
RI_120	1	46	0	35	2	4	0	0	0	1	50	1	0	1	2
RI_121	2	43	0	34	2	4	0	0	0	1	51	1	0	1	2
RI_122	2	246	0	47	1	3	0	0	0	1	42	3	0	1	1
RI_124	2	93	0	43	2	4	1	0	0	2	76	1	0	1	2
RI_125	4	406	0	44	2	3	0	0	0	1	59	1	0	1	1
RI_126	15	414	0	45	2	3	0	0	78	1	60	1	0	1	1
RI_127	155	270	0	40	1	2	0	0	0	1	65	1	0	1	1
RI_128	0	387	0	36	1	2	0	0	0	1	44	1	0	1	1
SJ_23	1	32	0	39	2	3	0	0	0	2	58	3	0	1	1
SJ_24	3	30	0	53	2	4	1	0	0	2	48	1	0	1	2
SJ_25	2	381	0	38	2	4	1	0	0	2	94	1	0	1	2
SJ_27	1	385	0	44	2	3	0	0	0	1	50	1	0	1	1
SJ_28	2	54	0	37	2	4	0	0	0	2	61	1	0	1	2
SJ_29	1	54	0	38	2	4	0	0	1	2	64	1	0	1	2
SJ_30	2	422	0	42	1	3	0	0	0	1	47	1	0	1	2
SJ_32	2	90	0	35	2	4	1	0	0	2	83	1	0	1	2
SJ_33	3	451	0	45	3	5	1	0	0	2	119	1	0	1	2
SJ_34	1	103	0	77	3	5	1	0	0	3	74	7	0	1	2
SJ_35	1	101	0	73	2	4	1	0	0	3	74	7	0	1	2
SJ_36	4	63	0	50	2	5	1	0	4	2	83	1	0	1	2
SJ_37	2	90	0	37	3	4	1	0	0	2	92	1	0	1	2
SJ_38	1	118	0	39	2	4	1	0	0	2	188	1	0	1	2
SJ_39	3	95	0	37	2	4	1	0	0	2	102	1	0	1	2
SJ_40	1	262	0	49	2	4	1	0	0	2	64	1	0	1	2
SL_08_1	2	309	0	78	4	7	1	0	0	3	34	1	0	1	4
	Subgroup Med P (n=2)														
DI_50	4	128	0	62	2	5	1	0	0	1	46	1	0	1	2
DI_51	2	114	0	59	3	6	1	0	0	2	43	1	0	1	2

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
RI_099	0	0	0	0	0	0	0	0	0	0	0	1
RI_100	0	0	0	0	0	0	0	0	0	0	0	1
RI_101	0	0	0	0	0	0	0	0	0	0	0	1
RI_102	0	0	0	0	0	0	0	0	0	0	0	1
RI_103	0	0	0	0	0	0	0	0	0	0	0	1
RI_119	0	0	0	0	0	0	0	0	0	0	0	1
RI_120	0	0	0	0	0	0	0	0	0	0	0	1
RI_121	0	0	0	0	0	0	0	0	0	0	0	1
RI_122	0	0	0	0	0	0	0	0	0	0	0	0
RI_124	1	0	1	0	1	0	0	0	0	0	1	1
RI_125	0	0	0	0	0	0	0	0	0	0	0	1
RI_126	0	0	0	0	0	0	0	0	0	0	0	1
RI_127	0	0	0	0	0	0	0	0	0	0	0	0
RI_128	0	0	0	0	0	0	0	0	0	0	0	0
SJ_23	0	0	0	0	0	0	0	0	0	0	0	0
SJ_24	0	0	0	0	0	0	0	0	0	0	0	1
SJ_25	0	0	0	0	0	0	0	0	0	0	0	1
SJ_27	0	0	0	0	0	0	0	0	0	0	0	0
SJ_28	0	0	0	0	0	0	0	0	0	0	0	1
SJ_29	0	0	0	0	0	0	0	0	0	0	0	1
SJ_30	1	0	1	0	0	0	0	0	1	0	1	0
SJ_32	0	0	0	0	0	0	0	0	0	0	0	1
SJ_33	1	0	0	0	0	0	0	0	0	0	0	1
SJ_34	1	0	0	0	1	0	0	0	0	0	0	1
SJ_35	0	0	1	0	1	0	0	0	0	0	0	1
SJ_36	1	0	0	0	0	0	0	0	0	0	1	1
SJ_37	0	0	0	0	0	0	0	0	0	0	0	1
SJ_38	0	0	0	0	0	0	0	0	0	0	0	1
SJ_39	1	0	0	0	0	0	0	0	0	0	0	1
SJ_40	0	0	0	0	0	0	0	0	0	0	0	1
SL_08_1	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup Med P (n=2)											
DI_50	0	0	0	0	0	0	0	0	0	0	0	1
DI_51	0	0	0	0	0	0	0	0	0	0	0	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	Subgroup IIa40 Mg-low-P + Ca (n=13)												
B_P251	Bell	66.2%	15.8%	2.3%	1.4%	0.2%	1.2%	9.3%	0.0%	0.6%	1.0%	257	6558
BR_01	Bell (Ridge)	66.4%	16.7%	2.5%	1.4%	0.2%	1.1%	8.4%	0.0%	0.6%	1.0%	247	714
BR_02	Bell (Ridge)	66.0%	17.1%	2.4%	1.4%	0.2%	1.2%	8.7%	0.0%	0.5%	1.1%	30	609
BR_03	Bell (Ridge)	66.1%	16.9%	2.6%	1.4%	0.2%	1.1%	8.6%	0.0%	0.6%	1.0%	230	717
MM_002	Marquette Mission	68.4%	15.8%	2.8%	1.0%	0.2%	1.0%	8.9%	0.0%	0.2%	0.9%	198	360
MM_015	Marquette Mission	66.9%	16.8%	2.9%	1.1%	0.2%	1.1%	9.1%	0.0%	0.3%	0.9%	204	354
MM_016	Marquette Mission	67.0%	16.5%	3.0%	1.2%	0.3%	1.0%	9.2%	0.0%	0.3%	0.9%	354	517
MM_019	Marquette Mission	66.5%	16.7%	3.0%	1.2%	0.2%	1.0%	9.2%	0.1%	0.6%	0.9%	232	366
MM_022	Marquette Mission	66.9%	16.7%	3.0%	1.0%	0.2%	1.0%	9.2%	0.0%	0.5%	0.9%	204	365
MM_023	Marquette Mission	66.5%	16.9%	3.0%	1.0%	0.2%	1.0%	9.2%	0.0%	0.6%	0.9%	209	354
MM_075	Marquette Mission	68.9%	15.0%	2.7%	1.2%	0.2%	1.2%	9.3%	0.0%	0.2%	0.9%	263	735
MM_076	Marquette Mission	67.5%	16.0%	2.8%	1.1%	0.2%	1.2%	9.6%	0.0%	0.3%	1.0%	234	702
ZM_47	Zimmerman	65.3%	16.8%	2.7%	1.9%	0.2%	3.1%	7.6%	0.2%	0.6%	1.1%	1935	3280
	Subgroup: IIa40 Mg-low-P low Ca (n=25)												
CG_01_1	Chautauqua Grounds	67.9%	15.0%	1.5%	0.9%	0.2%	5.8%	5.5%	0.0%	0.4%	1.5%	435	783
CG_02_1	Chautauqua Grounds	66.2%	17.5%	1.8%	0.9%	0.2%	3.6%	5.8%	0.1%	0.6%	1.4%	472	731
CG_03_1	Chautauqua Grounds	67.6%	16.1%	1.7%	0.9%	0.2%	4.8%	5.8%	0.0%	0.4%	1.4%	519	1007
CG_04_1	Chautauqua Grounds	68.7%	16.7%	1.6%	0.9%	0.2%	3.4%	5.2%	0.0%	0.6%	1.5%	640	924
CLU_01	Clunie	71.8%	15.1%	1.3%	1.2%	0.2%	2.5%	4.7%	0.0%	0.3%	1.8%	61	72
IV_62	Iliniwek Village	68.9%	16.2%	2.0%	1.1%	0.2%	1.8%	6.5%	0.0%	0.5%	1.0%	90	538
MM_012	Marquette Mission	67.7%	15.6%	2.3%	1.5%	0.2%	5.0%	5.8%	0.0%	0.3%	0.9%	26	142
MM_020	Marquette Mission	66.0%	19.8%	2.3%	1.2%	0.2%	2.5%	5.7%	0.0%	0.4%	1.1%	20	84
MM_021	Marquette Mission	69.8%	17.4%	1.8%	1.1%	0.2%	1.7%	5.2%	0.2%	0.4%	1.2%	407	603
MRK_01	Markman	67.7%	16.8%	1.7%	0.9%	0.2%	4.9%	5.2%	0.0%	0.6%	1.4%	545	562
NL_08	New Lenox	66.3%	18.4%	1.9%	1.1%	0.2%	2.9%	6.4%	0.0%	0.4%	0.9%	77	73
NL_09	New Lenox	67.8%	18.9%	2.3%	1.3%	0.2%	2.6%	2.9%	0.2%	0.4%	1.2%	554	826
NL_10	New Lenox	68.5%	18.4%	2.3%	1.4%	0.2%	2.6%	2.9%	0.2%	0.5%	1.2%	568	841
NL_11	New Lenox	64.9%	15.4%	2.2%	1.0%	0.2%	6.0%	6.9%	0.1%	0.4%	1.2%	203	282
PP_02	Peshtigo Point	66.2%	14.2%	1.7%	1.1%	0.1%	7.5%	5.8%	0.0%	0.4%	1.7%	460	584
PP_03	Peshtigo Point	67.0%	14.2%	1.7%	1.0%	0.2%	7.6%	5.5%	0.0%	0.4%	1.3%	449	735
PP_05	Peshtigo Point	66.6%	17.8%	1.6%	1.0%	0.1%	3.8%	5.5%	0.0%	0.2%	1.8%	776	834
PP_07	Peshtigo Point	65.7%	16.9%	1.8%	0.8%	0.1%	3.6%	6.3%	0.1%	0.5%	1.9%	2262	3414
PTS_2_1	Point Sauble	67.1%	14.4%	1.6%	1.0%	0.1%	7.4%	5.8%	0.0%	0.5%	1.5%	470	772
RB_01	Red Banks	68.4%	15.7%	1.9%	0.9%	0.3%	3.9%	6.3%	0.0%	0.5%	1.1%	160	1069

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	Subgroup IIa40 Mg-low-P + Ca (n=13)														
B_P251	6	1	73	2	72	8	11	35	142	63	226	9	389	19	2
BR_01	7	1	67	2	63	8	10	33	149	81	259	8	360	16	1
BR_02	8	0	66	2	58	8	10	30	116	61	255	9	381	15	1
BR_03	8	1	66	2	67	9	10	34	151	122	265	8	363	16	2
MM_002	8	1	94	2	181	6	10	47	100	34	358	6	499	14	1
MM_015	9	0	87	2	181	6	13	47	101	59	361	7	463	14	1
MM_016	10	1	115	2	236	6	17	43	97	79	306	6	484	14	1
MM_019	10	2	126	3	188	7	27	48	94	125	279	6	489	14	1
MM_022	9	1	90	3	174	6	16	42	95	49	298	6	466	13	1
MM_023	8	1	84	3	173	6	18	43	94	35	293	5	471	13	1
MM_075	7	1	99	2	227	7	17	47	116	43	381	7	499	15	1
MM_076	7	1	85	2	223	6	17	45	102	42	362	7	514	14	1
ZM_47	11	1	92	4	358	16	25	54	116	54	252	15	438	23	2
	Subgroup: IIa40 Mg-low-P low Ca (n=25)														
CG_01_1	11	0	84	1	59	5	1	57	74	26	123	42	236	15	1
CG_02_1	10	0	73	1	59	7	1	49	75	37	162	21	275	13	1
CG_03_1	8	1	66	1	59	5	1	60	80	16	158	25	225	14	1
CG_04_1	9	1	79	1	55	4	1	47	64	22	146	19	242	12	1
CLU_01	5	0	99	3	149	10	16	47	25	31	201	13	203	13	1
IV_62	7	0	89	3	187	14	18	63	112	28	116	11	344	12	1
MM_012	11	2	151	2	170	6	13	164	264	101	339	30	307	19	1
MM_020	10	1	120	2	172	6	14	163	267	46	342	13	307	17	1
MM_021	8	1	123	2	150	13	12	62	44	50	41	10	249	11	1
MRK_01	10	1	65	3	138	6	14	62	81	21	122	25	213	15	1
NL_08	8	1	61	3	175	6	17	37	69	23	74	13	336	19	1
NL_09	10	1	119	3	244	11	21	64	85	38	131	14	204	16	1
NL_10	10	1	116	4	250	11	22	67	86	43	124	14	208	16	1
NL_11	26	0	75	3	187	9	19	31	39	74	79	27	253	17	1
PP_02	10	0	65	3	169	7	15	53	71	53	222	45	222	20	1
PP_03	11	1	81	3	136	6	15	57	70	35	124	79	247	17	1
PP_05	9	0	78	1	134	5	5	49	64	30	144	20	258	13	1
PP_07	10	0	50	3	123	6	15	52	81	33	302	16	266	13	1
PTS_2_1	12	1	57	1	239	7	4	51	74	42	182	43	220	20	1
RB_01	10	0	138	2	47	5	7	51	69	316	128	17	275	14	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	Subgroup IIa40 Mg-low-P + Ca (n=13)														
B_P251	1	139	0	129	3	7	1	0	0	3	101	1	0	2	3
BR_01	1	99	0	107	3	5	1	0	0	3	71	1	0	1	2
BR_02	1	70	0	121	3	5	1	0	0	3	72	1	0	1	2
BR_03	1	97	0	106	3	5	1	0	0	3	71	1	0	1	3
MM_002	2	222	0	111	3	5	1	0	2	3	134	1	0	1	3
MM_015	2	209	0	111	3	5	1	0	2	2	123	1	0	1	3
MM_016	1	250	0	182	3	6	1	0	1	2	178	1	1	1	3
MM_019	2	218	0	120	3	5	1	0	1	2	123	2	1	1	3
MM_022	2	213	0	100	3	5	1	0	2	2	110	1	0	1	3
MM_023	2	211	0	100	3	5	1	0	2	2	108	1	1	1	2
MM_075	1	239	0	148	3	5	1	0	2	2	145	1	1	1	3
MM_076	2	226	0	155	3	6	1	0	1	2	149	1	0	1	3
ZM_47	1	73	0	160	4	8	1	0	0	4	75	1	0	1	4
	Subgroup: IIa40 Mg-low-P low Ca (n=25)														
CG_01_1	3	27	0	43	2	4	1	0	0	2	38	1	1	2	2
CG_02_1	11	23	0	31	2	5	1	0	0	2	41	1	0	2	2
CG_03_1	7	20	0	29	2	4	0	0	0	2	38	1	0	1	2
CG_04_1	4	23	0	27	2	4	0	0	0	2	37	1	0	1	2
CLU_01	2	17	0	46	2	3	0	0	1	2	25	0	0	2	1
IV_62	2	17	0	93	2	4	1	0	0	2	54	1	0	1	2
MM_012	2	33	0	85	2	4	1	0	4	3	219	27	1	1	2
MM_020	2	30	0	51	2	4	1	0	1	2	214	27	1	1	2
MM_021	3	24	0	60	2	5	1	0	2	2	22	1	1	1	3
MRK_01	2	18	0	35	2	4	0	0	2	2	38	1	1	2	2
NL_08	1	10	0	53	3	6	1	0	0	3	34	1	0	1	3
NL_09	5	49	0	28	2	5	1	0	1	3	41	1	0	2	2
NL_10	3	50	0	28	3	5	1	0	0	3	42	1	0	2	3
NL_11	1	22	0	35	5	10	1	0	0	3	11	1	0	1	5
PP_02	0	23	0	66	3	5	1	0	0	2	39	1	1	1	2
PP_03	1037	22	0	62	2	5	1	0	0	2	36	1	1	2	2
PP_05	0	25	0	37	2	4	1	0	0	2	41	1	0	2	2
PP_07	1	40	0	48	2	4	0	0	0	2	46	1	0	2	2
PTS_2_1	3	20	0	66	3	5	1	0	0	2	37	1	1	1	2
RB_01	12	13	0	41	2	5	1	0	0	2	26	1	0	1	2

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	Subgroup IIa40 Mg-low-P + Ca (n=13)											
B_P251	1	0	1	0	1	0	0	0	0	0	1	1
BR_01	1	0	1	0	0	0	0	0	0	0	0	1
BR_02	1	0	1	0	0	0	0	0	0	0	0	1
BR_03	1	0	1	0	1	0	0	0	0	0	0	1
MM_002	1	0	0	0	0	0	0	0	0	0	0	1
MM_015	1	0	1	0	0	0	0	0	0	0	1	1
MM_016	1	0	1	0	1	0	0	0	1	0	1	1
MM_019	1	0	1	0	1	0	0	0	1	0	1	2
MM_022	1	0	1	0	1	0	0	0	1	0	1	1
MM_023	1	0	1	0	1	0	0	0	0	0	1	1
MM_075	1	0	1	0	1	0	0	0	1	0	1	1
MM_076	1	0	1	0	0	0	0	0	0	0	0	1
ZM_47	1	0	1	0	1	0	0	0	0	0	1	1
	Subgroup: IIa40 Mg-low-P low Ca (n=25)											
CG_01_1	0	0	0	0	0	0	0	0	0	0	0	1
CG_02_1	0	0	0	0	0	0	0	0	0	0	0	1
CG_03_1	0	0	0	0	0	0	0	0	0	0	0	1
CG_04_1	0	0	0	0	0	0	0	0	0	0	0	1
CLU_01	0	0	0	0	0	0	0	0	0	0	0	0
IV_62	0	0	0	0	0	0	0	0	0	0	0	1
MM_012	1	0	1	0	1	0	0	0	1	0	1	1
MM_020	1	0	1	0	1	0	1	0	0	0	1	1
MM_021	1	0	1	0	1	0	0	0	1	0	1	1
MRK_01	1	0	1	0	0	0	0	0	1	0	1	1
NL_08	1	0	1	0	1	0	0	0	0	0	1	1
NL_09	1	0	1	0	1	0	0	0	0	0	1	1
NL_10	1	0	1	0	1	0	0	0	1	0	1	1
NL_11	1	0	1	0	1	0	0	0	0	0	1	1
PP_02	0	0	0	0	0	0	0	0	0	0	1	1
PP_03	0	0	0	0	0	0	0	0	0	0	0	1
PP_05	1	0	1	0	0	0	0	0	0	0	0	1
PP_07	0	0	1	0	0	0	0	0	0	0	0	1
PTS_2_1	0	0	0	0	0	0	0	0	0	0	1	1
RB_01	0	0	0	0	0	0	0	0	0	0	0	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
RB_02	Red Banks	69.5%	16.1%	1.7%	1.1%	0.2%	3.2%	5.7%	0.0%	0.5%	1.1%	263	794
RB_21	Red Banks	72.2%	13.7%	1.3%	1.3%	0.2%	3.5%	4.3%	0.1%	0.5%	1.9%	347	1208
RI_006	Rock Island 3b	67.4%	16.6%	1.8%	1.5%	0.1%	3.7%	5.7%	0.0%	0.6%	1.4%	124	580
RI_032	Rock Island 1	67.1%	18.3%	1.5%	0.9%	0.4%	3.5%	5.6%	0.1%	0.5%	1.1%	118	686
TB_4	Hanson	68.7%	14.0%	1.5%	1.1%	0.2%	6.2%	5.1%	0.0%	0.4%	1.4%	467	1702
	Subgroup: High Zn (n= 7)												
H_C71_1	Hanson	70.0%	16.0%	1.6%	1.0%	0.2%	2.1%	5.7%	0.0%	0.2%	2.0%	6	350
H_C72_1	Hanson	69.8%	16.1%	1.6%	1.1%	0.2%	2.2%	5.3%	0.0%	0.2%	2.0%	7	373
H_C73_1	Hanson	70.2%	15.7%	1.6%	1.1%	0.2%	2.0%	5.7%	0.0%	0.2%	2.1%	6	349
H_C74_1	Hanson	70.1%	16.0%	1.6%	1.1%	0.1%	2.1%	5.5%	0.0%	0.2%	2.0%	6	346
H_C75_1	Hanson	69.9%	15.8%	1.6%	1.1%	0.2%	2.1%	5.6%	0.1%	0.3%	2.0%	7	371
H_C76_1	Hanson	70.0%	15.7%	1.6%	1.1%	0.2%	2.1%	5.6%	0.1%	0.3%	1.9%	7	357
TB_7	Hanson	70.6%	15.3%	1.6%	1.0%	0.1%	2.2%	4.8%	0.1%	0.5%	2.1%	11	583
	Subgroup: Zn + Sn (n=34)												
CAD_2_1	Cadotte	64.0%	11.9%	2.2%	0.9%	0.3%	8.8%	6.9%	0.2%	0.4%	1.5%	10102	7423
CAD_4_1	Cadotte	63.2%	12.1%	2.3%	1.1%	0.5%	8.3%	7.4%	0.2%	0.6%	1.3%	11465	7560
CAD_5_1	Cadotte	62.4%	10.6%	2.4%	1.2%	0.3%	8.8%	9.2%	0.3%	0.6%	1.0%	16074	4479
GC_03	Gros Cap	64.5%	11.9%	2.9%	1.2%	0.3%	5.9%	9.1%	0.2%	0.4%	0.9%	5194	6167
GG_05_1	Gillett Grove	62.6%	11.8%	2.5%	1.1%	0.3%	9.1%	7.4%	0.2%	1.3%	1.2%	9373	5819
GG_10_1	Gillett Grove	61.9%	13.0%	2.6%	1.4%	0.3%	5.3%	10.7%	0.3%	0.6%	1.0%	11414	4573
GG_11_1	Gillett Grove	63.6%	12.3%	2.0%	1.0%	0.3%	8.6%	8.5%	0.3%	0.5%	1.2%	3513	2412
GL_04	Goose Lake Outlet #3	63.9%	15.5%	2.1%	1.1%	0.1%	4.3%	8.1%	0.2%	0.4%	0.8%	10502	7818
GL_05	Goose Lake Outlet #3	62.2%	15.8%	2.4%	1.2%	0.4%	5.6%	7.8%	0.3%	0.2%	1.2%	6521	3763
GL_06	Goose Lake Outlet #3	63.7%	16.6%	2.0%	1.1%	0.1%	4.0%	7.7%	0.2%	0.4%	1.0%	9165	6247
GL_07	Goose Lake Outlet #3	61.0%	10.3%	1.7%	0.9%	0.2%	13.4%	7.4%	0.2%	0.4%	1.2%	13195	5158
GL_08	Goose Lake Outlet #3	63.3%	18.6%	1.9%	1.0%	0.1%	4.2%	6.5%	0.0%	0.3%	1.3%	5456	2959
GL_09	Goose Lake Outlet #3	64.2%	16.2%	2.1%	1.1%	0.2%	4.5%	7.3%	0.3%	0.5%	1.0%	5675	5188
GL_10	Goose Lake Outlet #3	64.1%	17.0%	1.9%	1.0%	0.1%	4.2%	6.2%	0.1%	0.6%	1.5%	11548	3711
GL_11	Goose Lake Outlet #3	63.7%	18.3%	1.8%	1.0%	0.1%	3.7%	6.6%	0.0%	0.3%	1.4%	8126	4038
GL_12	Goose Lake Outlet #3	64.0%	17.5%	1.8%	1.0%	0.1%	4.1%	6.4%	0.1%	0.5%	1.4%	7962	3923
GL_13	Goose Lake Outlet #3	64.3%	17.0%	1.9%	1.0%	0.1%	4.3%	6.7%	0.1%	0.4%	1.5%	5174	2773
IV_23	Iliniwek Village	64.3%	17.3%	1.7%	1.0%	0.1%	3.3%	6.3%	0.0%	0.4%	1.2%	4681	5020
IV_42	Iliniwek Village	65.1%	14.5%	2.1%	1.2%	0.2%	3.1%	7.1%	0.4%	0.5%	1.2%	8318	4309
IV_56	Iliniwek Village	61.4%	12.1%	1.9%	1.0%	0.3%	8.9%	8.4%	0.3%	0.4%	1.1%	5987	2906
IV_57	Iliniwek Village	60.7%	12.5%	2.5%	1.5%	0.4%	5.5%	10.6%	0.2%	0.6%	0.9%	10062	6010

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
RB_02	7	1	108	2	63	8	42	33	50	474	109	14	301	13	1
RB_21	8	1	58	2	61	6	6	72	48	118	150	29	218	21	1
RI_006	14	1	76	3	119	13	7	64	90	30	189	20	247	20	1
RI_032	10	1	77	2	140	8	5	95	73	32	260	16	237	14	1
TB_4	12	0	86	1	79	5	3	58	77	51	98	40	242	18	1
	Subgroup: High Zn (n= 7)														
H_C71_1	14	0	67	2	777	9	9	11	15	6338	9	15	255	298	7
H_C72_1	14	0	68	2	819	9	12	12	15	6493	5	17	257	307	8
H_C73_1	13	0	79	2	794	9	10	12	15	6260	6	14	252	300	7
H_C74_1	14	0	79	2	791	9	9	11	14	6294	6	15	254	300	7
H_C75_1	13	0	81	2	804	9	13	13	15	6585	4	17	257	306	8
H_C76_1	13	0	83	2	788	9	13	12	15	6445	0	17	250	288	7
TB_7	14	0	69	2	640	9	11	14	21	7111	19	22	260	310	8
	Subgroup: Zn + Sn (n=34)														
CAD_2_1	15	0	116	2	1027	11	10	14	5	4959	22	33	339	181	4
CAD_4_1	14	1	112	2	1336	11	17	24	6	4505	20	29	358	205	5
CAD_5_1	20	1	87	2	1118	13	11	19	16	3459	50	35	384	207	6
GC_03	15	1	131	4	569	12	26	28	46	2635	210	64	423	91	3
GG_05_1	15	2	81	1	414	10	10	12	4	2463	0	29	328	197	5
GG_10_1	19	1	59	2	442	9	9	18	17	2188	0	20	452	245	5
GG_11_1	17	1	85	2	350	9	6	13	9	3263	14	31	392	201	4
GL_04	15	0	68	4	1110	8	22	13	11	2671	32	22	392	327	7
GL_05	14	1	98	3	1165	9	11	9	9	4106	13	47	330	304	7
GL_06	15	0	76	4	1127	8	20	11	9	3063	28	21	376	334	7
GL_07	12	1	111	4	1013	9	19	15	6	3763	5	64	320	313	6
GL_08	13	0	77	3	1210	8	20	7	3	3807	12	16	350	346	7
GL_09	15	1	75	4	1133	9	23	11	7	3308	12	24	367	325	7
GL_10	13	0	66	5	1124	8	25	10	8	4731	7	20	302	324	7
GL_11	13	0	89	3	1223	8	16	9	3	4215	27	18	364	367	8
GL_12	13	0	79	4	1222	8	21	9	6	4339	13	19	324	354	7
GL_13	13	0	74	4	1165	8	21	9	8	4458	6	20	315	338	7
IV_23	13	0	74	4	1297	8	18	7	3	3652	12	16	342	353	7
IV_42	19	0	74	5	1349	11	22	15	11	3851	31	23	407	314	7
IV_56	15	0	80	4	800	9	17	15	10	3712	24	32	388	209	5
IV_57	18	1	73	4	1085	11	27	19	17	3315	34	24	487	259	6

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
RB_02	4	11	0	70	2	4	1	0	0	2	29	0	0	2	2
RB_21	15	54	0	45	3	6	1	0	1	3	46	1	0	4	3
RI_006	1	14	0	59	3	6	1	0	0	3	30	1	0	1	3
RI_032	2	13	0	68	2	5	1	0	0	2	38	1	0	1	2
TB_4	2	19	0	65	2	5	1	0	0	2	44	1	1	2	2
	Subgroup: High Zn (n= 7)														
H_C71_1	10	2	0	86	4	11	1	1	0	9	1	1	0	0	5
H_C72_1	12	2	0	93	5	11	1	1	0	9	1	1	1	1	5
H_C73_1	10	3	0	84	4	11	1	1	0	9	1	1	0	0	5
H_C74_1	10	2	0	85	4	11	1	1	0	9	1	1	0	0	5
H_C75_1	11	3	0	89	4	11	1	1	1	9	1	1	0	0	5
H_C76_1	11	2	0	85	4	11	1	1	0	9	1	1	0	0	5
TB_7	11	3	0	99	5	12	1	1	1	9	3	3	1	0	5
	Subgroup: Zn + Sn (n=34)														
CAD_2_1	3	10	0	163	3	7	1	0	1	6	23	1	1	4	3
CAD_4_1	3	9	0	311	4	9	1	0	0	6	24	1	1	4	4
CAD_5_1	2	153	0	164	5	10	1	0	0	7	11	1	1	2	5
GC_03	4	2058	0	85	5	9	1	0	0	5	20	1	0	1	4
GG_05_1	2	6	0	138	4	7	1	0	0	7	21	1	1	5	4
GG_10_1	2	139	0	120	6	8	2	0	0	7	17	1	1	1	6
GG_11_1	5	5	0	112	4	7	1	0	0	7	12	1	1	4	4
GL_04	14	5	0	161	5	13	1	1	0	9	21	2	3	1	5
GL_05	1	5	1	319	10	18	2	1	0	9	6	2	2	1	7
GL_06	1	6	0	131	5	12	1	1	28	9	18	2	2	1	5
GL_07	0	20	0	250	4	11	1	1	0	8	10	1	1	5	4
GL_08	0	2	0	66	5	13	1	1	9	9	4	2	1	1	5
GL_09	155	4	0	184	6	14	2	1	0	9	9	2	3	1	6
GL_10	1	3	0	66	4	13	1	1	11	9	8	2	1	0	5
GL_11	1	3	0	69	5	13	1	1	1	10	6	2	1	1	6
GL_12	1	2	0	70	5	13	1	1	1	10	7	2	1	1	5
GL_13	1	2	0	67	5	13	1	1	0	9	7	2	1	0	5
IV_23	3	2	0	82	5	13	1	1	0	9	6	2	1	1	6
IV_42	2	5	0	232	6	13	2	1	0	9	10	2	3	1	6
IV_56	3	41	0	193	4	7	1	1	0	7	12	1	1	4	3
IV_57	0	74	0	231	7	11	2	1	1	8	28	1	1	2	7

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
RB_02	0	0	0	0	0	0	0	0	0	0	0	1
RB_21	0	0	1	0	0	0	0	0	0	0	1	1
RI_006	1	0	1	0	0	0	0	0	0	0	0	1
RI_032	0	0	0	0	0	0	0	0	0	0	0	1
TB_4	0	0	0	0	0	0	0	0	0	0	0	1
	Subgroup: High Zn (n= 7)											
H_C71_1	1	0	1	0	1	0	1	0	1	0	8	2
H_C72_1	1	0	1	0	2	0	1	0	1	0	8	2
H_C73_1	1	0	1	0	1	0	1	0	1	0	8	2
H_C74_1	1	0	1	0	2	0	1	0	1	0	8	2
H_C75_1	1	0	1	0	2	0	1	0	1	0	8	2
H_C76_1	1	0	1	0	1	0	1	0	1	0	8	2
TB_7	1	0	1	0	2	0	1	0	1	0	9	2
	Subgroup: Zn + Sn (n=34)											
CAD_2_1	1	0	1	0	1	0	1	0	1	0	5	1
CAD_4_1	1	0	1	0	1	0	1	0	1	0	6	1
CAD_5_1	1	0	1	0	1	0	1	0	1	0	6	2
GC_03	1	0	1	0	1	0	0	0	0	0	2	1
GG_05_1	1	0	1	0	1	0	1	0	1	0	6	1
GG_10_1	1	0	1	0	1	0	1	0	1	0	7	2
GG_11_1	1	0	1	0	1	0	1	0	1	0	6	2
GL_04	1	0	1	0	2	0	1	0	1	0	9	2
GL_05	2	0	2	0	2	0	1	0	1	0	9	3
GL_06	1	0	1	0	2	0	1	0	1	0	10	2
GL_07	1	0	1	0	1	0	1	0	1	0	10	2
GL_08	1	0	1	0	2	0	1	0	2	0	11	2
GL_09	2	0	2	0	2	0	1	0	2	0	10	2
GL_10	1	0	1	0	2	0	1	0	1	0	10	2
GL_11	2	0	1	0	2	0	1	0	1	0	11	3
GL_12	2	0	2	0	2	0	1	0	1	0	11	2
GL_13	1	0	1	0	2	0	1	0	1	0	10	2
IV_23	2	0	1	0	2	0	1	0	1	0	11	2
IV_42	1	0	1	0	2	0	1	0	1	0	9	3
IV_56	1	0	1	0	1	0	1	0	1	0	7	2
IV_57	2	0	1	0	1	0	1	0	1	0	8	3

Sample ID	**Site**	**SiO_2**	**Na_2O**	**MgO**	**Al_2O_3**	**P_2O_5**	**K_2O**	**CaO**	**MnO**	**Fe_2O_3**	**CuO**	**Sn**	**Pb**
IV_59	Iliniwek Village	63.0%	12.3%	2.0%	1.0%	0.3%	8.8%	8.7%	0.3%	0.4%	1.2%	3414	2955
IV_60	Iliniwek Village	61.7%	12.0%	2.2%	1.1%	0.3%	8.7%	9.5%	0.1%	0.5%	1.1%	8223	6275
IV_61	Iliniwek Village	63.1%	16.4%	1.9%	1.1%	0.2%	4.7%	7.8%	0.2%	0.5%	1.0%	6954	5899
MA_01	Marina	63.2%	10.4%	2.0%	1.0%	0.3%	9.4%	9.0%	0.1%	0.6%	1.4%	7203	7729
PP_01	Peshtigo Point	61.8%	12.0%	2.1%	1.0%	0.3%	10.2%	8.6%	0.3%	0.4%	1.3%	4731	2423
PP_04	Peshtigo Point	61.7%	12.3%	2.0%	0.9%	0.2%	9.7%	9.2%	0.3%	0.1%	1.4%	4424	3503
PP_06	Peshtigo Point	62.4%	12.7%	2.4%	1.1%	0.2%	9.0%	7.7%	0.2%	0.3%	1.3%	6259	6393
PTS_3_1	Point Sauble	61.6%	13.7%	2.8%	1.2%	0.3%	5.5%	11.2%	0.2%	0.5%	0.9%	8582	4553
RB_03	Red Banks	61.0%	10.5%	2.1%	1.8%	0.6%	8.5%	8.3%	0.1%	0.7%	1.6%	15855	18257
RB_04	Red Banks	64.8%	14.7%	2.0%	1.1%	0.2%	4.5%	7.1%	0.2%	0.5%	1.6%	5843	14363
RB_19	Red Banks	61.5%	13.9%	2.6%	1.3%	0.2%	6.5%	9.6%	0.2%	0.5%	1.0%	5569	9457
RI_008	Rock Island 3b	63.2%	11.3%	2.5%	1.0%	0.3%	5.3%	8.3%	0.2%	0.4%	0.9%	6836	40294
RI_104	Rock Island 3	63.1%	11.9%	2.5%	1.1%	0.3%	5.4%	8.3%	0.2%	0.5%	1.1%	6520	31591
	Subgroup: Zn (n=5)												
IV_22	Iliniwek Village	61.2%	10.8%	2.4%	0.9%	0.2%	8.2%	11.4%	0.1%	0.4%	1.2%	4	123
IV_52	Iliniwek Village	60.9%	13.9%	2.4%	1.1%	0.2%	4.9%	9.6%	0.3%	0.5%	1.7%	20	229
IV_58	Iliniwek Village	62.8%	11.8%	2.5%	1.1%	0.5%	7.8%	10.5%	0.4%	0.2%	0.9%	875	1396
MM_017	Marquette Mission	69.7%	11.9%	2.7%	0.9%	0.2%	5.1%	6.9%	0.1%	0.3%	1.2%	5	170
MM_018	Marquette Mission	69.4%	11.9%	2.8%	0.9%	0.2%	5.3%	7.0%	0.1%	0.3%	1.3%	6	177
	Subgroup: Zn + Sb (n=4)												
CAD_3_1	Cadotte	65.3%	13.4%	2.3%	1.1%	0.3%	5.6%	9.0%	0.2%	0.8%	0.9%	636	889
PTS_1_1	Point Sauble	63.6%	12.8%	2.4%	1.6%	0.3%	6.5%	10.3%	0.2%	0.5%	0.7%	818	2251
RB_08	Red Banks	64.0%	13.5%	2.4%	1.3%	0.2%	6.5%	9.0%	0.2%	0.5%	1.0%	478	1057
WA_01_1	Wanampito	64.5%	12.9%	2.4%	1.5%	0.2%	7.7%	7.5%	0.2%	0.6%	0.9%	559	2450
	Subgroup: Sb+Zn+Pb												
MM_024	Marquette Mission	65.7%	10.8%	2.9%	1.1%	0.2%	3.4%	7.6%	0.1%	0.5%	1.5%	12	13488
	Subgroup: Med-Pb												
RI_123	Rock Island 3b	65.9%	14.6%	1.8%	1.0%	0.5%	4.9%	6.7%	0.1%	0.4%	1.5%	45	13522

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
IV_59	15	0	104	3	828	9	18	15	10	3377	28	31	401	208	4
IV_60	12	0	117	4	954	11	27	18	4	2887	8	24	385	213	5
IV_61	17	0	82	5	1307	9	21	8	7	2465	9	19	343	311	6
MA_01	14	1	120	3	1114	11	16	19	4	3798	12	30	384	211	5
PP_01	16	0	101	4	738	10	19	16	11	4192	32	36	423	222	5
PP_04	16	1	93	2	786	9	9	15	10	4624	35	34	407	212	5
PP_06	12	0	122	3	833	11	18	23	16	4283	41	31	394	213	5
PTS_3_1	19	1	71	2	984	8	8	16	17	2965	35	23	509	201	5
RB_03	14	1	89	3	337	12	24	16	3	3158	11	24	353	214	6
RB_04	16	0	70	3	374	9	12	11	8	2564	28	20	363	308	7
RB_19	18	0	61	2	270	10	11	16	26	3290	55	22	501	215	5
RI_008	19	0	90	3	227	10	10	26	50	2195	210	54	439	100	3
RI_104	17	0	79	2	125	10	9	25	49	2601	212	59	439	101	3
	Subgroup: Zn (n=5)														
IV_22	27	0	81	3	701	7	13	22	30	4096	35	28	489	221	4
IV_52	18	1	84	3	836	9	16	11	8	5574	12	17	480	245	5
IV_58	16	1	103	3	798	11	11	16	17	2546	44	28	540	191	4
MM_017	15	1	121	3	543	9	17	11	3	4200	0	86	474	88	3
MM_018	17	2	128	3	548	10	23	13	3	3802	0	91	458	85	3
	Subgroup: Zn + Sb (n=4)														
CAD_3_1	20	1	94	2	1091	12	14	18	12	2892	36	26	427	190	5
PTS_1_1	17	1	75	2	946	9	16	15	22	2342	36	37	487	190	4
RB_08	15	0	74	3	276	10	13	20	13	3381	43	26	417	206	5
WA_01_1	17	0	96	2	343	11	11	19	28	2735	44	50	390	185	4
	Subgroup: Sb+Zn+Pb														
MM_024	13	1	91	3	511	10	20	43	6	4763	1	48	455	75	2
	Subgroup: Med-Pb														
RI_123	18	0	88	2	58	7	5	179	390	42	390	20	478	14	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
IV_59	5	6	0	139	3	7	1	0	0	7	12	1	1	4	3
IV_60	4	6	0	168	3	6	1	0	0	7	13	1	1	3	3
IV_61	4	18	0	149	5	12	1	1	1	9	9	2	7	1	5
MA_01	3	6	0	192	4	7	1	0	1	7	18	1	1	3	4
PP_01	3	4	0	147	4	7	1	0	0	7	10	1	1	5	4
PP_04	0	6	0	135	4	7	1	0	0	7	12	1	2	5	4
PP_06	0	6	0	126	4	8	1	0	0	7	31	1	1	6	4
PTS_3_1	3	122	0	133	5	9	1	0	0	7	15	1	1	2	4
RB_03	9	5	0	184	4	10	1	0	0	7	17	1	1	3	4
RB_04	9	4	0	148	5	13	2	1	0	9	17	2	3	1	5
RB_19	8	24	0	133	5	9	1	0	1	8	14	1	1	2	4
RI_008	4	1473	0	133	5	11	1	0	0	5	29	2	1	1	5
RI_104	3	1438	0	122	6	11	1	0	0	5	27	2	1	2	5
	Subgroup: Zn (n=5)														
IV_22	4	7	0	89	3	7	1	0	0	7	11	1	1	5	3
IV_52	5	349	0	153	4	7	1	0	1	7	4	1	2	1	4
IV_58	5	8	0	295	5	8	1	0	0	7	7	1	2	2	4
MM_017	6	7	0	89	6	11	2	0	2	5	2	1	1	0	6
MM_018	5	7	1	91	6	11	1	0	2	5	2	1	1	1	6
	Subgroup: Zn + Sb (n=4)														
CAD_3_1	2	1999	0	146	4	9	1	0	1	6	5	1	1	2	4
PTS_1_1	6	1491	0	157	7	14	2	0	0	6	10	1	1	1	6
RB_08	9	1460	0	129	4	9	1	0	1	7	9	1	1	2	4
WA_01_1	4	2381	1	130	7	14	2	0	0	6	10	1	1	1	6
	Subgroup: Sb+Zn+Pb														
MM_024	14	20239	1	84	6	11	1	0	4	5	27	1	1	1	6
	Subgroup: Med-Pb														
RI_123	2	627	0	55	2	4	1	0	0	2	108	1	0	2	2

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
IV_59	1	0	1	0	1	0	1	0	1	0	6	1
IV_60	1	0	1	0	1	0	1	0	1	0	5	1
IV_61	1	0	1	0	1	0	1	0	1	0	8	2
MA_01	1	0	1	0	1	0	1	0	1	0	6	1
PP_01	1	0	1	0	1	0	1	0	1	0	6	1
PP_04	1	0	1	0	1	0	1	0	1	0	6	2
PP_06	1	0	1	0	1	0	1	0	1	0	6	1
PTS_3_1	1	0	1	0	1	0	1	0	1	0	6	2
RB_03	1	0	1	0	1	0	1	0	1	0	6	1
RB_04	1	0	1	0	2	0	1	0	1	0	9	2
RB_19	1	0	1	0	1	0	1	0	1	0	6	2
RI_008	1	0	1	0	1	0	0	0	1	0	3	1
RI_104	1	0	1	0	1	0	1	0	1	0	3	2
	Subgroup: Zn (n=5)											
IV_22	1	0	1	0	1	0	1	0	1	0	6	2
IV_52	1	0	1	0	1	0	1	0	1	0	7	2
IV_58	1	0	1	0	1	0	1	0	1	0	5	2
MM_017	2	0	1	0	1	0	1	0	1	0	3	2
MM_018	2	0	2	0	1	0	1	0	2	0	3	3
	Subgroup: Zn + Sb (n=4)											
CAD_3_1	1	0	1	0	1	0	1	0	1	0	5	2
PTS_1_1	1	0	1	0	1	0	1	0	1	0	5	2
RB_08	1	0	1	0	1	0	1	0	1	0	6	2
WA_01_1	1	0	1	0	1	0	1	0	1	0	5	2
	Subgroup: Sb+Zn+Pb											
MM_024	1	0	1	0	1	0	1	0	1	0	2	2
	Subgroup: Med-Pb											
RI_123	0	0	0	0	0	0	0	0	0	0	0	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	5.2.4 Manganese-colored black beads (IIa7)												
BL_31_1	La Belle Shipwreck	60.5%	13.1%	3.0%	3.0%	0.4%	1.9%	9.7%	5.1%	1.8%	0.1%	209	1584
BL_32_1	La Belle Shipwreck	60.3%	13.4%	3.1%	2.9%	0.4%	1.8%	10.0%	4.9%	1.7%	0.1%	226	1684
BL_33_1	La Belle Shipwreck	60.2%	11.4%	4.0%	2.8%	0.5%	1.6%	10.6%	5.0%	1.9%	0.1%	185	5790
BL_34_1	La Belle Shipwreck	60.0%	13.2%	3.1%	3.0%	0.4%	1.8%	10.0%	5.3%	1.8%	0.1%	200	1519
BL_35_1	La Belle Shipwreck	60.0%	13.1%	3.1%	3.0%	0.4%	1.9%	10.0%	5.3%	1.7%	0.1%	199	1504
CM_59	Fort Michilimackinac	36.7%	4.5%	0.9%	1.2%	0.8%	2.2%	4.7%	6.7%	0.4%	0.1%	338	352935
DI_1	Doty Island Village	41.5%	7.3%	1.1%	1.1%	0.5%	3.7%	5.3%	7.4%	0.9%	0.2%	472	260946
DI_2	Doty Island Village	43.2%	7.9%	1.1%	1.2%	0.5%	3.9%	5.6%	5.2%	0.9%	0.1%	923	253977
M_02	Mahler	60.5%	10.6%	2.4%	1.6%	1.1%	4.6%	9.6%	7.1%	1.1%	0.0%	7	3108
M_03	Mahler	64.8%	9.2%	2.0%	1.5%	1.0%	4.7%	8.8%	6.0%	1.0%	0.0%	7	1648
MM_109	Marquette Mission	59.5%	12.9%	4.7%	2.5%	0.9%	2.0%	11.1%	5.1%	0.9%	0.1%	42	1551
SL_14_1	Fort St. Louis	61.2%	14.7%	3.0%	2.8%	0.2%	1.1%	8.6%	6.4%	1.3%	0.1%	87	4772
SL_15_1	Fort St. Louis	61.6%	15.2%	3.0%	2.6%	0.2%	1.1%	8.6%	5.8%	1.2%	0.1%	91	3203
	5.2.5 Antimony-opacified white beads (IIa13/14)												
BL_36_1	La Belle Shipwreck	66.7%	14.1%	3.7%	0.8%	0.3%	1.8%	10.6%	0.5%	0.4%	0.0%	1	512
BL_37_1	La Belle Shipwreck	65.5%	14.2%	3.8%	0.9%	0.3%	2.1%	11.0%	0.5%	0.5%	0.0%	3	1214
BL_38_1	La Belle Shipwreck	67.9%	12.4%	3.5%	0.9%	0.2%	1.9%	11.3%	0.5%	0.4%	0.0%	2	37
BL_39_1	La Belle Shipwreck	66.1%	14.2%	3.7%	0.9%	0.3%	1.8%	10.9%	0.5%	0.4%	0.0%	1	541
BL_40_1	La Belle Shipwreck	65.5%	14.1%	3.8%	1.0%	0.3%	2.0%	11.1%	0.5%	0.5%	0.0%	8	1929
CM_60	Fort Michilimackinac	64.7%	11.8%	1.6%	1.4%	1.0%	4.7%	12.1%	0.1%	0.5%	0.0%	4	285
CM_61	Fort Michilimackinac	67.3%	10.9%	1.8%	1.0%	0.6%	5.1%	10.0%	0.8%	0.5%	0.0%	4	311
CM_62	Fort Michilimackinac	68.0%	11.4%	1.7%	1.0%	0.6%	5.0%	9.0%	0.8%	0.5%	0.0%	3	229
CM_63	Fort Michilimackinac	68.7%	10.0%	1.5%	0.8%	0.9%	7.2%	8.5%	0.7%	0.4%	0.0%	8	396
CM_64	Fort Michilimackinac	69.8%	12.2%	1.8%	1.0%	1.0%	3.8%	7.8%	0.7%	0.5%	0.0%	7	594
CM_65	Fort Michilimackinac	68.8%	12.3%	1.7%	1.1%	0.9%	4.0%	8.5%	0.8%	0.5%	0.0%	8	237
CM_66	Fort Michilimackinac	70.7%	12.1%	1.1%	0.9%	0.7%	4.4%	7.6%	0.6%	0.5%	0.0%	5	198
CM_67	Fort Michilimackinac	66.4%	15.2%	1.6%	1.0%	0.7%	4.6%	7.7%	0.5%	0.5%	0.0%	4	134
CM_68	Fort Michilimackinac	69.5%	11.3%	1.7%	1.6%	0.5%	4.1%	9.0%	0.6%	0.6%	0.0%	4	171
CM_69	Fort Michilimackinac	68.1%	12.3%	1.3%	1.2%	0.6%	4.7%	9.1%	0.8%	0.5%	0.0%	7	203
CM_70	Fort Michilimackinac	66.6%	12.9%	1.3%	1.0%	0.8%	5.4%	9.4%	0.5%	0.5%	0.0%	6	120
GG_13_1	Gillett Grove	64.8%	12.1%	3.3%	1.1%	0.2%	5.8%	11.2%	0.5%	0.5%	0.0%	2	21
MP_03	Mormon Print Shop	67.7%	10.7%	1.7%	1.4%	0.8%	5.8%	9.7%	0.2%	0.4%	0.0%	3	151
SL_16_1	Fort St. Louis	58.2%	11.9%	3.4%	1.0%	0.1%	3.8%	11.8%	0.5%	0.5%	0.0%	3	589

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	5.2.4 Manganese-colored black beads (IIa7)														
BL_31_1	9	1	76	4	558	27	19	29	36	57	125	11	752	47	3
BL_32_1	10	1	77	4	541	26	19	31	44	55	124	9	753	46	3
BL_33_1	10	1	121	4	583	27	20	32	41	66	138	9	723	52	3
BL_34_1	10	1	75	4	570	27	21	30	39	49	132	10	784	50	3
BL_35_1	10	1	76	4	577	27	22	30	40	49	129	9	778	49	4
CM_59	7	0	57	3	280	26	18	34	27	99	128	12	420	25	2
DI_1	12	0	70	1	39	17	9	49	45	56	887	9	507	16	1
DI_2	13	0	74	2	45	16	11	39	40	87	1167	10	584	19	2
M_02	18	0	135	2	72	24	17	37	37	91	105	15	665	24	2
M_03	17	0	123	3	65	22	13	38	36	89	69	14	603	23	2
MM_109	10	1	258	4	551	19	28	44	39	115	153	9	569	36	2
SL_14_1	11	1	81	2	293	16	0	204	110	59	386	12	397	43	3
SL_15_1	11	1	80	2	269	15	0	75	55	48	156	10	415	40	2
	5.2.5 Antimony-opacified white beads (IIa13/14)														
BL_36_1	11	1	99	2	151	7	10	11	23	34	42	10	597	14	1
BL_37_1	11	1	103	2	170	8	11	13	27	34	49	10	632	16	1
BL_38_1	8	1	87	2	137	7	11	26	15	27	29	11	613	13	1
BL_39_1	11	1	98	2	156	8	11	13	24	32	42	9	615	15	1
BL_40_1	10	1	96	2	175	8	12	13	27	35	48	11	636	16	1
CM_60	12	0	125	4	287	12	22	10	3	66	7	16	490	29	2
CM_61	16	0	76	4	224	9	19	9	5	51	10	19	690	32	1
CM_62	17	0	86	4	213	9	17	12	5	55	29	19	730	32	2
CM_63	20	0	87	4	174	8	19	33	24	60	39	17	868	16	1
CM_64	10	0	126	5	236	10	24	29	9	88	19	18	597	17	2
CM_65	11	1	116	5	277	9	23	17	12	81	22	18	608	18	2
CM_66	18	1	108	5	222	9	23	13	12	64	24	24	494	18	2
CM_67	18	1	125	4	192	9	18	14	8	59	14	10	697	15	2
CM_68	24	1	104	5	359	13	24	21	21	65	30	26	756	46	2
CM_69	21	1	115	5	248	10	23	25	12	77	9	20	720	22	2
CM_70	15	0	112	5	223	9	24	21	14	73	16	22	779	21	1
GG_13_1	17	1	62	1	99	6	2	12	14	21	22	26	715	24	1
MP_03	21	0	134	4	294	12	25	14	3	61	10	11	637	20	1
SL_16_1	14	0	52	1	144	6	0	6	5	17	6	15	959	26	1

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	5.2.4 Manganese-colored black beads (IIa7)														
BL_31_1	0	322	0	471	8	13	2	0	0	8	12	1	0	1	7
BL_32_1	0	366	0	456	8	12	2	0	0	8	12	1	0	1	7
BL_33_1	0	384	0	446	8	12	2	0	0	8	10	1	0	1	8
BL_34_1	0	206	0	472	8	12	2	0	0	8	12	1	0	1	7
BL_35_1	0	197	0	474	8	12	2	0	0	8	12	1	0	1	7
CM_59	10	1609	0	475	4	7	1	0	38	4	14	2	1	3	4
DI_1	3	845	0	669	6	6	2	0	0	5	33	2	1	3	6
DI_2	3	861	0	505	6	8	2	0	1	5	43	2	1	2	6
M_02	0	333	0	538	5	9	1	0	0	4	8	2	1	4	4
M_03	0	394	0	365	4	8	1	0	0	4	14	1	1	3	4
MM_109	0	193	0	369	6	11	2	0	3	7	14	1	1	1	6
SL_14_1	0	613	0	824	11	15	3	0	0	9	39	4	1	1	10
SL_15_1	0	673	0	753	10	14	2	0	0	8	20	3	1	1	9
	5.2.5 Antimony-opacified white beads (IIa13/14)														
BL_36_1	0	381	0	133	3	5	1	0	0	3	10	0	0	1	2
BL_37_1	0	284	0	135	3	5	1	0	0	3	11	0	0	1	3
BL_38_1	0	176	0	171	3	5	1	0	0	3	6	1	0	1	2
BL_39_1	0	427	0	134	3	5	1	0	0	3	10	0	0	1	3
BL_40_1	0	336	0	135	3	5	1	0	0	3	11	0	0	1	3
CM_60	1	3552	0	89	4	8	1	0	1	3	1	1	0	1	4
CM_61	2	4525	0	188	3	6	1	0	2	3	4	1	0	2	3
CM_62	3	4644	0	181	3	6	1	0	1	3	3	1	0	2	3
CM_63	23	275	0	78	2	5	1	0	7	2	24	2	3	2	2
CM_64	208	413	0	86	3	5	1	0	4	3	5	1	1	2	3
CM_65	23	485	0	69	3	6	1	0	10	3	14	1	0	1	3
CM_66	6	242	0	113	3	5	1	0	8	2	7	1	0	1	3
CM_67	22	1597	1	85	3	5	1	0	4	2	7	1	1	2	3
CM_68	2	85	1	122	5	9	1	0	3	4	13	3	1	1	5
CM_69	5	248	0	74	3	6	1	2	19	3	6	2	8	2	3
CM_70	6	1058	0	112	3	5	1	0	5	3	11	1	0	2	3
GG_13_1	0	241	0	104	3	6	1	0	0	3	24	0	0	1	3
MP_03	0	4282	0	83	2	5	1	0	1	2	8	0	0	0	2
SL_16_1	0	54238	0	170	4	8	1	0	0	3	8	1	0	0	4

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	5.2.4 Manganese-colored black beads (IIa7)											
BL_31_1	2	0	2	0	1	0	1	0	1	0	1	2
BL_32_1	2	0	1	0	1	0	1	0	1	0	1	2
BL_33_1	2	0	2	0	1	0	1	0	1	0	2	1
BL_34_1	2	0	1	0	1	0	1	0	1	0	1	2
BL_35_1	2	0	2	0	1	0	1	0	1	0	1	2
CM_59	2	0	1	0	1	0	1	0	1	0	1	1
DI_1	1	0	1	0	1	0	1	0	0	0	0	1
DI_2	1	0	1	0	1	0	1	0	1	0	1	1
M_02	1	0	1	0	1	0	0	0	0	0	1	1
M_03	1	0	1	0	1	0	0	0	0	0	1	1
MM_109	1	0	1	0	1	0	1	0	1	0	1	2
SL_14_1	2	0	2	0	2	0	1	0	1	0	2	2
SL_15_1	2	0	2	0	2	0	1	0	1	0	1	2
	5.2.5 Antimony-opacified white beads (IIa13/14)											
BL_36_1	1	0	0	0	0	0	0	0	0	0	0	1
BL_37_1	1	0	1	0	0	0	0	0	0	0	0	1
BL_38_1	0	0	0	0	0	0	0	0	0	0	0	1
BL_39_1	0	0	0	0	1	0	0	0	0	0	0	1
BL_40_1	1	0	1	0	0	0	0	0	0	0	0	1
CM_60	1	0	1	0	1	0	1	0	1	0	1	1
CM_61	1	0	1	0	1	0	1	0	1	0	1	1
CM_62	1	0	1	0	1	0	1	0	1	0	1	1
CM_63	1	0	1	0	1	0	0	0	1	0	1	1
CM_64	1	0	1	0	1	0	0	0	0	0	1	1
CM_65	1	0	1	0	1	0	1	0	0	0	1	1
CM_66	1	0	1	0	1	0	0	0	0	0	1	1
CM_67	1	0	1	0	1	0	0	0	1	0	1	1
CM_68	2	0	1	0	1	0	1	0	1	0	2	2
CM_69	1	0	1	0	1	0	1	1	2	1	2	3
CM_70	1	0	1	0	1	0	0	0	1	0	1	1
GG_13_1	1	0	1	0	0	0	0	0	0	0	1	1
MP_03	0	0	0	0	0	0	0	0	0	0	0	1
SL_16_1	1	0	1	0	1	0	0	0	0	0	1	1

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	5.2.6 Miscellaneous types												
	5.2.6.1 High Potassium Blue Beads (wood-ash and potash glass)												
	Subgroup: High K20 (n=5)												
CAD_10_1	Cadotte	63.1%	2.5%	0.5%	1.1%	0.4%	18.2%	13.0%	0.5%	0.5%	0.0%	207	235
PTS_5_1	Point Sauble	61.7%	2.6%	0.9%	1.5%	0.5%	17.6%	13.6%	0.5%	0.6%	0.0%	587	1361
PTS_4_1	Point Sauble	67.2%	1.5%	0.3%	0.8%	0.2%	17.5%	11.3%	0.5%	0.4%	0.0%	65	145
CAD_9_1	Cadotte	67.5%	2.4%	0.5%	1.0%	0.3%	15.5%	11.8%	0.2%	0.5%	0.0%	77	314
GC_02	Gros Cap	65.9%	0.8%	0.3%	0.6%	0.1%	19.3%	12.3%	0.1%	0.3%	0.0%	2	27
RB_07	Red Banks	62.8%	2.0%	0.6%	1.4%	0.4%	22.0%	9.5%	0.4%	0.5%	0.0%	169	735
RB_06	Red Banks	63.2%	2.0%	0.6%	1.3%	0.4%	22.2%	9.1%	0.4%	0.5%	0.0%	157	705
	High K2O plus Zn												
RB_22	Red Banks	60.8%	0.8%	0.8%	1.0%	0.2%	24.1%	11.4%	0.1%	0.3%	0.4%	42	231
	Med high K20												
H_L2B_1	Hanson	62.9%	7.3%	2.2%	0.7%	0.4%	15.1%	9.5%	0.2%	0.1%	1.0%	7	127
	5.2.6.2 Moderate to High Lead Blue Beads												
	High Pb												
RI_012	Rock Island 3a	37.4%	0.6%	0.2%	0.4%	0.1%	7.2%	0.8%	0.0%	0.1%	0.8%	5	449137
B_P295	Bell	41.0%	0.8%	0.3%	0.5%	0.1%	7.7%	1.1%	0.0%	0.2%	1.0%	9	405266
B_P286	Bell	42.4%	0.5%	0.2%	0.5%	0.1%	8.4%	0.8%	0.0%	0.2%	0.8%	7	396620
	Med Pb + K												
GC_06	Gros Cap	60.7%	0.5%	0.2%	0.5%	0.1%	14.8%	0.7%	0.0%	0.2%	1.3%	9	174057
	Cu AND Co + Pb												
AR_03	Arrowsmith	65.3%	17.2%	0.1%	3.8%	0.0%	3.0%	4.6%	0.2%	0.3%	1.7%	211	19761
	Na-Ca +Pb												
RI_106	Rock Island 3b	61.9%	6.9%	1.9%	1.1%	0.2%	7.4%	7.5%	0.2%	0.5%	1.4%	7	85240

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	5.2.6 Miscellaneous types														
	5.2.6.1 High Potassium Blue Beads (wood-ash and potash glass)														
	Subgroup: High K20 (n=5)														
CAD_10_1	13	0	128	2	429	13	6	89	236	87	775	371	133	58	2
PTS_5_1	18	1	137	2	474	14	8	113	367	95	1305	342	171	58	2
PTS_4_1	11	0	166	1	535	12	4	117	332	71	695	501	81	145	2
CAD_9_1	15	1	85	2	325	11	6	76	632	145	1745	262	126	32	1
GC_02	11	0	118	3	83	8	16	146	305	52	1212	490	66	5	0
RB_07	13	1	91	2	101	14	9	92	398	63	901	324	127	46	2
RB_06	14	1	96	2	101	15	10	94	399	73	925	319	123	41	2
	High K2O plus Zn														
RB_22	27	1	62	1	34	9	5	113	738	8422	0	417	107	3	4
	Med high K20														
H_L2B_1	15	0	104	2	681	7	6	11	3	3124	12	62	423	320	7
	5.2.6.2 Moderate to High Lead Blue Beads														
	High Pb														
RI_012	7	0	28	1	101	3	3	7	23	2119	41	25	44	40	1
B_P295	7	0	39	1	67	4	4	5	3	2582	34	29	54	45	2
B_P286	8	0	42	2	67	4	3	7	21	1867	49	29	34	42	1
	Med Pb + K														
GC_06	7	0	29	3	393	4	12	6	2	4512	5	61	32	64	2
	Cu AND Co + Pb														
AR_03	14	0	95	4	131	5	46	113	2210	331	1762	58	53	22	1
	Na-Ca +Pb														
RI_106	18	0	40	2	87	7	6	9	15	4766	54	39	327	42	2

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	5.2.6 Miscellaneous types														
	5.2.6.1 High Potassium Blue Beads (wood-ash and potash glass)														
	Subgroup: High K20 (n=5)														
CAD_10_1	0	210	2	424	5	9	1	0	0	10	120	9	2	4	4
PTS_5_1	1	349	2	575	5	10	1	0	0	10	202	16	2	5	4
PTS_4_1	1	36	4	366	9	18	2	0	0	14	87	10	1	2	8
CAD_9_1	0	353	2	299	3	7	1	0	0	10	97	20	1	8	3
GC_02	1	1	1	110	2	2	0	0	13	2	68	5	1	2	1
RB_07	4	152	2	445	5	8	1	0	7	8	136	11	1	6	4
RB_06	3	148	2	420	4	8	1	0	5	8	134	10	2	6	4
	High K2O plus Zn														
RB_22	2	0	0	9	2	20	2	6	4	0	0	0	0	0	0
	Med high K20														
H_L2B_1	7	2	0	194	4	10	1	1	0	8	1	1	1	5	4
	5.2.6.2 Moderate to High Lead Blue Beads														
	High Pb														
RI_012	21	439	1	39	3	6	1	0	0	2	13	0	0	0	3
B_P295	17	517	1	58	4	8	1	0	1	3	3	1	0	0	4
B_P286	37	358	0	42	3	7	1	0	1	3	13	0	0	0	4
	Med Pb + K														
GC_06	20	1521	0	29	4	8	1	0	0	3	1	0	0	0	4
	Cu AND Co + Pb														
AR_03	1	6943	1	365	2	4	0	0	0	9	3	1	0	0	2
	Na-Ca +Pb														
RI_106	6	415	0	112	4	9	1	0	1	3	6	1	0	1	4

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	5.2.6 Miscellaneous types											
	5.2.6.1 High Potassium Blue Beads (wood-ash and potash glass)											
	Subgroup: High K20 (n=5)											
CAD_10_1	1	0	1	0	1	0	1	0	1	0	2	1
PTS_5_1	1	0	1	0	1	0	1	0	1	0	2	2
PTS_4_1	2	0	2	0	2	0	1	0	1	0	4	3
CAD_9_1	1	0	1	0	1	0	1	0	0	0	1	1
GC_02	0	0	0	0	0	0	0	0	0	0	0	0
RB_07	1	0	1	0	1	0	1	0	0	0	1	1
RB_06	1	0	1	0	1	0	0	0	0	0	1	1
	High K2O plus Zn											
RB_22	0	0	0	0	0	1	2	0	60	230	0	6
	Med high K20											
H_L2B_1	1	0	1	0	1	0	1	0	1	0	9	2
	5.2.6.2 Moderate to High Lead Blue Beads											
	High Pb											
RI_012	1	0	1	0	0	0	0	0	0	0	1	1
B_P295	1	0	1	0	1	0	0	0	0	0	2	2
B_P286	1	0	1	0	1	0	0	0	0	0	1	2
	Med Pb + K											
GC_06	1	0	1	0	0	0	0	0	0	0	2	1
	Cu AND Co + Pb											
AR_03	1	0	1	0	1	0	0	0	0	0	1	1
	Na-Ca +Pb											
RI_106	1	0	1	0	1	0	0	0	0	0	1	2

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
	5.2.6.3 Antimony Opacified Cored Blue and White Beads												
	Sb Opacified IVa16												
BL_30_1	La Belle Shipwreck	83.5%	2.0%	1.6%	1.8%	0.0%	0.5%	2.8%	0.1%	0.6%	0.0%	192	2107
BL_29_1	La Belle Shipwreck	64.8%	16.0%	2.5%	1.0%	0.2%	2.3%	7.2%	0.2%	0.5%	0.0%	18	964
BL_26_1	La Belle Shipwreck	67.6%	14.6%	2.4%	1.1%	0.2%	2.1%	7.4%	0.5%	0.6%	0.0%	39	677
BL_28_1	La Belle Shipwreck	65.7%	16.3%	2.9%	1.0%	0.2%	2.4%	9.4%	0.4%	0.4%	0.0%	23	392
BL_25_1	La Belle Shipwreck	65.7%	16.3%	3.0%	0.9%	0.2%	2.2%	9.7%	0.4%	0.4%	0.0%	13	211
	5.2.6.4 Soda-Lime Colorless Beads												
	Hanson pale yellow												
C_5	Hanson	68.3%	11.4%	2.9%	1.7%	0.3%	5.4%	8.4%	0.1%	0.8%	0.0%	35	182
H_C53_1	Hanson	67.6%	13.9%	2.6%	1.6%	0.3%	4.5%	8.3%	0.3%	0.4%	0.0%	163	294
H_C52_1	Hanson	67.1%	14.1%	2.7%	1.6%	0.3%	4.5%	8.6%	0.3%	0.4%	0.0%	176	335
H_C54_1	Hanson	67.6%	13.9%	2.6%	1.6%	0.2%	4.5%	8.3%	0.3%	0.5%	0.0%	173	318
H_C51_1	Hanson	67.2%	12.5%	2.9%	1.9%	0.3%	5.3%	8.9%	0.2%	0.4%	0.0%	35	113
	5.3.1 Cu-colored blue glass pendants or fragments												
	Subgroup: P-low-Mg (n=6)												
CM_73	Fort Michilimackinac	69.7%	14.0%	1.4%	0.8%	1.0%	3.6%	7.3%	0.0%	0.5%	1.4%	182	399
CM_74	Fort Michilimackinac	69.2%	15.1%	1.4%	0.8%	0.7%	3.9%	7.2%	0.0%	0.5%	1.1%	31	50
CM_75	Fort Michilimackinac	69.7%	13.4%	1.2%	1.1%	0.8%	5.1%	6.8%	0.0%	0.6%	1.2%	42	57
RI_023	Rock Island 3 or 4	68.2%	14.8%	1.3%	0.8%	0.8%	3.8%	7.3%	0.0%	0.4%	1.5%	31	80
RI_027	Rock Island 4	68.7%	13.0%	1.2%	1.3%	0.7%	4.5%	7.7%	0.0%	0.5%	1.3%	35	76
RI_028	Rock Island 4	68.5%	13.3%	1.2%	1.2%	0.7%	4.5%	7.6%	0.0%	0.5%	1.2%	34	82
	Subgroup: Mg-low-P (n=22)												
GG_03	Gillett Grove	62.6%	12.7%	2.5%	1.5%	0.3%	7.0%	8.1%	0.2%	0.6%	1.1%	16570	4811
ZM_02	Zimmerman	60.9%	11.8%	2.3%	1.0%	0.3%	10.4%	9.2%	0.1%	0.4%	1.0%	9070	4912
GC_04	Gros Cap	63.9%	12.5%	2.8%	1.1%	0.3%	6.0%	8.6%	0.2%	0.4%	1.0%	7066	9309
GG_02	Gillett Grove	64.3%	13.9%	2.7%	1.3%	0.3%	5.1%	8.5%	0.2%	0.6%	1.0%	6333	3773
GC_05	Gros Cap	63.8%	7.9%	3.0%	1.1%	0.3%	7.8%	8.1%	0.1%	0.3%	1.3%	8	17945
GG_04	Gillett Grove	64.4%	12.8%	2.3%	1.0%	0.3%	6.0%	8.8%	0.1%	0.5%	1.1%	9081	5271
ZM_04	Zimmerman	62.9%	14.7%	2.8%	1.0%	0.3%	2.8%	10.6%	0.3%	0.5%	0.8%	11309	2826
ZM_07	Zimmerman	61.4%	11.7%	1.9%	2.2%	0.3%	9.9%	7.4%	0.1%	0.5%	1.3%	13333	5981
GG_17	Gillett Grove	65.0%	15.1%	4.1%	0.8%	0.2%	2.3%	9.5%	0.1%	0.4%	1.3%	4	732
ZM_03	Zimmerman	65.4%	17.6%	2.2%	0.8%	0.2%	4.4%	5.6%	0.0%	0.3%	1.4%	36	314
GG_01	Gillett Grove	62.3%	16.0%	2.2%	1.4%	0.2%	4.8%	7.1%	0.1%	0.8%	1.5%	14562	6092

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
	5.2.6.3 Antimony Opacified Cored Blue and White Beads														
	Sb Opacified IVa16														
BL_30_1	3	1	33	3	182	4	13	244	318	155	436	9	239	20	2
BL_29_1	10	0	100	2	116	9	11	833	902	57	2117	11	501	11	1
BL_26_1	8	0	85	2	120	7	11	381	398	91	1034	11	555	11	1
BL_28_1	9	0	98	2	125	9	12	10	5	51	6	13	684	12	1
BL_25_1	8	1	97	2	121	8	11	13	8	44	29	10	737	12	1
	5.2.6.4 Soda-Lime Colorless Beads														
	Hanson pale yellow														
C_5	22	0	65	3	508	15	11	9	9	53	12	27	299	213	5
H_C53_1	36	0	56	2	538	13	15	8	6	47	0	26	335	193	5
H_C52_1	36	0	60	3	557	13	15	8	7	51	0	27	343	201	5
H_C54_1	36	1	58	3	533	13	16	8	6	50	0	26	328	183	4
H_C51_1	20	0	58	3	658	15	13	11	12	43	16	28	324	230	5
	5.3.1 Cu-colored blue glass pendants or fragments														
	Subgroup: P-low-Mg (n=6)														
CM_73	11	1	125	4	140	6	14	69	56	78	116	14	567	12	1
CM_74	14	0	119	4	164	7	14	52	58	79	91	16	644	14	1
CM_75	17	1	102	4	169	8	14	62	49	62	83	11	541	18	1
RI_023	15	0	127	2	118	5	6	52	57	87	103	13	558	11	1
RI_027	15	0	78	2	154	8	7	46	34	53	69	11	608	18	2
RI_028	15	0	85	2	160	8	7	46	33	54	57	10	617	17	1
	Subgroup: Mg-low-P (n=22)														
GG_03	15	1	80	2	408	9	9	12	11	2880	29	22	461	223	5
ZM_02	11	0	105	4	808	11	24	19	5	3373	9	28	393	198	5
GC_04	17	0	101	4	571	11	23	26	46	2245	198	50	408	103	3
GG_02	18	1	74	2	391	9	8	11	11	2482	24	19	469	202	5
GC_05	10	0	91	4	549	10	21	42	6	5091	15	36	430	72	2
GG_04	13	1	84	2	365	9	9	13	6	2908	32	22	403	219	4
ZM_04	17	1	91	4	821	9	23	16	18	2723	22	15	561	205	5
ZM_07	12	1	95	5	1017	11	30	19	8	3984	16	29	391	236	5
GG_17	11	0	83	2	276	7	5	11	12	3401	3	12	621	195	4
ZM_03	17	0	81	2	169	6	10	140	268	29	579	24	338	14	1
GG_01	10	0	109	3	459	13	14	26	38	3792	145	17	361	222	6

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
	5.2.6.3 Antimony Opacified Cored Blue and White Beads														
	Sb Opacified IVa16														
BL_30_1	1	39135	0	79	2	4	1	0	0	2	1493	28	0	1	2
BL_29_1	1	26848	0	83	2	4	0	0	0	3	620	40	0	3	2
BL_26_1	1	15630	0	94	2	4	0	0	0	3	317	21	0	2	2
BL_28_1	0	1165	0	98	2	4	1	0	0	3	11	1	0	1	2
BL_25_1	0	320	0	103	2	4	1	0	0	2	5	1	0	1	2
	5.2.6.4 Soda-Lime Colorless Beads														
	Hanson pale yellow														
C_5	1	1	1	112	5	11	1	0	0	7	3	1	1	1	5
H_C53_1	1	1	0	191	5	9	1	0	0	6	1	1	2	1	4
H_C52_1	0	1	0	201	5	10	1	0	0	7	1	1	2	1	5
H_C54_1	0	1	0	195	4	10	1	0	0	6	1	1	1	1	4
H_C51_1	1	1	0	119	5	11	1	0	0	8	3	1	1	1	5
	5.3.1 Cu-colored blue glass pendants or fragments														
	Subgroup: P-low-Mg (n=6)														
CM_73	1	412	0	56	2	3	0	0	1	2	81	1	0	1	2
CM_74	14	71	0	43	2	4	1	0	87	2	66	1	0	1	2
CM_75	6	301	0	102	3	5	1	0	84	2	60	1	0	1	2
RI_023	2	40	0	35	2	4	0	0	0	1	54	1	0	1	2
RI_027	1	311	0	75	3	6	1	0	0	2	36	1	0	1	2
RI_028	1	314	0	81	3	5	1	0	0	2	32	1	0	1	2
	Subgroup: Mg-low-P (n=22)														
GG_03	5	100	0	167	5	9	1	0	0	8	13	1	2	2	5
ZM_02	6	6	0	117	3	7	1	0	1	7	17	1	1	4	3
GC_04	4	1593	0	85	5	9	1	0	0	5	21	1	0	1	4
GG_02	4	83	0	128	5	9	1	0	0	7	12	1	1	1	5
GC_05	3	19995	0	62	5	10	1	0	0	5	21	0	0	0	5
GG_04	5	8	0	137	5	7	1	0	0	7	16	1	1	2	4
ZM_04	1	816	0	99	5	9	1	1	1	7	15	1	2	1	4
ZM_07	4	6	0	193	4	8	1	1	3	7	16	1	1	4	4
GG_17	5	880	0	71	3	5	1	0	0	6	4	1	0	1	3
ZM_03	2	159	0	45	3	5	1	0	1	2	218	1	0	3	3
GG_01	6	10	0	87	5	10	1	0	0	7	23	1	0	2	5

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
	5.2.6.3 Antimony Opacified Cored Blue and White Beads											
	Sb Opacified IVa16											
BL_30_1	1	0	1	0	1	0	0	0	0	0	1	1
BL_29_1	1	0	1	0	1	0	0	0	0	0	0	1
BL_26_1	0	0	0	0	0	0	0	0	0	0	0	1
BL_28_1	0	0	0	0	0	0	0	0	0	0	0	1
BL_25_1	0	0	0	0	0	0	0	0	0	0	0	1
	5.2.6.4 Soda-Lime Colorless Beads											
	Hanson pale yellow											
C_5	1	0	1	0	1	0	1	0	1	0	6	2
H_C53_1	1	0	1	0	1	0	1	0	1	0	5	2
H_C52_1	1	0	1	0	1	0	1	0	1	0	5	2
H_C54_1	1	0	1	0	1	0	1	0	1	0	5	2
H_C51_1	1	0	1	0	1	0	1	0	1	0	6	2
	5.3.1 Cu-colored blue glass pendants or fragments											
	Subgroup: P-low-Mg (n=6)											
CM_73	0	0	1	0	0	0	0	0	0	0	0	1
CM_74	1	0	0	0	0	0	0	0	0	0	0	1
CM_75	1	0	0	0	0	0	0	0	0	0	1	1
RI_023	0	0	0	0	0	0	0	0	0	0	0	0
RI_027	0	0	0	0	0	0	0	0	0	0	0	1
RI_028	0	0	0	0	0	0	0	0	0	0	0	1
	Subgroup: Mg-low-P (n=22)											
GG_03	1	0	1	0	1	0	1	0	1	0	7	2
ZM_02	1	0	1	0	1	0	1	0	1	0	6	1
GC_04	1	0	1	0	1	0	0	0	0	0	2	1
GG_02	1	0	1	0	1	0	1	0	1	0	6	2
GC_05	1	0	1	0	1	0	0	0	0	0	2	1
GG_04	1	0	1	0	1	0	1	0	1	0	7	2
ZM_04	1	0	1	0	1	0	1	0	1	0	6	2
ZM_07	1	0	1	0	1	0	1	0	1	0	7	2
GG_17	1	0	1	0	1	0	1	0	1	0	6	1
ZM_03	1	0	1	0	1	0	0	0	1	0	1	1
GG_01	1	0	1	0	1	0	1	0	1	0	6	2

Sample ID	Site	SiO_2	Na_2O	MgO	Al_2O_3	P_2O_5	K_2O	CaO	MnO	Fe_2O_3	CuO	Sn	Pb
ZM_06	Zimmerman	64.1%	18.7%	2.3%	0.8%	0.2%	4.3%	5.5%	0.0%	0.4%	1.4%	33	193
ZM_08	Zimmerman	68.0%	15.8%	2.7%	1.0%	0.2%	1.6%	7.4%	0.0%	0.4%	1.2%	210	273
ZM_05	Zimmerman	67.6%	16.5%	2.4%	1.2%	0.2%	1.9%	6.8%	0.2%	0.5%	0.9%	528	1263
ZM_01	Zimmerman	63.2%	22.8%	1.8%	0.8%	0.1%	0.8%	4.8%	0.1%	0.4%	1.5%	200	384
MM_026	Marquette Mission	64.6%	10.1%	3.0%	1.1%	0.3%	3.6%	7.8%	0.1%	0.3%	1.4%	13	19372
MM_025	Marquette Mission	66.7%	16.6%	2.5%	1.3%	0.3%	2.5%	6.8%	0.2%	0.4%	1.8%	790	676
MM_028	Marquette Mission	66.5%	16.8%	3.0%	1.1%	0.2%	1.0%	9.4%	0.1%	0.4%	0.9%	225	381
MM_027	Marquette Mission	69.6%	11.7%	2.7%	1.0%	0.2%	5.3%	7.0%	0.1%	0.5%	1.2%	7	229
M_24	Mahler	65.9%	13.5%	3.0%	1.1%	0.2%	4.3%	10.0%	0.0%	0.7%	0.9%	29	245
MA_13	La Point (surface)	64.5%	14.7%	2.8%	1.0%	0.5%	2.5%	10.8%	0.0%	1.0%	1.3%	128	1886
MA_14	La Point (surface)	65.2%	16.6%	2.4%	1.2%	0.2%	2.2%	8.9%	0.1%	0.7%	1.3%	162	858
	5.3.2 Co-colored blue glass pendants or fragments												
CM_71	Fort Michilimackinac	67.3%	12.9%	2.1%	1.2%	0.7%	5.0%	10.0%	0.2%	0.5%	0.0%	3	441
CM_76	Fort Michilimackinac	67.0%	14.5%	2.0%	1.2%	0.7%	3.9%	9.9%	0.1%	0.7%	0.0%	5	308
RI_024	Rock Island 3 or 4	69.0%	11.8%	1.9%	1.2%	0.7%	3.7%	9.7%	0.1%	0.7%	0.0%	4	1446
	5.3.3 Sb-opacified white glass pendants or fragments												
CM_72	Fort Michilimackinac	62.1%	11.8%	1.7%	1.6%	0.6%	4.9%	9.3%	0.4%	0.6%	0.0%	44	1760
CM_77	Fort Michilimackinac	66.3%	11.8%	3.0%	1.2%	0.2%	5.7%	10.8%	0.4%	0.5%	0.0%	1	16
RI_025	Rock Island 3 or 4	64.8%	10.5%	1.4%	1.3%	0.9%	4.0%	9.8%	0.1%	0.7%	0.0%	2	720
RI_026	Rock Island 3 or 4	66.2%	11.9%	1.5%	1.5%	0.6%	4.4%	8.7%	0.5%	0.9%	0.0%	25	1987
	5.3.4 High Calcium Glass Fragments												
	High Ca Bottle Frags												
RI_029	Rock Island 4	59.0%	2.1%	4.2%	5.1%	1.1%	2.4%	23.0%	0.2%	2.5%	0.0%	24	425
RI_030	Rock Island 4	59.9%	1.9%	4.2%	5.0%	1.1%	2.2%	22.7%	0.2%	2.4%	0.0%	23	381
RI_031	Rock Island 4	59.6%	1.9%	4.2%	5.0%	1.1%	2.2%	23.0%	0.2%	2.4%	0.0%	23	391
RI_129	Rock Island	62.2%	1.9%	4.3%	5.2%	1.2%	2.4%	21.2%	0.2%	1.1%	0.0%	35	190
RI_130	Rock Island	62.0%	1.9%	4.4%	5.2%	1.2%	2.4%	21.4%	0.2%	1.0%	0.0%	25	179

Sample ID	Li	Be	B	Sc	Ti	V	Cr	Ni	Co	Zn	As	Rb	Sr	Zr	Nb
ZM_06	18	0	71	3	145	6	16	140	271	24	518	21	351	13	1
ZM_08	12	0	76	4	207	13	21	45	70	40	168	13	437	14	1
ZM_05	7	1	77	4	220	15	21	45	93	56	164	11	359	16	1
ZM_01	5	0	84	3	140	7	18	123	147	30	519	6	307	11	1
MM_026	12	1	88	3	525	10	16	66	42	4792	132	30	450	80	3
MM_025	8	1	201	2	215	8	11	95	164	268	489	18	393	19	1
MM_028	9	2	91	2	205	6	15	42	93	46	295	6	459	17	1
MM_027	14	1	135	3	558	10	16	12	3	3365	0	85	449	92	2
M_24	15	2	63	3	222	8	18	68	89	42	125	15	405	18	1
MA_13	18	1	86	3	308	13	18	47	68	65	183	16	477	10	1
MA_14	17	2	85	3	318	9	18	69	159	58	185	14	446	19	1
	5.3.2 Co-colored blue glass pendants or fragments														
CM_71	22	0	126	4	262	9	16	532	569	238	805	11	887	27	2
CM_76	12	0	112	4	351	10	20	317	776	95	1159	22	709	20	2
RI_024	17	0	115	2	274	10	12	455	642	155	1090	12	583	24	2
	5.3.3 Sb-opacified white glass pendants or fragments														
CM_72	19	0	110	4	363	13	17	15	7	85	86	12	835	30	2
CM_77	32	0	50	4	238	6	16	8	11	24	32	30	653	32	1
RI_025	13	0	122	2	267	11	10	12	9	84	28	23	560	22	2
RI_026	21	0	114	2	254	11	10	14	10	66	58	11	690	28	2
	5.3.4 High Calcium Glass Fragments														
	High Ca Bottle Frags														
RI_029	26	5	152	6	879	37	29	16	7	214	15	33	1111	118	4
RI_030	26	5	154	6	847	35	25	14	6	209	17	32	1065	118	4
RI_031	28	5	153	6	848	36	26	15	6	209	14	33	1104	118	4
RI_129	27	5	176	8	1091	36	44	16	7	272	2	37	1209	122	5
RI_130	28	5	178	8	1049	35	39	17	7	258	2	33	1238	123	4

Sample ID	Ag	Sb	Cs	Ba	La	Ce	Pr	Ta	Au	Y	Bi	U	W	Mo	Nd
ZM_06	1	149	0	38	2	4	1	0	0	2	194	0	0	2	2
ZM_08	9	18	0	57	3	5	1	0	3	2	41	1	0	1	2
ZM_05	3	37	0	63	3	6	1	0	1	3	41	1	0	2	3
ZM_01	3	114	0	38	2	3	0	0	0	2	146	2	0	3	2
MM_026	5	23759	0	91	6	12	2	0	5	5	55	3	1	1	6
MM_025	5	175	0	93	3	4	1	0	7	3	115	1	1	2	3
MM_028	2	221	0	115	3	5	1	0	2	2	121	1	1	1	3
MM_027	7	99	1	85	5	10	1	0	2	5	2	1	1	1	5
M_24	2	273	0	66	3	5	1	0	2	2	65	1	1	1	3
MA_13	8	212	0	131	2	4	1	0	0	3	64	1	1	2	2
MA_14	45	297	0	89	3	5	1	0	0	3	70	1	0	2	3
	5.3.2 Co-colored blue glass pendants or fragments														
CM_71	0	340	0	115	3	6	1	0	0	5	359	19	0	18	3
CM_76	5	333	0	269	3	6	1	0	0	5	318	28	1	11	3
RI_024	1	712	0	230	3	6	1	0	0	4	321	11	0	12	3
	5.3.3 Sb-opacified white glass pendants or fragments														
CM_72	0	41675	0	95	4	9	1	0	0	3	7	1	0	1	4
CM_77	4	4	0	145	4	7	1	0	6	3	4	1	0	1	3
RI_025	0	21560	0	78	4	8	1	0	0	3	7	1	0	1	3
RI_026	1	11606	0	83	4	8	1	0	0	3	8	1	0	1	3
	5.3.4 High Calcium Glass Fragments														
	High Ca Bottle Frags														
RI_029	0	4	1	954	18	38	5	0	0	18	0	5	0	2	15
RI_030	0	2	1	912	17	35	4	0	0	18	0	5	0	2	15
RI_031	0	1	1	937	17	36	5	0	0	18	0	5	0	2	15
RI_129	83	1	1	1075	19	38	5	0	4	18	0	7	0	3	18
RI_130	10	1	1	1060	19	36	5	0	4	19	0	7	0	2	18

Sample ID	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Th
ZM_06	0	0	0	0	0	0	0	0	0	0	0	1
ZM_08	0	0	0	0	0	0	0	0	0	0	0	1
ZM_05	1	0	1	0	1	0	0	0	0	0	1	1
ZM_01	1	0	0	0	0	0	0	0	0	0	0	0
MM_026	1	0	2	0	1	0	1	0	1	0	3	2
MM_025	1	0	1	0	1	0	0	0	1	0	2	1
MM_028	1	0	1	0	1	0	1	0	1	0	1	1
MM_027	2	1	2	0	1	0	1	0	1	0	3	2
M_24	1	0	1	0	1	0	1	0	1	0	1	1
MA_13	1	0	1	0	1	0	0	0	0	0	1	0
MA_14	1	0	1	0	1	0	0	0	0	0	1	1
	5.3.2 Co-colored blue glass pendants or fragments											
CM_71	1	0	1	0	1	0	1	0	0	0	1	1
CM_76	1	0	1	0	1	0	0	0	1	0	1	1
RI_024	1	0	1	0	1	0	0	0	0	0	1	1
	5.3.3 Sb-opacified white glass pendants or fragments											
CM_72	1	0	1	0	1	0	0	0	0	0	1	1
CM_77	1	0	1	0	1	0	1	0	0	0	1	1
RI_025	1	0	1	0	1	0	0	0	0	0	1	1
RI_026	1	0	1	0	1	0	0	0	0	0	1	1
	5.3.4 High Calcium Glass Fragments											
	High Ca Bottle Frags											
RI_029	3	1	3	0	3	1	2	0	1	0	3	4
RI_030	3	1	3	0	3	1	1	0	1	0	3	3
RI_031	3	1	3	0	3	1	1	0	1	0	3	4
RI_129	4	1	3	1	3	1	2	0	2	0	3	5
RI_130	4	1	4	0	3	1	2	0	2	0	4	5

Appendix D: *La Belle* and Fort St. Louis Interpretations

This appendix presents chronological, spatial and ethnic interpretations of the results of chemically analyzing glass beads from the French trade ship *La Belle* (41 MG 86) and the associated on-shore Fort St. Louis site (41 VT 4). I contextualize the findings with the glass bead data for the Upper Great Lakes sites. Since Robert Cavelier, Sieur de la Salle, conducted two exploratory journeys into the Great Lakes region prior to his expedition in the Gulf of Mexico, beads from *La Belle* provide an opportunity to compare beads known to be associated with La Salle with beads from locations where he may have previously traded beads in the Great Lakes region (Figure D.1).

Some NSF funding remained in my project when *La Belle's* beads became available for me to analyze in early 2013, and I decided to use the funds to obtain LA-ICP-MS samples from all major bead types recovered from the shipwreck, as well as a limited sample of beads from the associated on-shore French colony site, Fort St. Louis, c. 1685-1689, which was later built upon by the Spanish c.1721-1730, who constructed the presidio Nuestra Senora de Loreto de la Bahia (Perttula 2006). In this project, I analyzed a total of 83 samples associated with La Salle's presence in Texas, including 67 glass samples from *La Belle* and 16 beads from French and Spanish-associated blocks and features on shore at Fort St. Louis and the Presidio. The interpretations of findings from LA-ICP-MS analyses of beads from *La Belle* and Fort St. Louis were not included in the body of the dissertation because of the very different nature of their archaeological context outside of the Upper Great Lakes region. Complete compositional data for all of these samples are available in Appendix C.

Figure D.1: Map of routes that French explorer La Salle travelled in the Great Lakes region and in the Gulf of Mexico. La Salle, Sieur de: location. Map/Still. Britannica Online for Kids. Web. 14 Apr. 2015. <http://kids.britannica.com/comptons/art-149862>.

The bead types analyzed included black and white seed beads, as well as same types of blue beads analyzed from the Upper Great Lakes, blue seed beads (“Variety 1” in the *La Belle* project’s nomenclature) and blue tubular beads (“Variety 8”). The excavators of *La Belle* have suggested that these beads come from a Venetian glasshouse on the basis of a historical text mentioning trade in "Venetian pearls" (Bruseth and Turner 2005:87), but their European provenience remains unconfirmed. A limited typological and chemical study of the glass beads from *La Belle* restated the need for comparative information from French and Venetian glasshouses (Perttula 2003:22). The most common glass bead type recovered from *La Belle* is the IIa55 brite navy blue translucent seed bead (Variety 1), some of which were still on strings, possibly as packaged from the glassmaker. These varied in the particular shade or hue of blue coloration, and were described as light, medium, and dark blues, but most fall into the IIa55/56 Kidd and Kidd type. Beads were selected from major contexts of *La Belle* (Table D.1) and from features or areas with clear French or Spanish associations on-shore (Table D.2).

Table D.1: Summary of La Belle bead sample IDs and archaeological contexts. Varieties and types in the artifact description follow Perttula 2003.

HW ID	**DESCRIPTION**	**KIDD**	**CASK**	**BOX**	**East (X)**	**North (Y)**	**ID and area**
BL_01	Lt. Blue Type 1	IIa55/56		1	2010	2011	5858.2.11 Aft Hold
BL_02	Lt. Blue Type 1	IIa55/56		1	2010	2011	5858.2.12 Aft Hold
BL_03	Lt. Blue Type 1	IIa55/56		1	2010	2011	5858.2.13 Aft Hold
BL_04	Lt. Blue Type 1	IIa55/56		1	2010	2011	5858.2.14 Aft Hold
BL_05	Lt. Blue Type 1	IIa55/56		1	2010	2011	5858.2.15 Aft Hold
BL_06	Lt. Blue Type 1	IIa55/56		1	2010	2011	5858.2.16 Aft Hold
BL_07	Lt. Blue Type 1	IIa55/56		1	2010	2011	5858.2.17 Aft Hold
BL_08	Med. Blue Type 1	IIa55/56		1	2010	2011	5858.2.23 Aft Hold
BL_09	Med. Blue Type 1	IIa55/56		1	2010	2011	5858.2.24 Aft Hold
BL_10	Med. Blue Type 1	IIa55/56		1	2010	2011	5858.2.25 Aft Hold
BL_11	Med. Blue Type 1	IIa55/56		1	2010	2011	5858.2.26 Aft Hold
BL_12	Med. Blue Type 1	IIa55/56		1	2010	2011	5858.2.27 Aft Hold
BL_13	Med. Blue Type 1	IIa55/56		1	2010	2011	5858.2.28 Aft Hold
BL_14	Med. Blue Type 1	IIa55/56		1	2010	2011	5858.2.29 Aft Hold
BL_15	Dk. Blue Type 1	IIa55/56		1	2010	2011	5858.2.35 Aft Hold
BL_16	Dk. Blue Type 1	IIa55/56		1	2010	2011	5858.2.36 Aft Hold
BL_17	Dk. Blue Type 1	IIa55/56		1	2010	2011	5858.2.37 Aft Hold
BL_18	Dk. Blue Type 1	IIa55/56		1	2010	2011	5858.2.38 Aft Hold
BL_19	Dk. Blue Type 1	IIa55/56		1	2010	2011	5858.2.39 Aft Hold
BL_20	Dk. Blue Type 1	IIa55/56		1	2010	2011	5858.2.40 Aft Hold
BL_21	Dk. Blue Type 1	IIa55/56		1	2010	2011	5858.2.41 Aft Hold
BL_22	Blue Tubular Type 8	Ia19		1	2010	2011	5858.2.51 Aft Hold
BL_23	Blue Tubular Type 8	Ia19		1	2010	2011	5858.2.52 Aft Hold
BL_24	Blue Tubular Type 8	Ia19		1	2010	2011	5858.2.53 Aft Hold
BL_25	Blue/White Type 4	IVa16		1	2010	2011	5858.2.47 Aft Hold
BL_26	Blue/White Type 4	IVa16		1	2010	2011	5858.2.48 Aft Hold
BL_27	Blue/White Type 4	IVa16		1	2010	2011	5858.2.49 Aft Hold
BL_28	Blue/White Type 4 - point 1 outer blue	IVa16		1	2010	2011	5858.2.5 (a) Aft Hold
BL_29	Blue/White Type 4 - point 3 inner blue	IVa16		1	2010	2011	5858.2.5 (b) Aft Hold
BL_30	Blue/White Type 4 - point 2 mid white	IVa16		1	2010	2011	5858.2.5 (c) Aft Hold
BL_31	Black Type 2	IIa7		1	2010	2011	5858.2.1 Aft Hold
BL_32	Black Type 2	IIa7		1	2010	2011	5858.2.2 Aft Hold
BL_33	Black Type 2	IIa7		1	2010	2011	5858.2.3 Aft Hold
BL_34	Black Type 2	IIa7		1	2010	2011	5858.2.4 Aft Hold

BL_35	Black Type 2	IIa7		1	2010	2011	5858.2.5 Aft Hold
BL_36	White Type 3	IIa13		1	2010	2011	5858.2.6 Aft Hold
BL_37	White Type 3	IIa13		1	2010	2011	5858.2.7 Aft Hold
BL_38	White Type 3	IIa13		1	2010	2011	5858.2.8 Aft Hold
BL_39	White Type 3	IIa13		1	2010	2011	5858.2.9 Aft Hold
BL_40	White Type 3	IIa13		1	2010	2011	5858.2.10 Aft Hold
BL_41	Blue Tubular Type 8	Ia19		1	2010	2011	5858.2.54 Aft Hold
BL_42	Blue Tubular Type 8	Ia19		1	2010	2011	5858.2.55 Aft Hold
BL_43	Blue Tubular Type 8	Ia19		1	2010	2011	5858.2.56 Aft Hold
BL_44	Lt. Blue Type 1	IIa55/56	26		2009	2018	6002.1.1 Main Hold
BL_45	Lt. Blue Type 1	IIa55/56	26		2009	2018	6002.1.2 Main Hold
BL_46	Lt. Blue Type 1	IIa55/56	26		2009	2018	6002.1.3 Main Hold
BL_47	Lt. Blue Type 1	IIa55/56	26		2009	2018	6002.1.4 Main Hold
BL_48	Med. Blue Type 1	IIa55/56	26		2009	2018	6002.1.6 Main Hold
BL_49	Med. Blue Type 1	IIa55/56	26		2009	2018	6002.1.7 Main Hold
BL_50	Med. Blue Type 1	IIa55/56	26		2009	2018	6002.1.8 Main Hold
BL_51	Med. Blue Type 1	IIa55/56	26		2009	2018	6002.1.9 Main Hold
BL_52	Opaque Blue Type 1/3?	IIa31	26		2009	2018	6002.1.11 Main Hold
BL_53	Opaque Blue Type 1/3?	IIa31	26		2009	2018	6002.1.12 Main Hold
BL_54	Opaque Blue Type 1/3?	IIa31	26		2009	2018	6002.1.13 Main Hold
BL_55	Opaque Blue Type 1/3?	IIa31	26		2009	2018	6002.1.14 Main Hold
BL_56	Lt. Blue Type 1	IIa55/56		4	2010	2011	7841.1.1 Aft Hold
BL_57	Lt. Blue Type 1	IIa55/56		4	2010	2011	7841.1.2 Aft Hold
BL_58	Lt. Blue Type 1	IIa55/56		4	2010	2011	7841.1.3 Aft Hold
BL_59	Lt. Blue Type 1	IIa55/56		4	2010	2011	7841.1.4 Aft Hold
BL_60	Med. Blue Type 1	IIa55/56		4	2010	2011	7841.1.6 Aft Hold
BL_61	Med. Blue Type 1	IIa55/56		4	2010	2011	7841.1.7 Aft Hold
BL_62	Med. Blue Type 1	IIa55/56		4	2010	2011	7841.1.8 Aft Hold
BL_63	Med. Blue Type 1	IIa55/56		4	2010	2011	7841.1.9 Aft Hold
BL_64	Dk. Blue Type 1	IIa55/56		4	2010	2011	7841.1.11 Aft Hold
BL_65	Dk. Blue Type 1	IIa55/56		4	2010	2011	7841.1.12 Aft Hold
BL_66	Dk. Blue Type 1	IIa55/56		4	2010	2011	7841.1.13 Aft Hold
BL_67	Dk. Blue Type 1	IIa55/56		4	2010	2011	7841.1.14 Aft Hold

Table D.2: Fort St. Louis and Presidio bead sample IDS and contexts; varieties and types follow those described in Perttula 2006.

HW ID	Lot No.	Artifact Description	Kidd	Block/ Area	North- ing	East- ing	Level
SL_01	1082	Opaque Blue, French	IIa37	B18	426	781	2
SL_02	1271	Blue, French	IIa39	B18	422	785	2
SL_03	1366-1.1	Blue, French	IIa39	B18	423	775	1
SL_04	1366-1.2	Blue, French	IIa39	B18	423	775	1
SL_05	2078-1.1	Blue, Variety 8 French	Ia18	B18	424	774	1
SL_06	2078-1.2	Opaque Blue, French	IIa37	B18	424	774	1
SL_07	2268-1.2	Opaque Blue, French	IIa36	B18, F. 20	424	773	2
SL_08	2531	Blue Translucent French	IIa31	Add. 2	337.96	775.44	20
SL_09	3104	Blue Type 1 Spanish	IIa55	B66	385	794	1
SL_10	3969	Dk. Blue Spanish	IIa44	B254	370	743	1
SL_11	3981	Blue Type 1 Spanish	IIa55	B66	384	761	1
SL_12	727	Lt. Blue Spanish	IIa40	B2	388	752	1
SL_13	745	Dk. Blue Type 1 French	IIa55	B7	377	814	1
SL_14	1272	Black Type 2 French	IIa7	B18	424	775	1
SL_15	2268-1.3	Black Type 2 French	IIa7	B18, F. 20	424	773	2
SL_16	2268-1.1	White French	IIa2	B18, F. 20	424	773	2

In my analysis of beads associated with La Salle in the Gulf of Mexico, I developed three specific research questions that could be addressed using the chemical compositions obtained with LA-ICP-MS:

1) Are beads from *La Belle* compositionally similar to beads from any sites in the Upper Great Lakes region that may have been reached by La Salle?
2) Are there compositional similarities between beads from *La Belle* and the French-associated contexts of the Fort St. Louis site?
3) Do the beads from Spanish-associated contexts of the Fort St. Louis site have a different composition from those from *La Belle* or the French-associated contexts at that site?

To address these questions, I used the same methods of exploratory PCA, cluster analysis, and bivariate scatter plots that I applied to the rest of the data set to sort the beads from *La Belle* and Fort St. Louis into chemical subgroups with all of the Upper Great Lakes samples (Table D.3). Approximate dates of subgroups based on known occupation periods of Upper Great Lakes sites fit well with the chronology of *La Belle*, French Fort St. Louis, and the Spanish Presidio. Findings specific to each compositional group are discussed individually.

Table D.3: Glass beads from La Belle and on-shore site French and Spanish contexts assigned to chemical subgroups delineated for Upper Great Lakes sites. For individual beads from Fort St. Louis, sample IDs are given; for sample IDs and for La Belle beads, see Appendix C

Chemical subgroup and approximate dates	**N total**	**N from *La Belle***	**N from FSL French**	**N from FSL Spanish**
Co-colored Mg-low-P (pre-1700)	219	47	5 (SL_02, 03, 04, 05, 13)	1 (SL_09)
Co-colored P-low-Mg (post-1700)	101	0	0	1 (SL_11)
Co+Sb Mg-low-P (post-1670, pre-1700)	55	5	2 (SL_01, 07)	1 (SL_12)
Co+Sb P-low-Mg (post-1700)	23	0	0	1 (SL_10)
Cu-colored Mg-low-P (pre-1700)	127	0	1 (SL_06)	0
Cu-colored P-low-Mg (post-1700)	104	0	1 (SL_08)	0
Mn-colored (black)	13	5	2 (SL_14, 15)	0
Sb-opacified (white, post 1670)	19	5	1 (SL_16)	0
Sb-opacified (white and cored blue)	5	5	0	0

D.1. Cobalt colored beads

D.1.1 Co-colored Mg-low-P

Most of the beads sampled from *La Belle* fell into the largest overall subgroup in the full dissertation dataset, the Co-colored Mg-low-P, pre-1700 subgroup (n=219, 47 of which were from *La Belle* and another six of which came from on-shore at Fort St. Louis). Beads were typologically classified as IIa55/56, or Variety 1 in the shipwreck site nomenclature. Beads from *La Belle* in this subgroup were visually separable in lighter, medium, and darker shades of translucent navy blue, and also came from several different archaeological contexts, including Box 1 and Box 4 from the Aft Hold, and Cask 26 from the Main Hold.

To determine if there were compositional differences among beads from different archaeological contexts at the inter- and intra-site levels and to compare the beads to the Upper Great Lakes samples, I conducted exploratory multivariate statistical investigations using PCA and cluster analyses. These revealed that the elements Nb, Mo, and Hf were slightly elevated in Upper Great Lakes sites dated to c. AD 1650 or possibly earlier (Figure D.2), a temporally significant finding which was not recognized during the initial analyses of this subgroup using only Upper Great Lakes beads.

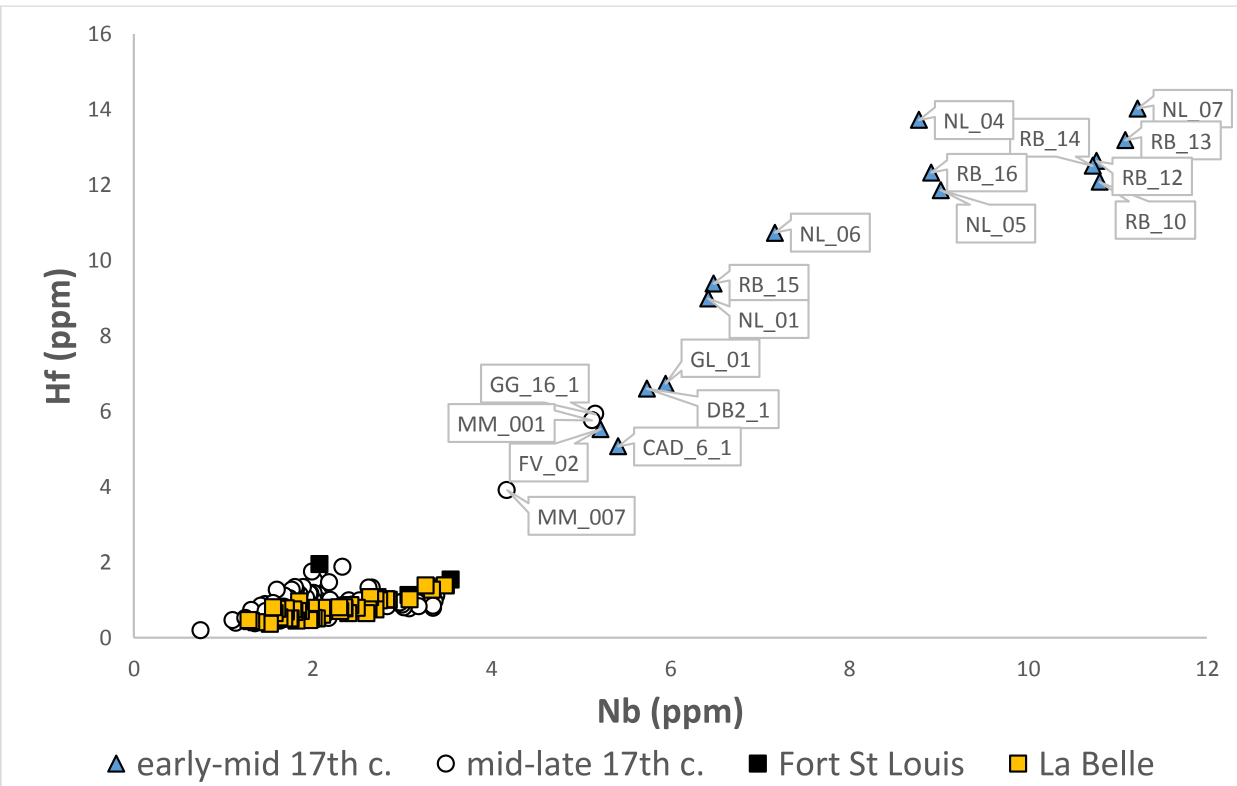


Figure D.2: Trace elements Nb and Hf illustrating a temporal difference in beads from early-mid seventeenth century sites and later sites, including La Belle and Fort St. Louis

The slightly elevated trace elements were the major source of variation within the Co-colored Mg-low-P subgroup, meaning that that beads from *La Belle* were least similar to beads from Hanson, Red Banks, New Lenox, Goose Lake Outlet #3, and the Cadotte sites, all which could date as early as c. 1625 – 1650. Samples MM_001, MM_007, and GG_16 come from mid-late seventeenth century contexts at Marquette Mission and Gillett Grove, but these three beads have the slightly elevated trace element levels associated with the early-mid seventeenth century beads from other sites; the three samples may come from curated beads. However, I did not identify any further chemical elements clearly distinguish the Mg-low-P beads from *La Belle* as more or less similar to any subset of other beads in the Mg-low-P subgroup from mid-late seventeenth century sites in the Upper Great Lakes. These sites are attributed to multiple different ethnic and cultural groups and widely spread across the region (Table D.4).

Further compositional comparisons using PCA (Figure D.3 and Table D.5) and cluster analyses of the Mg-low-P Co-colored beads without elevated levels of Nb, Mo, and Hf did not reveal any clear patterning that would link beads from *La Belle* to particular sites in the Upper Great Lakes. Rather, variability in iron (Fe) and the rare earth and other trace elements (Nb La Ce Th Pr Y Nd Sm Eu Gd Tb Dy Ho Er Tm Yb) was present within the compositions of beads from the same sites. For these elements, I have illustrated the similarities and differences among *La Belle* and Great Lakes beads using PCA, which identified two components with Eigenvalues >1, explaining 88.3% of the variance among the samples. Variations do not appear to correspond to chronology, but rather they may be results of inter-batch variations and/or inhabitants of particular sites obtaining beads from multiple trading sources and therefore multiple workshops, which may have used slightly different glass recipes.

Table D.4: Beads in the Mg-low P subgroup from the Upper Great Lakes region most similar to those from La Belle. Site contextual information reprinted from tables 3.4 and 3.5.

Site	**N**	**Area**	**Dates**	**Attributed Ethnicities**
Arrowsmith	1	Lake Winnebago	c. 1730	Meskwaki
Bell	11	Lake Winnebago	c.1680 - 1730	Meskwaki
Carcajou Point	1	Koshkonong	17^{th} – 18^{th} C.?	Ho-Chunk (?)
Chickadee	1	Lake Winnebago	c. 1670 – 1730	Meskwaki (?)
Cloudman	15	Michigan	Early 17^{th} C.?	Odawa
Doty Island Village	4	Lake Winnebago	c. 1680 – 1712?	Meskwaki?
Farley Village	2	Western neighbors	Mid-late 17^{th} C?	Oneota/Ioway
Fort Michilimackinac	2	Michigan	1715-1781	Metis/French
Fort St. Joseph	6	Michigan	1691-1781	Metis/French
Gillett Grove	2	Western neighbors	17^{th} C.	Oneota/Ioway
Gros Cap	1	Michigan	17^{th} C.	Huron (?)
Iliniwek Village	19	Southern neighbors	c. 1640 – 1683	Illinois
Marina	2	Lake Superior	c. 1715 – 1775	Ojibwe/various
Marquette Mission	44	Michigan	c. 1670 – 1701	Huron
Milford	3	Western neighbors	17^{th} C.	Oneota/Ioway
Mormon Print Shop	1	Michigan	17^{th} C.?	Indeterminate
Rock Island Period 2	2	Door Peninsula	c. 1650	Huron-Petun-Odawa
Rock Island Period 3	14	Door Peninsula	c. 1670 – 1730	Potawatomi
Rock Island Period 4	9	Door Peninsula	c. 1760	Odawa
Zimmerman	11	Southern neighbors	c. 1650 - 1690	Illinois

Table D.5: Component Matrix and Eigenvalues for PCA of Mg-low-P Co-colored beads with the probable early seventeenth-century beads with elevated Nb, Mo, and Hf levels removed.

Component Matrix			**Total Variance Explained**			
	Component			Initial Eigenvalues		
	1	2	Component	Total	% of Variance	Cumulative %
Fe	.489	.673	1	12.681	74.592	74.592
Nb	.767	.419	2	2.344	13.789	88.381
La	.904	.355	3	.519	3.053	91.434
Ce	.886	.384	4	.404	2.378	93.812
Th	.895	.204	5	.277	1.631	95.443
Pr	.902	.378	6	.180	1.059	96.502
Y	.863	.318	7	.123	.725	97.228
Nd	.930	.296	8	.100	.586	97.814
Sm	.923	.214	9	.074	.436	98.250
Eu	.865	.364	10	.070	.411	98.662
Gd	.910	.291	11	.056	.327	98.989
Tb	.926	.249	12	.050	.295	99.283
Dy	.947	.141	13	.045	.264	99.547
Ho	.934	.236	14	.033	.192	99.739
Er	.929	.216	15	.021	.124	99.863
Tm	.703	.596	16	.014	.080	99.943
Yb	.783	.516	17	.010	.057	100.000

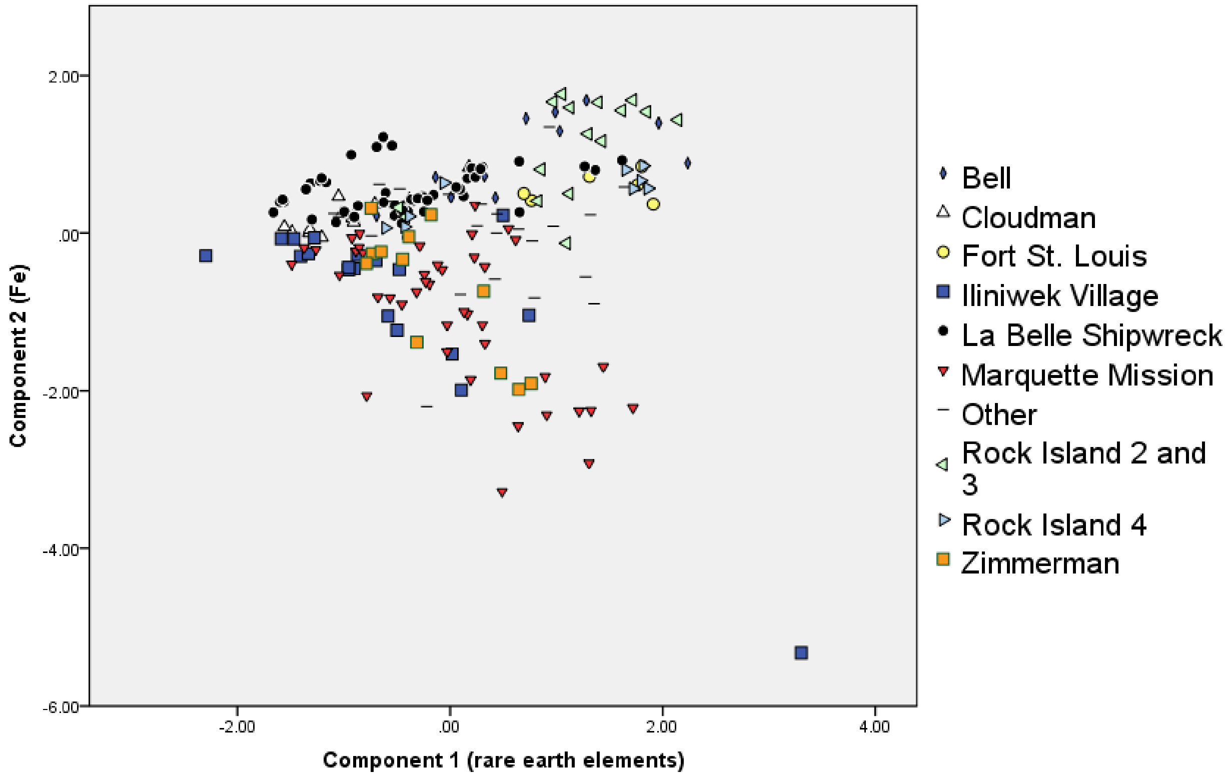


Figure D.3: Scatterplot of two the components identified using PCA, showing variation within site assemblages of beads of the Mg-low-P subgroup

Of the Upper Great Lakes sites with beads in the Co-colored Mg-Low-P subgroup, several locations are possible places where La Salle may have stopped in his explorations of the Upper Great Lakes prior to his voyage with *La Belle*. La Salle's travels likely took him through the Straits of Mackinac, which includes the Marquette Mission, Gros Cap, and the later Fort Michilimackinac sites. The CM_13 bead sample from Michilimackinac, which fits with the Mg-low-P subgroup, comes from outside the fortification walls and could reflect the presence of European traders prior to the construction of the fort in 1714. La Salle also is argued to have stopped on Rock Island (Mason 1986, 2015), and explored sites along the Mississippi River and its tributaries, which could easily have led to the deposition of beads of this type at the Zimmerman (Rohrbaugh et al. 1999) and Iliniwek Village sites. Other European explorers also may have had access to beads of this composition, which might explain their widespread distribution across the landscape. Down the line exchange and redistribution of beads acquired from La Salle's expeditions further complicate the possibility of tracing La Salle's journey using a particular compositional subgroup in glass trade beads.

The glass bead type IIa55/56 is a relatively homogenous type in terms of its chemical composition. Differences in color categories described visually (light, medium, and darker blue) in beads from *La Belle* did not correspond to variations levels of copper, cobalt, or iron, manganese, which are the most common ingredients used to color glass blue. It is possible that differential surface corrosion, other taphonomic factors, or lighting levels used when assessing beads might lead to slight perceptions of color differences.

To determine if there were meaningful differences among the various archaeological contexts of type IIa55/56 beads recovered from *La Belle,* I used exploratory PCA and cluster analyses of only the subset from *La Belle* (Figure D.4). A PCA run of Fe and trace elements (Sc Ti V Zr Nb Ba La Ce Pr Ta Y U Nd Sm Eu Gd Tb Dy Ho Er Tm Yb Lu Hf Th) produced two components with Eigenvalues >1, and explained 94.0% of the variation in the data set (Table D.6 and Figure D.4).

No compositional patterns corresponding to the contexts of beads in the main hold, aft hold, or different casks or boxes were identified; however, beads from *La Belle* were distinct from samples recovered at the on-shore sites. Furthermore, SL_09 is from the Spanish Presidio contexts and plots as a more distant outlier from the shipwreck beads and the beads that come from the French contexts of Fort St. Louis. This difference may indicate that beads used to supply the French colony site came from contexts different than the boxes and casks of beads from *La Belle*. This is not unexpected, since presumably some cargo boxes were transported to the shore, while others sank with the ship. The recipe differences between beads from Fort St. Louis and *La Belle* are minimal and could reflect different batches of beads or beads from slightly different glass workshop sources stored in different cargo containers.

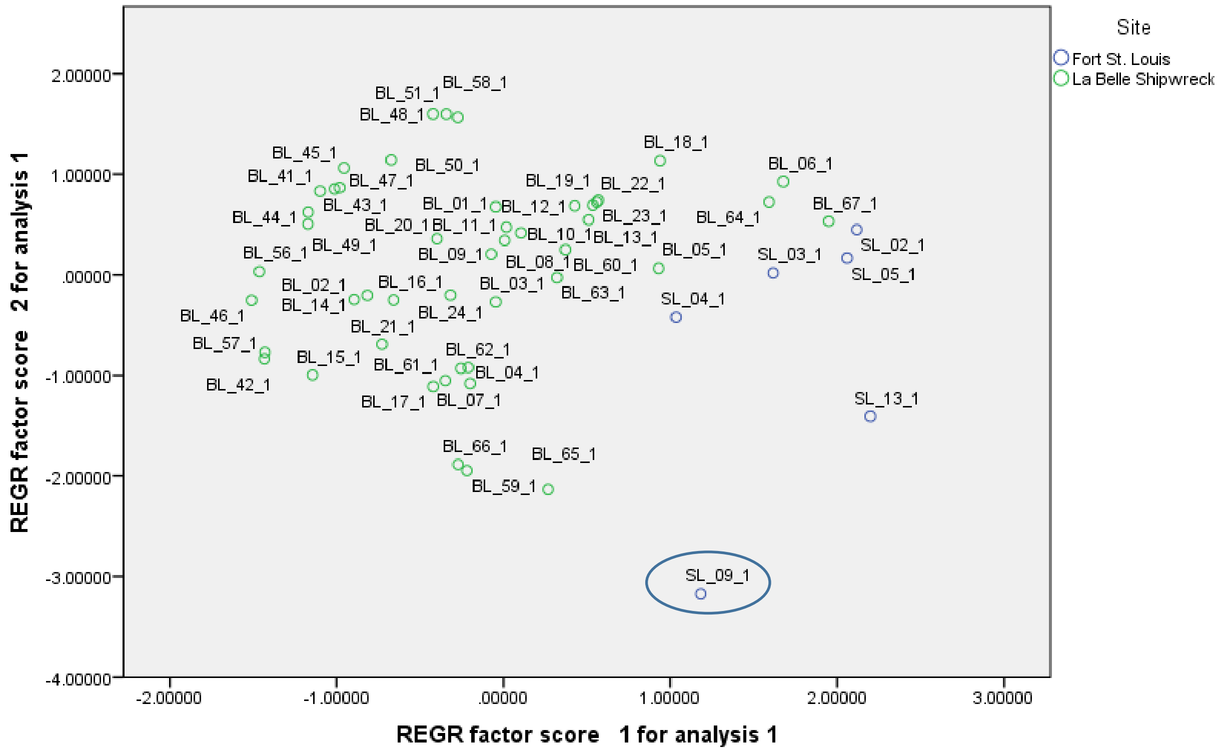


Figure D.4: PCA of glass beads of type IIa55/56 from La Belle and the Fort St. Louis site, illustrating that the Fort St. Louis samples are somewhat different from the shipwreck samples. Bead SL_09 (circled) comes from the Spanish, not the French contexts of the onshore site (41 VT 4), indicating a possible difference between bead sources for Spanish and French colonists.

Table D.6: PCA Component Matrix and Eigenvalues for analysis shown in Figure 4

Component Matrix			Total Variance Explained			
	Component			Initial Eigenvalues		
	1	2	Component	Total	% of Variance	Cumulative %
Fe	.590	.779	1	20.095	77.287	77.287
Sc	-.083	.892	2	4.344	16.709	93.995
Ti	.563	.804	3	.709	2.726	96.721
V	.520	.830	4	.283	1.087	97.808
Zr	.828	.113	5	.155	.596	98.404
Nb	.870	.466	6	.127	.487	98.891
Ba	.703	-.632	7	.072	.276	99.167
La	.988	-.125	8	.048	.183	99.350
Ce	.996	-.039	9	.027	.105	99.455
Pr	.993	-.071	10	.024	.090	99.546
Ta	.947	-.010	11	.021	.082	99.628
Y	.961	.166	12	.018	.068	99.696
U	.365	-.841	13	.014	.055	99.751
Nd	.994	-.039	14	.013	.049	99.800
Sm	.988	-.007	15	.011	.042	99.842
Eu	.971	.081	16	.008	.029	99.871
Gd	.984	-.021	17	.007	.029	99.900
Tb	.986	-.070	18	.006	.021	99.921
Dy	.985	-.079	19	.004	.016	99.937
Ho	.984	-.047	20	.004	.015	99.953
Er	.987	-.078	21	.003	.013	99.966
Tm	.982	-.044	22	.003	.013	99.978
Yb	.987	-.055	23	.002	.009	99.987
Lu	.982	-.089	24	.002	.007	99.994
Hf	.918	-.152	25	.001	.004	99.999
Th	.894	-.395	26	.000	.001	100.000

D.1.2 Co-colored P-low-Mg

The cobalt colored P-low-Mg blue glass bead subgroup from the Upper Great Lakes (n=100) contained beads from post-1700 archaeological contexts. The single bead (SL_011) from the Texas contexts that matched this subgroup came from a Spanish Presidio feature. Sites in the Upper Great Lakes with sampled Co-colored beads in the P-low-Mg subgroup include Bell (n=14), Fort Michilimackinac (n=24), Fort St. Joseph (n=15), Doty Island Village (n=7), Doty

Island Mahler (n = 10), Marina (n=1), Rock Island Period 3 (n = 4), and Rock Island Period 4 (n = 24).

Bead SL_011, from the Presidio, contained 7272 ppm of Pb, which is greater than most beads in the Co-colored P-low-Mg subgroup, but it is close in composition to bead RI_033, from Rock Island Period 3b, c. 1700 – 1730, with 7357 ppm of Pb. Mean Pb for the Co-colored subgroup is 1676 ppm, +/- 1673, meaning that Pb is a variable element in this subgroup. The compositional similarity of SL_11 and RI_033 makes sense temporally, and also may indicate that French and Spanish traders or colonists obtained beads from glass workshops using similar recipes, or perhaps even the same workshops.

D.1.3 Co+Sb Mg-low-P

The cobalt colored, antimony opacified, Mg-low-P subgroup of beads sampled from the Upper Great Lakes region includes a total of 55 beads, which were produced post c. 1670 but pre-1700, based on the glass recipes identified and compared to known dates of Upper Great Lakes sites. The sites with Co+Sb Mg-low-P beads include Chickadee (n=2), Doty Island Village (n=1), Gillett Grove (n=1), Iliniwek Village (n=15), Marquette Mission (n=11), Rock Island Period 3a (c. 1670 – 1700; n=4), and the Zimmerman site (n=13)

The Co+Sb Mg-low-P glass subgroup also includes 5 beads from *La Belle*, two beads from French levels of the on shore site (SL_01 and SL_07), and one from the Presidio area of the Fort St. Louis site (SL_12). SL_12 is a type IIa40 bead with higher Sb than other beads in this subgroup. Sb-opacified IIa40 type beads from the Upper Great Lakes region were more variable in composition than other Sb-opacified types, and the bead from the Presidio may be an older, curated bead. The similarity between SL_01 and SL_07, from French levels, and the five beads from the ship is an indicator at least some beads of the types on *La Belle* made it ashore to Fort St. Louis. The locations and chronology of Upper Great Lakes sites yielding beads with Co+Sb Mg-low-P recipes, especially the Marquette Mission, Rock Island, and Zimmerman contexts, support the possibility that La Salle carried beads of this type with him on his earlier expeditions.

D.1.4 Co+Sb P-low-Mg

There is a single co-colored, P-low-Mg bead (SL_10) from the Spanish Presidio area of Fort St. Louis. It is similar in composition to 22 sampled beads in this subgroup from the Upper Great Lakes region, from eighteenth-century sites including Fort Michilimackinac (n=7), Doty Island Village (n=1), Doty Island Mahler (n=4), Rock Island Period 3b (c. 1700 – 1730; n=1) and Period 4 (c. 1760, n=10), and Fort St. Joseph (n=5). Like SL_11, described in the Co-colored P-low-Mg subgroup, SL_10 is slightly higher in Pb (8168 ppm) than most others in the subgroup (mean Pb = 2342 ppm, +/- 2237). Sb levels in this subgroup are also variable (mean Sb = 22064 ppm, +/- 8692), and bead SL_10 contains some of the highest Sb in the subgroup (Sb = 39912 ppm). This is similar to two beads from Fort Michilimackinac, however Pb levels in those beads are in the range of 1300 ppm, much lower than the bead from the Presidio area. Therefore, bead SL_10 is not a close compositional match for any of the beads from the Upper Great Lakes sample, although it fits into the general range of variation for the Co+Sb P-low-Mg subgroup. Reasons for variability in Pb and Sb levels in beads of this type are not well understood.

D.2 Copper colored beads

D.2.1 Cu-colored Mg-low-P

In the Cu-colored, Mg-low-P subgroup, there is one bead from French level of Fort St. Louis, (SL_06) but none from the ship. This is a pre-1700 subgroup from the Upper Great Lakes region, n = 126. Sampled beads in this subgroup come from a wide geographic and temporal range of sites in the seventeenth century, including Arrowsmith (n= 1, probably a curated bead), Bell (n=4), Chickadee (n=6), Doty Island Village (n=1), Doty Island Mahler (n=1), Gillett Grove (n=5), Iliniwek Village (n=23), Marina (n=2), Marquette Mission (n=40), Mormon Print Shop (n=2), New Lenox (n=3), Norge Village (n=1), Peshtigo Point (n=4), Red Banks (n=2), Rock Island Period 3a (n=2), Fort St. Joseph (n=3), and Zimmerman (n=26).

D.2.2 Cu-colored P-low-Mg

One bead from the Cu-colored P-low-Mg subgroup comes from the French level of Fort St. Louis (SL_08) but none come from the ship. This is a post-1700 subgroup identified the Upper Great Lakes region, n = 103. Sampled beads in this group come from a range of sites and components in dated to the early –mid eighteenth century, including Cadotte (n=1, possibly a curated or intrusive bead), Fort Michilimackinac (n=25), Fort St. Joseph (n=16), Doty Island Village (n=3), Doty Island Mahler (n=6) , Marina (n=7), and Rock Island Periods 2 – 4 (n=44).

D.3 Mn-colored (black)

Mn-colored black beads were not the focus of the Upper Great Lakes research, so there are no comparative glass bead samples available from sites in the region. However, the black beads recovered from Fort St. Louis are generally similar to those from *La Belle* though not identical in composition across the major, minor, and trace elements.

D.4 Sb opacified (white)

Five white beads from *La Belle* and one from the French contexts of Fort St. Louis were sampled. Much more antimony (Sb) was detected in the Fort St. Louis sample (Sb = 54238 ppm) than the others from the ship (in the range of 170 – 430 ppm). This could be a product of sampling the core of a bead rather than a clear layer that has been documented on other white beads (e.g. Shugar and O’Connor 2008) and also in the Upper Great Lakes study sample.

Taphonomic considerations, perhaps including the degradation of the outer layer of clear glass in the Fort St. Louis sample but not the beads from the ship, may also be responsible in variation among the samples analyzed with LA-ICP-MS, which is a point-based method that may not always cut through a clear outer glass layer to reach the inner, opaque, Sb-rich core.

D.5 Cu-colored Cored beads:

Blue and white cored beads are the only compound bead type analyzed in this study. I analyzed the blue portions of beads of this type, similar to Kidd and Kidd type Iva16 in LA-ICP-MS in samples BL_25 and BL_26, and analyzed three samples from the blue and white portions of a single bead, reported as samples BL_028, BL_029, and BL_030 (Figure D.5).

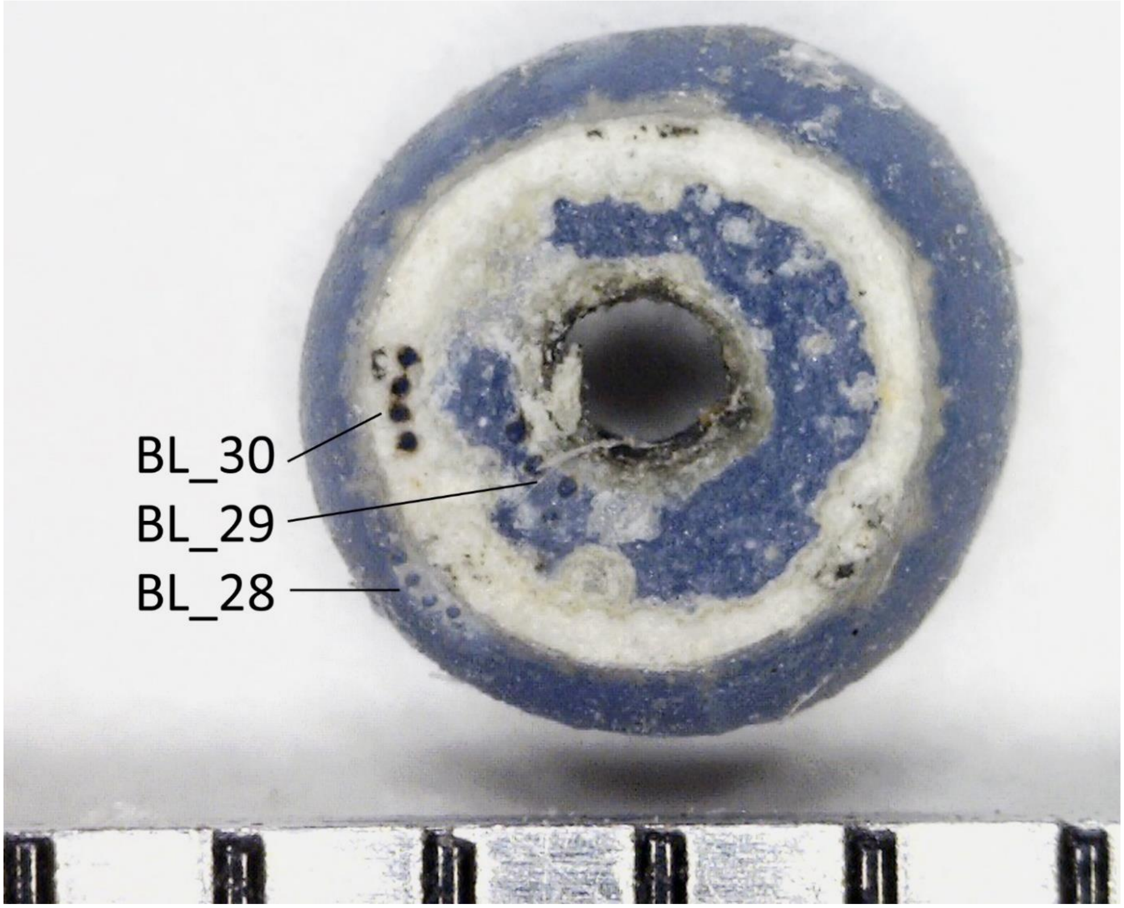


Figure D.5: Glass bead from La Belle after LA-ICP-MS analysis, showing the laser ablation points for samples taken of each of the layers of glass

Using LA-ICP-MS, I analyzed the outer, middle, and inner layers of this cored bead type (Kidd and Kidd IVa16) unique to *La Belle*; beads of this type were not encountered in any of the collections analyses in the Upper Great Lakes region. They make up approximately 4% (n= 31,552) of all beads from *La Belle* (Perttula 2003) and were not recovered at the on-shore site of Fort St. Louis. The white layer is a very high silica (83.5%) Sb-opacified glass type, while the blue layers are made of a soda-lime-silica glass similar to other opaque cobalt blue soda-lime glass seed beads. However, higher than usual Sb levels are present in the blue glass, possibly indicating that some overlap between the white and blue layers occurred during the bead-making process. The LA-ICP-MS ablation points are visible with magnification, showing that it is also possible that some Sb-opacified white glass was sampled inadvertently at the boundaries of the layers. Both of these possibilities make it more difficult to compare the blue glass of the cored blue and white beads to other blue glass types.

Based on the compositional results, I interpret the type IVa16 beads as compositionally similar to those in a Sb-opacified, Mg-low-P group produced c. 1670 - 1700, which is appropriate for the timeframe of *La Belle*. Typologically similar beads of this type are recorded on St. Croix Island, Maine (Bradley 2012:158) and the Coosa River Valley of Alabama and across the Southeast (Little 2010:223-225) from sites dated to the late sixteenth century to the early-mid seventeenth century. Further investigations into glass bead assemblages in the Upper Great Lakes region could reveal beads of this type, or, conversely, the type may only have been available to La Salle for his mission on *La Belle*.

D.6 Discussion and Interpretations related to research questions

1) **Are beads from *La Belle* compositionally similar to beads from any sites in the Upper Great Lakes region?**

Most of the beads sampled from *La Belle* were types IIa55/56. They were sorted into the Co-colored Mg-low-P group of Upper Great Lakes beads, which is compositionally quite homogeneous and is widely distributed across the region. The Co-colored, Sb-opacified Mg-low-P beads sampled from *La Belle* are a different glass recipe, which also fit a compositional group of beads present on Great Lakes sites in the path of La Salle's travels. However, based solely on these compositional similarities between Mg-low-P bead groups from *La Belle*, it is not possible to specifically trace a path linked to La Salle in historical documents or texts. Rather, La Salle and other explorers of the Upper Great Lakes may have been obtaining beads from the same glasshouse(s). Furthermore, since beads were likely redistributed among Native communities throughout the Upper Great Lakes via inter-tribal exchange, down-the-line trade, and other means, widespread distribution of this common and apparently popular glass bead type has led to compositional variability among and within bead assemblages. More direct evidence would be needed to link La Salle to particular beads from Upper Great Lakes sites, but the compositional similarities between beads from *La Belle* and those found in the Upper Great Lakes are present.

2) **Are there compositional similarities between beads from *La Belle* and the French-associated contexts of the Fort St. Louis site?**

Compositional similarities between beads from *La Belle* and the associated Fort St. Louis site are present in the Co+Sb Mg-low-P blue bead subgroup, and some of the black beads are also similar. In the most frequent variety from the shipwreck, Variety 1, the IIa55/56 Co-colored Mg-low-P subgroup, some minor compositional differences between beads from the two contexts were identified (Figure D.4). This is complicated by the fact that boxes and casks that remained on *La Belle* were of course not the ones that were taken to shore, and different cargo boxes might contain beads of different compositions produced in different workshops or batches.

To address variability within glass bead batches, it would be necessary to increase the sample size of white and black beads, and clarify if, despite the sub-surface sampling method used in LA-ICP-MS, there may be a taphonomic explanations for differences that perhaps could be attributed to salt-water corrosion contexts for *La Belle* versus on-shore contexts in soil at Fort St. Louis.

3) **Do the beads from Spanish-associated contexts of the Fort St. Louis site have a different composition from those from French-associated contexts at that site?**

In general, beads from the French associated contexts are distinct from those in the Spanish contexts. The Spanish Presidio context beads are compositionally similar to post-1700 glass recipe subgroups found in the Upper Great Lakes, though a bead (SL_12) is of the IIa40 type and does not fit this pattern as well, and may be a curated artifact. French and Spanish traders may have been obtaining beads from the same glasshouses(s) or glasshouses using similar recipes in the eighteenth century, leading to similarity between beads from the Presidio and those in the Upper Great Lakes.

In conclusion, the analysis of glass beads from *La Belle*, and French and Spanish contexts associated with colonial activities on-shore near the wreck provided new insight into the timing of components and the similarity of late seventeenth and early eighteenth century glass trade beads circulating in North America. Ongoing typological and compositional analyses should provide further comparable information making it possible to clarify routes of exchange across the Upper Great Lakes region and in French colonial contexts more broadly.

Appendix E: Metal attribute typology

Code	Portion	Completion	Description
			Clips
1	Intact	Finished	clip, both legs bent in (closed) completely in staplelike fashion
2	Intact	Finished	clip, one leg bent in, one arm flat
3	Intact	Finished	clip, one leg bent in, one arm flat; midsection is bent or rippled perpendicular to the long axis of the blank - bent or pried open?
4	Intact	Finished	clip, folded or bent irregularly
5	Intact	Finished	clip, twisted
6	Intact	Finished	clip, both legs bent in; midsection bent or rippled (at times more than once) perpendicular to the long axis of the blank
7	Intact	Finished	clip, both legs bent upward but only one bent in (not completely rolled), bent or pried open?
8	Intact	Finished	clip, both legs bent up, neither bent in; midsection bent or rippled, (not completely rolled) - bent or pried open?
9	Fragmentary	Finished	clip, both legs bent in, but blank is broken
10	Fragmentary	Finished	clip, one leg missing - artifact consists of one bent leg and midsection only
11	Fragmentary	Finished	clip, both bent legs missing - artifact consists of midsection and arched ends only
12	Fragmentary	Partially Processed	clip, fragmentary, both legs bent up, neither bent inward, blank broken
13*	Intact	Finished	clip, both legs bent up, neither bent in
			Beads
49	Intact	Finished	bead, ovoid cross section/closure abuts
50	Intact	Finished	bead, ovoid/closure overlaps
51	Intact	Finished	bead, ovoid/ends do not meet
52	Intact	Finished	bead, ovoid/closure not recorded
53	Intact	Finished	bead, round cross section/closure abuts
54	Intact	Finished	bead, round/closure overlaps
55	Intact	Finished	bead, round/ends do not meet
56	Intact	Finished	bead, round/closure not recorded
57	Intact	Partially Processed	bead, not completely rolled
58	Fragmentary	Finished	bead, rolled fragment that can be determined to be a fragment of a bead
59	Intact	Finished	bead, short flattened midsection/closure overlaps
60	Intact	Finished	bead, short flattened midsection/closure abuts
61	Intact	Finished	bead, short flattened midsection/short edges do not quite meet
62	Intact	Finished	bead, tubular (at least 3x as long as diameter?)
63	Fragmentary	Finished	bead, tubular fragment
64	Intact	Finished	bead, irregularly rolled - edges abut in teardrop fashion - (see also 46)

Code	Portion	Completion	Description
65	Intact	Finished	bead, irregularly rolled - twisted
66	Intact	Finished	bead, irregularly rolled/edges overlap
67	Intact	Finished	bead, irregularly rolled/edges do not meet
68*	Intact	Finished	bead, folded in half and flattened (post deposition?); rectangular blank
69*	Intact	Finished	bead, irregularly rolled, edges overlap, at least one rivet
70*	Intact	Finished	bead, partially rolled, one edge overlaps, one edge open
71*	Intact	Finished	bead, ovoid, closure overlaps, at least one perforation
72*	Intact	Finished	bead, flattened, rectangular blank with both long edges folded in to the center with seam at
			Blanks
100	Intact	Partially Processed	blank, rectangular, flat
101	Intact	Partially Processed	blank, rectangular, one short end rolled/folded, one side flat (see 02 above)
102	Intact	Partially Processed	blank, rectangular, bent or rolled irregularly
103	Intact	Partially Processed	blank, rectangular, flat, midsection bent/rippled perpendicular to long axis of blank
104	Intact	Partially Processed	blank, rectangular, long, flat strip
105	Intact	Partially Processed	blank, rectangular, large blank from which smaller blanks appear to have been cut
106	Intact	Partially Processed	blank, rectangular, short ends bent into teardrop shape - edges don't close
107	Intact	Partially Processed	blank, rectangular, long blank, long edges partially rolled - tubing in the making?
108	Intact	Partially Processed	blank, rectangular, flat, “backed” (one long edge folded over)
109	Fragmentary	Partially Processed	blank, rectangular, curved, S-shape
110	Fragmentary	Partially Processed	blank, rectangular, flat
111	Fragmentary	Partially Processed	blank, rectangular, short end only; rolled/forms flattened "e" shape (probable clip or bead
112	Fragmentary	Partially Processed	blank, rectangular, short end only; rolled/forms "c"shape (probable clip or bead fragment)
113	Fragmentary	Partially Processed	blank, rectangular, short end only; rolled/forms "u"shape (probable clip or bead fragment)
114	Fragmentary	Partially Processed	blank, rectangular, short end only; rolled/forms teardrop shape (probable clip or bead fragment)
115	Fragmentary	Partially Processed	blank, rectangular, short end only; rolled and bent/forms "v"shape (probable clip or bead
116	Fragmentary	Partially Processed	blank, rectangular, small; short end slightly curved
117	Fragmentary	Partially Processed	blank, rectangular, curved and twisted into "s"shape
118	Fragmentary	Partially Processed	blank, rectangular, short end folded in tightly, then rolled; forms "u"shape
119	Fragmentary	Partially Processed	blank, rectangular, short end and partial midsection, rolled (probable clip fragment - see 10
120	Fragmentary	Partially Processed	blank, rectangular, short end and partial midsection
121	Fragmentary	Partially Processed	blank, rectangular, very small; rolled, shape not recorded
122	Fragmentary	Partially Processed	blank, rectangular, short end and partial midsection; rolled and twisted
123	Fragmentary	Partially Processed	blank, rectangular, short end only; folded in half crosswise, then rolled into "C" shape
124	Intact	Partially Processed	blank, rectangular, set of three, in graduated sizes, nested, then rolled into >c= shape

Code	Portion	Completion	Description
125	Intact	Partially Processed	blank, rectangular, long edge rolled in
126	Fragmentary	Partially Processed	blank, rectangular, irregularly shaped fragment, one short side pointed
127	Intact	Partially Processed	blank, trapezoidal
128	Intact	Partially Processed	blank, square
129	Intact	Partially Processed	blank, parallelogram shaped
130	Intact	Partially Processed	blank, irregular, large, irregularly shaped preform
131	Intact	Partially Processed	blank, rectangular, long, folded in half lengthwise
132	Fragmentary	Partially Processed	blank, short end only; folded flat
133*	Intact	Partially Processed	blank, trapezoidal, one rolled corner/edge
134*	Intact	Partially Processed	blank, parallelogram, midsection rolled perpendicular to long axis of blank
135*	Intact	Partially Processed	blank, rectangular, “backed” on one long edge and folded in half
136*	Intact	Partially Processed	blank, trapezoidal, partially rolled, both edges upturned (U –shape)
137*	Intact	Partially Processed	blank, triangular, flat
138*	Fragmentary	Partially Processed	blank, trapezoidal, short end only, small and slightly curved
139*	Intact	Partially Processed	blank, semicircular, parallel curving sides, may be perforated
140*	Fragmentary	Partially Processed	blank, circular, curved edge (broken or unfinished)
141*	Intact	Partially Processed	blank, trapezoidal, rolled or folded widthwise
142*	Fragmentary	Partially Processed	blank, triangular, broken at perforation
143*	Fragmentary	Partially Processed	blank, trapezoidal, broken
144*	Intact	Partially Processed	blank, rectangular, partially rolled, both edges upturned (U –shape)
145*	Intact	Partially Processed	blank, rectangular, one long edge bent perpendicular to the blank
146*	Fragmentary	Partially Processed	blank, parallelogram, broken
147*	Fragmentary	Partially Processed	blank, rectangular, midsection only, one long edge backed, short ends rolled
148*	Intact	Partially Processed	blank, trapezoidal, bent, rolled irregularly
149*	Intact	Partially Processed	blank, triangular, one corner rolled or bent
150*	Fragmentary	Partially Processed	blank, rectangular, short end only, flat with one end slightly rolled (probable clip or bead)
151*	Intact	Partially Processed	blank, rectangular, both long edges folded inward as if in thirds
			Tubes, Tubing, and Objects Made from Tubes
200	Intact	Finished	tube, hollow, ends abut
201	Intact	Finished	tube, hollow, ends overlap
202	Fragmentary	Finished	tube, hollow, ends do not meet; fragment is still at least 3x as long as it is wide (otherwise,
203	Intact	Partially Processed	tubing, B-shaped hollow segment - curved or straight
204	Intact	Partially Processed	tubing, e-shaped hollow segment - curved or straight
205	Intact	Partially Processed	tubing, o-shaped hollow segment - curved or straight

Code	Portion	Completion	Description
206	Intact	Partially Processed	wire, solid segment - curved or straight
207	Intact	Partially Processed	wire, strip segment - curved or straight; (strip is actually a long, flat, rectangular blank)
208	Fragmentary	Finished	bracelet, made from B-shaped tubing
209	Fragmentary	Finished	bracelet, made from e-shaped tubing
210	Intact	Finished	bracelet, made from o-shaped tubing
211	Intact	Finished	bracelet, wire, strip, (meaning made from a long, flat blank; see type 207)
212	Intact	Finished	bracelet, wire, solid
213	Intact	Finished	ringlet, e-shaped tubing, ends overlap
214	Intact	Finished	ring, tubing, B-shaped
215	Intact	Finished	ring, tubing, e-shaped
216	Intact	Finished	ring, wire, from strip (a long, flat blank)
217	Intact	Finished	ring, wire, hollow
218	Intact	Finished	ring, wire, solid
219	Intact	Finished	loop or ringlet, B-shaped tubing
220	Intact	Finished	coil/spiral from strip (these are also known as "spiral beads")
221	Intact	Finished	coil, tubing, B-shaped; coils resemble miniature bedsprings
222	Intact	Finished	coil, tubing, e-shaped
223	Intact	Finished	coil, tubing, o-shaped
224	Intact	Finished	double spiral ornament, e-shaped tubing
225	Intact	Finished	ringlet, solid metal – wire
226*	Intact	Finished	bracelet, B-shaped tubing
227*	Intact	Finished	tubing, hollow, at least one perforation (pre-rolling)
228*	Intact	Finished	tubing, curved or straight, hollow, twisted post-rolling
			Tinkling Cones
300	Intact	Finished	tinkling cone, trapezoidal blank, tip open, midsection open, base open, closure parallel but not
301	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and base overlap, midsection bulges open
302	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck abuts, midsection bulges open, base overlaps
303	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection bulges open, base abuts
304	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection bulges open, base doesn't
305	Intact	Finished	tinkling cone, trapezoidal blank, tip closed, neck abuts, midsection bulges open, base doesn't
306	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection closed, base abuts
307	Intact	Finished	tinkling cone, trapezoidal scrap-like blank; tip open, neck, midsection, and base overlap
308	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and midsection overlap, base open
309	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and midsection abut, base overlaps

Code	Portion	Completion	Description
310	Intact	Finished	tinkling cone, parallelogram shaped blank; tip open, neck and midsection overlap, base open
311	Intact	Finished	tinkling cone, square blank; tip open, neck, midsection, and base overlap slightly
312	Intact	Finished	tinkling cone, square blank; tip open, neck overlaps, midsection and base don’t meet (both are
313	Intact	Finished	tinkling cone, triangular blank; tip open, neck abuts, base open
314	Intact	Finished	tinkling cone, irregularly shaped scrap-like blank; crudely made
315	Fragmentary	Finished	tinkling cone, body fragment only
316*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and midsection abuts, base open
317*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection abuts and bulges, crimped base (concave on both sides)
318*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck abuts, midsection overlaps, base overlaps and
319*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck, midsection and base overlap
320*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck abuts, midsection and base overlap
321*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck open, midsection and base abut
322*	Intact	Finished	tinkling cone, irregular blank, tip closed, neck, midsection, abut, base overlaps
323*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck, midsection, and base abut
324*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck open, midsection and base overlap
325*	Intact	Finished	tinkling cone, square blank, tip open, neck overlaps, midsection and base abut
326*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck, midsection, and base are open (parallel but do not
327*	Intact	Finished	tinkling cone, trapezoidal blank, tip closed, neck and midsection abut, base overlaps
328*	Intact	Finished	tinkling cone, square blank, tip open, neck abuts, midsection and base overlap
329*	Intact	Finished	tinkling cone, trapezoidal blank, tip closed, neck overlaps, midsection and base abut
330*	Intact	Finished	tinkling cone, trapezoidal blank, tip closed, neck overlaps, midsection abuts, base open
331*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection and base abut
332*	Intact	Finished	tinkling cone, square blank, tip open, neck and midsection overlap, base open
333*	Intact	Finished	tinkling cone, square blank, tip open, neck, midsection and base overlap
334*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, folded, not rolled, midsection and base abut in teardrop
335*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck abuts, midsection open, base abuts
336*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection abuts, base overlaps
337*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection and base open
338*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection abuts, base overlaps
339*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck open, midsection abuts, base open
340*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck abuts, midsection open, base overlaps
341*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck open, midsection abuts, base overlaps

Code	Portion	Completion	Description
342*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and midsection abut, base is open and curved inward (see 317*)
343*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck abuts, midsection open, base very open
344*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and midsection open, base abuts
345*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and midsection abut, base open (parallel edges)
346*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck open, midsection overlaps, base abuts and is crimped or rolled inward
347*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck abuts, midsection and base open (parallel but do not meet)
348*	Intact	Finished	tinkling cone, triangular blank, tip open, neck and midsection open, base overlaps
349*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck overlaps, midsection abuts, base open
350*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck and midsection overlap, base abuts
351*	Intact	Finished	tinkling cone, triangular blank, tip open, neck and midsection open (parallel but do not meet), base overlaps
352*	Intact	Finished	tinkling cone, irregular blank, tip open, neck and midsection abut, base overlaps
353*	Intact	Finished	tinkling cone or projectile point, trapezoidal blank, tip closed, neck, midsection, and base overlap
354*	Intact	Finished	tinkling cone, triangular blank, tip open, neck open, midsection and base overlap; corner at the base is a "tail" opposite the seam
355*	Intact	Finished	tinkling cone, trapezoidal blank, tip open, neck open, midsection bulges open, base overlaps
			Scrap
400	Intact	Partially Processed	scrap, roughly parallelogram shaped
401	Intact	Partially Processed	scrap, roughly square
402	Intact	Partially Processed	scrap, irregularly shaped
403	Intact	Partially Processed	scrap, roughly triangular
404	Intact	Partially Processed	scrap, roughly circular/ovoid
405	Intact	Partially Processed	scrap, roughly trapezoidal
406	Intact	Partially Processed	scrap, roughly rectangular
407	Intact	Partially Processed	scrap, roughly kite-shaped
408	Intact	Partially Processed	scrap, irregularly shaped, with one right angle
409	Intact	Partially Processed	scrap, irregularly shaped, with two parallel edges indicative of blank-cutting
410	Intact	Partially Processed	scrap, irregularly shaped, folded, heated, melted in fire
411	Intact	Partially Processed	scrap, irregularly shaped, one straight edge
412	Intact	Partially Processed	scrap, flat, roughly shaped, round function uknown
413*	Intact	Partially Processed	scrap, irregular, perforated at least once, no straight sides, all others see patch

Code	Portion	Completion	Description
414*	Intact	Partially Processed	scrap, two or more irregular pieces, joined by rivets
415*	Intact	Partially Processed	scrap, geometric irregular polygon
416*	Intact	Partially Processed	scrap, geometric irregular polygon with one curved edge
417*	Intact	Partially Processed	scrap, irregularly shaped, with a blank removed from it
			Miscellaneous
500	Fragmentary	Partially Processed	bell, hawk, fragmentary
501	Intact	Finished	awl
502	Intact	Finished	pendant, flat, triangular shaped, perforated at apex
503	Fragmentary	Finished	pendant, flat, triangular shaped, perforated at apex
504	Intact	Finished	kettle parts, bail
505	Intact	Finished	Kettle parts, rivets
506	Fragmentary	Partially Processed	Kettle parts - body fragment with rivet attached
507	Intact	Partially Processed	kettle parts, lug, manipulated?
508	Fragmentary	Partially Processed	kettle parts, lug manipulated?
509	Fragmentary	Finished	point, small, thin, needle or pin? Round in X-section
510	Intact	Finished	point, projectile, triangular, flat in cross section
511	Fragmentary	Finished	fragment, flat, small, unidentifiable
512	Intact	Finished	nodule, heated?
513	Intact	Finished	bipointed piece, small, function unknown
514*	Fragmentary	Finished	pendant, rounded, flat, ovate/round, perforated at apex, broken at perforation
515*	Intact	Partially Processed	irregular form decoration, four curved lobes with perforation, reworked kettle rim piece
516*	Intact	Finished	bracelet, cut brass, rectangular blank, one curved sheet
517*	Intact	Partially Processed	blank, circular flat disk - unknown use
518*	Intact	Finished	projectile point, triangular or diamond, with body perforation
519*	Fragmentary	Partially Processed	kettle parts, almost whole kettle body, partially worked
520*	Intact	Finished	pendant, square, flat, perforated at middle of one edge (all edges straight)
521*	Intact	Finished	pendant, flat, trapezoidal, perforated at narrow, short side (all edges straight)
522*	Intact	Finished	pendant, flat, square, perforated at one corner (all edges straight)
523*	Intact	Finished	hinge? Rectangular blank, rolled along short axis, matching perforations at short end, firearm
524*	Intact	Finished	bell, hawk, complete
525*	Intact	Finished	point, projectile, rectangular blank folded to a diamond shape
526*	Intact	Finished	point, serrated, blunt or pointed tip (saw-like)
527*	Intact	Finished	cross, cut brass
528*	Intact	Partially Processed	indeterminate piece, possibly machine manufactured, firearm part?

Code	Portion	Completion	Description
529*	Intact	Finished	pendant, long rectangular, perforated on short edge
530*	Intact	Finished	Kettle rim portion, reworked possibly for use as a scraper
531*	Fragmentary	Finished	blank, circular flat disk with perforation - unknown use
532*	Intact	Partially Processed	kettle parts, rim portion, (sometimes with perforations for lug attachment)
533*	Fragmentary	Finished	kettle parts, rivet, fragmentary
			Patches and patched pieces
550*	Intact	Finished	patch, rectangular, perforations/rivets at all four corners
551*	Fragmentary	Partially Processed	patch, rectangular, long and flat, at least one perforation or rivet, short end broken
552*	Fragmentary	Partially Processed	patch, rectangular, broken at perforation
553*	Intact	Partially Processed	patch, rectangular, perforations and/or rivets at irregular placements
554*	Intact	Partially Processed	patch, irregular, geometric, irregular shape, perforations or rivets
555*	Intact	Partially Processed	patch, rectangular,long and flat, at least one rivet or perforation
556*	Fragmentary	Partially Processed	patch, fragmentary, likely one corner or other portion of a patch, at least one perforation or rivet
557*	Fragmentary	Partially Processed	patch, parallelogram, long and flat, broken at perforation
558*	Fragmentary	Partially Processed	patch, rectangular, scraplike piece, one or more perforations or rivets
559*	Fragmentary	Partially Processed	patch, trapezoidal, scraplike piece, one or more perforations or rivets
560*	Intact	Finished	patch, intact, attached to one or more kettle fragments by rivets
561*	Fragmentary	Partially Processed	patch, irregular scraplike piece, one or more perforations or rivets
562*	Intact	Finished	patch or applique, intact, rolled, with rivets
563*	Fragmentary	Finished	patch, rectangular, modified and reused as a vermillion container
564*	Fragmentary	Partially Processed	patch, rectangular, modified portion of a rectangular piece with regular perforations