

4-26-2018

Pit Features: A View From Grand Island, Michigan

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PIT FEATURES: A VIEW FROM GRAND ISLAND, MICHIGAN

EMILY R. BARTZ

161 Pages

Serving a multitude of functions from subterrestrial cavities of storage, basins for cooking, to vessels that securely hold pounds of rice allowing the grains to be danced upon to thresh, pit features are one of North America's most common archaeological feature. These constructions are dug to fit a diversity of needs based on the people who manufacture them. By understanding the distinct function(s) a pit or group of pit features played at a site-level, the needs of the people who inhabited that landscape are better understood. The nature of a pit feature is to store or process something that is of value, by virtue of the objects pits once contained, those materials are predominantly reclaimed from the pit when it was in use. This lack of associated material remains found in the archaeological record make it difficult to understand the activities associated with these features. Recorded pit features of the lower peninsula of Michigan have contained varying floral remains, charred wood, burned soils, fire-cracked rocks, and limited amounts of ceramics and lithics. A considerable amount of regional ethnohistoric accounts demonstrates the importance of pit features in the subsistence and settlement patterns of native Upper Great Lakes groups. Despite these accounts, and high frequencies in which these features manifest throughout the region, there have been no formal archaeological investigations into pit feature use in the Upper Peninsula of Michigan.

To address this regional gap in research, archaeological investigations into selected pit features at the Muskrat Point site (03-910) were conducted under the direction of the Grand

Island Archaeological Project in the summer of 2017. Field survey identified 24 surface depressions, likely to be pit features along the southern end of Grand Islands eastern lobe. Fifteen of these are located in the area of the Muskrat Point site, four of these surface depressions were excavated, each confirmed to be pit features. A performance-based approach is used to consider pit stratigraphy, macrobotanical remains, radiocarbon dating, and other contextual evidence in order to investigate pit feature function at this coastal Lake Superior site. This research acts as an initial step towards understanding the roles pit features played in Native American lifeways of the Upper Peninsula of Michigan.

KEYWORDS: Pit Feature; Grand Island; Woodland Period; Upper Great Lakes; Hunter-Gatherer Storage.

PIT FEATURES: A VIEW FROM GRAND ISLAND, MICHIGAN

EMILY R. BARTZ

A Thesis Submitted in Partial
Fulfillment of the Requirements
for the Degree of

MASTER OF SCIENCE

Department of Sociology and Anthropology

ILLINOIS STATE UNIVERSITY

2018

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PIT FEATURES: A VIEW FROM GRAND ISLAND, MICHIGAN

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ACKNOWLEDGMENTS

My sincerest appreciation and gratitude to my committee chair and incredible mentor, Dr. James M. Skibo. You have allowed me the choice to pursue a research topic I am truly passionate about and have given me constant support and guidance throughout the thesis process. Over the past two years you have taught me so much and have always answered my incessant stream of questioning with patience and a smile. I cannot thank you enough for all you have done for me and I will forever be grateful for the chance to learn from you. To Eric Drake, you are one of the smartest men I have ever had the pleasure of meeting and your passion for archaeology is truly inspiring. You have guided my research in ways that have pushed my understanding and broadened my interpretative acumen. To Dr. Sean Dunham, your research on the *Ne-con-ne-pe-wah-se* pit features was my first introduction to the features I have now become fascinated with. Your knowledge and experience in Upper Great Lakes archaeology was of tremendous value to my research and you have had an immense effect on my methods and interpretation of this study. Thank you to Dr. G. Logan Miller for helping me understand the foreign topics of lithics and radiocarbon dating that helped in my methods and for revising drafts of my thesis with comments that made me laugh so hard I cried.

To my parents, Jim and Bonnie Bartz, and my brother Bill, thank you for your unwavering support. The love of my family has been my life's greatest blessing. And finally thank you, Paige Dobbins and Abigail Peeples, for the humor and friendship that made the worst days of grad school unforgettable.

E. R. B.

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CHAPTER I
INTRODUCTION AND RESEARCH QUESTIONS

Introduction – “Holes Dug in the Ground”

Pit features, often recognizable as conspicuous surface depression, are manifests of historic and prehistoric activity throughout North America. Although pit features are the most common archaeological feature found in the Great Lakes region, a frequent lack of associated material remains make it difficult to understand the activities connected with them (Dunham 2000; Hinsdale 1925, 1931). Despite a general lack cultural material, they commonly contain remnants such as charred wood, burned soils, and/or fire cracked rock. As a result, these features have commonly been interpreted as being food storage and/or food processing pits. The tenuous perceptions of subterranean pits, however, can lead to a misinterpretation of their function and may overlook meaningful ecological and social functions associated with the peoples using them (see DeBoer 1988; Duham 2000; Howey and O’Shea 2006). Traditional explanations such as these, no matter how weakly supported, have long been entrenched in archaeological literature, and there is certainly a need for more directed research. Recently, these features have been receiving more attention in Great Lakes scholarship (Dunham 2000; Hambacher and Holman 1995; Holman and Krist 2011; Howey et al. 2016; Howey and Frederick 2016; Howey and Parker 2008). This recent research has expanded the understanding of pit function as diverse responses to subsistence needs in the seasonally fluctuating climate of the Great Lakes region.

One of the first mentions of pit features appears in the *Archaeological Atlas of Michigan* written by Wilber B. Hinsdale in 1931. Here, in a section titled “Cultural Features Not Included on Maps” Hinsdale describes pits as:

Holes dug in the ground are the commonest type of earthwork found in Michigan. They are often referred to as Indian pits and occur singly or in groups numbering over a hundred. Sometimes the groups appear to have been arranged according to plan, but usually they were dug regardless of any preconceived pattern. The depth varied from two or three to six or seven feet. At the top they are usually round and from four to eight feet in diameter. Some of them are so close together that their rims overlap, forming a kind of figure eight surface outline [1931:12].

Hinsdale describes the basic physical characteristics of pit features with no mention of their functions or importance. Mention of pit features (also called cache pits or subterranean surface depressions) is common throughout site reports, but no additional information beyond their existence and location is usually given. In the past twenty-five years, archaeologists have begun to give these features more attention by exploring how they were used by pre-contact and contact period Native Americans in the Great Lakes region. There is still, however, much to be learned, especially in researching pit features in relation to hunter-gatherer mobility and subsistence patterns.

Per ethnographic and historic accounts from the Great Lakes region, pit features were commonly lined with bark and filled with foodstuffs. Food was placed in ceramic or bark containers and the areas between the containers was filled with grass. The pits were closed off with mounded dirt and sometimes the dirt was piled on top of logs laid across the pit opening (Densmore 1929; Hilger 1951; Kinietz 1965). When excavated, these pits are circular depressions that are one to two meters wide, and typically a half to one meter deep. The features typically appear in clusters of ten to twenty-five but can reach numbers into the hundreds

(Dunham 2000, Hambacher and Holman 1995). Pit features tend to be found near bodies of water but also occur up to a mile away from a water source (Hambacher and Holman 1995). Pits not found near rivers or lakes are commonly found near occupation sites (Howey and Fredrick 2016).

The environment of the Upper Great Lakes presents varying degrees of subsistence uncertainty and a reliable way to reduce this risk is to set aside an allotted portion of stored foods for later consumption. The existing Late Woodland subsistence models focus attention on the intensive harvest, creation of surplus, and subsequent storage of fall-spawning fish species as the pillar of Upper Great Lakes subsistence and seasonal risk buffering (Cleland 1982). The storage of fish was certainly a primary food resource, but not an exclusive one (Dunham 2014). As further detailed in chapters two and three, the Upper Peninsula had/has series of potential resources that supplemented the diets of Later Woodland period hunter gatherers. Pit features functioned as a means to not only store these foods, but also mechanism for food processing, hide processing, and storage for the instruments and tools used for hunting, fishing, and processing (i.e., projectile points, fishing nets, etc.).

Analysis of the physical attributes and further indications of use can contribute to the understanding of pit feature functions. Additionally, careful examination of the performance characteristics and technical choices within a performance matrix can be used in the Upper Great Lakes Region to compare and interpret morphological correlates of use. There is a lot of information to be gleaned from these seemingly ordinary features, and research implementing careful consideration paid to pit feature characteristics and function would contribute to our understanding of the region. This study sets out to further explore the current understanding of prehistoric storage practices in the Upper Great Lakes. In this thesis I will examine the

function(s) of recently excavated pit feature from the Muskrat Point site (03-910) on Grand Island in the Upper Peninsula of Michigan.

Study Area - Grand Island, Michigan

Grand Island is located on the southern shore of Lake Superior, just north of the present-day city of Munising, Michigan. With 35 miles of shoreline, Grand Island is the largest island on the southern shore of Lake Superior (Roberts 1991:26). The island is around seven and a half miles long and three and a half miles wide, covering an area of over 13,000 acres (Figure 1) (Dunham 2004). The island is made up of two major portions: the eastern lobe, a smaller portion known as the “Thumb,” and the larger western lobe (Anderton 2004:114). These two portions are connected by a tombolo, a narrow, low-elevation sandy isthmus. This low-lying land mass would have been submerged during periods of high lake levels. The island has two interior lakes: Echo Lake is about a mile long and a half-mile wide, located in the center of the western lobe, and Duck Lake is a smaller projectile-point shaped lake located less than a quarter of a mile north of Murray Bay. At the northern edges of the island are high sandstone cliffs, existing from the same Munising geologic formation as the colorful cliffs found along the Picture Rocks National Lakeshore located just east of the island (Skibo et al. 2007). The southern shore looks strikingly different. The shores of Murray Bay are made of sand or pebble beaches that are protected from lake winds and extreme wave action. There is evidence for human habitation of this protected bay from the Archaic Period to present-day (Dunham and Anderton 1999). The water surrounding Grand Island, most notably the shallow waters of Murray Bay, is one of the most productive fisheries along the southern shore of Lake Superior (Drake and Dunham 2004). Apart

from a first-rate fishing spot, Murray Bay also provides a diverse variety of plant foods and game such as nuts, berries, maple sugar, deer, beaver, and black bear (Neubauer 2016).



Figure 1: Google Earth image showing important features of Grand Island in Michigan's Upper Peninsula.

Research Questions

Evidence of pit feature use is presented here based on the results of fieldwork done in the summer of 2017 as part of the Grand Island Archaeological Program. Pit feature function is examined within a regional context, informed by regional archaeological, ethnohistoric, and

ethnographic data. Through the exploration of pit feature function, this research aims to expand upon our regional understanding of hunter-gatherer storage in the Upper Great Lakes through examination of a new location of pit clustering combined with relevant data from previously recorded pit feature sites in northern Michigan. The research is framed around the following research questions:

1. When were pit features on Grand Island constructed?
2. What were the function(s) of the pit features at the Muskrat Point site?
3. Can multi-use of pit features be determined through stratigraphy?

By exploring the role pit features performed among hunter-gatherers of the Upper Great Lakes, this research expands upon the current understanding of the use of storage among mobile hunter-gather groups.

Review of Chapters

In this chapter, I introduced the reader to the nature and relevance of pit feature research in the Upper Great Lakes, highlighting the importance of their interpreted function. This was followed by a brief overview of the study area, Grand Island, and the research questions that guided this research.

Chapter 2 discusses the physical and geographical characteristics of the Upper Great Lakes region, with particular focus on the Upper Peninsula of Michigan. This chapter also overviews the regions floral, faunal, and environmental characteristics. This is followed by a discussion of the areas cultural background leading with early Euromerican accounts of life on the island, accompanied by archaeological data informing on the Woodland period and the subsistence and settlement models interpreting a shifting pattern from the Initial to Terminal Woodland period.

The chapter ends with an overview of archaeological evidence of fishing on the island, reviewing the remains of fish bones and fishing related gear discovered on the island and nearby mainland.

Chapter 3 informs the reader on previous archaeological work done in Michigan researching pit features. These studies are from a number of areas in the Lower Peninsula, with features from the Late Woodland and Historic periods. These studies examine the role of pit features used as food storage in the Lower Peninsula and how these features supported the settlement and subsistence patterns. This chapter also includes a unique study discussing historic period smudge pits from the *Gete Odena* site on Grand Island. This chapter ends with a review of an experimental study recreating subterranean food storage done at Michigan State University.

Chapter 4 reviews the performance-based approach within a behavioral theoretical framework used in this research to explore the role of pit features at the Muskrat Point site (03-910). I discuss the stages of an artifact's or feature's life history based on the behavioral chain of Schiffer (1992) and Schiffer and Skibo (1997), followed by review of technical choices and performance characteristics. The performance approach is applied to this study in efforts to observe and understand patterns in performance characteristics related to feature function. I also discuss the performance matrix and how it is used in this study to compare the performance characteristics from various pit feature functional attributes. The chapter ends with a discussion of storage among small-scale hunter-gatherers and historical accounts of pit features used in the Upper Great Lakes including cache pits, hide smudging pits, and food processing pits.

Chapter 5 provides an overview of field and laboratory methodologies used in this study. Chapter 6 informs on the results of the fieldwork and assemblage analysis in a functional analysis. Each excavated pit feature is described in detail of its morphology, stratigraphy, and botanical remains. These results are followed by a discussion of the contextual data associated with the

Muskrat Point site providing supporting information on the function of these features. The second half of the chapter provides the results of the performance matrices for historical and archaeological documented pit features in the Upper Great Lakes. Finally, Chapter 7 presents the breakdown of the performance analysis of the Muskrat Point pit features. Followed by an interpretation of this study of pit feature function at the Muskrat Point site, returning to the research questions and reviewing what has been accomplished by this study in its relevance to the understanding of the regions archeological record.

CHAPTER II

GEOGRAPHIC, ENVIRONMENTAL, AND CULTURAL BACKGROUND OF MICHIGAN'S UPPER PENINSULA

This chapter reviews the geographic, environmental, and cultural background information related to the Upper Peninsula of Michigan. More exhaustive information is given to the archaeology and history of Grand Island. This review does not carry out a complete background but rather a synthesis for readers to contextualize this research.

Geographic Characteristics

Investigations into site settings and function are better informed with a knowledge of the geomorphic processes that created the landscapes and terrains Native Americans chose to inhabit. Furthermore, any interpretation made about lake-oriented prehistoric human occupation is lacking without attention drawn to the long- and short-term nature of the changing coastal environments of the Great Lakes (Anderton 1993, 2004; Jackson et al. 2000; Legg and Anderton 2010). The following section describes the areas glacial history, geology and soil composition, and post- glacial lake levels.

Deglaciation

The geology of the Upper Great Lakes has been greatly impacted by a sequence of glacial advances and retreats throughout the Quaternary period (2.588 ± 0.005 million years ago to the present), which has resulted in a complicated, yet visually spectacular landscape. Grand Island

has been carved out and shaped by these glacial events, predominantly taking place in the last 11,000 years (Larson and Schaetzl 2001). Ice Age glaciation not only shaped the island but is also responsible for the land formations and soil compositions still present today. At the peak of the last Ice Age glacial advance (Laurentide), a continental ice sheet nearly as wide as the North America, covered the entire region of Canada and the northern United States extending down into the state of Wisconsin and parts of Ohio. This glacial advance is termed the “Wisconsin advance” which profoundly changed the landscape and pushed life out of the area. The glacier acted like a plow, scraping away rocks and soils as it traveled south. Rocks and sediments that were carried on top and within the glacier were deposited in large drifts of debris called moraines as the glacier retreated (Dorr and Eschman 1970:147-48). As the glacier retreated it also left behind kettle holes which were areas where huge chunks of ice sank, forming a depression that filled with melt ice and formed lakes (Dorr and Eschman 1970:151). The most significant artifact created as a result of this glaciation were the Great Lakes themselves.

Bedrock Geology and Soil Composition

Michigan is a geologic basin, formed by the tectonic warping of formally flat-lying strata. The Michigan Structural Basin is represented by a circular pattern of sedimentary strata gently dipping towards the center of the Lower Peninsula. Sediments in the center of Michigan’s Lower Peninsula are the youngest in age, increasing in age as the basin expands outward (Dorr and Eschman 1970; Hamblin 1958). Grand Island is situated at the northern edge of the Michigan Structural Basin, formed by Pre-Cambrian, Cambrian, and Ordovician sediments. The associated rock foundations are: a basal unit of Jacobsville Sandstone, Munising Formation Sandstone,

which is partially overlain (not present in eastern lobe) by the Au Train Formation sandy dolomites, and dolomitic sandstones (Anderton 2004).

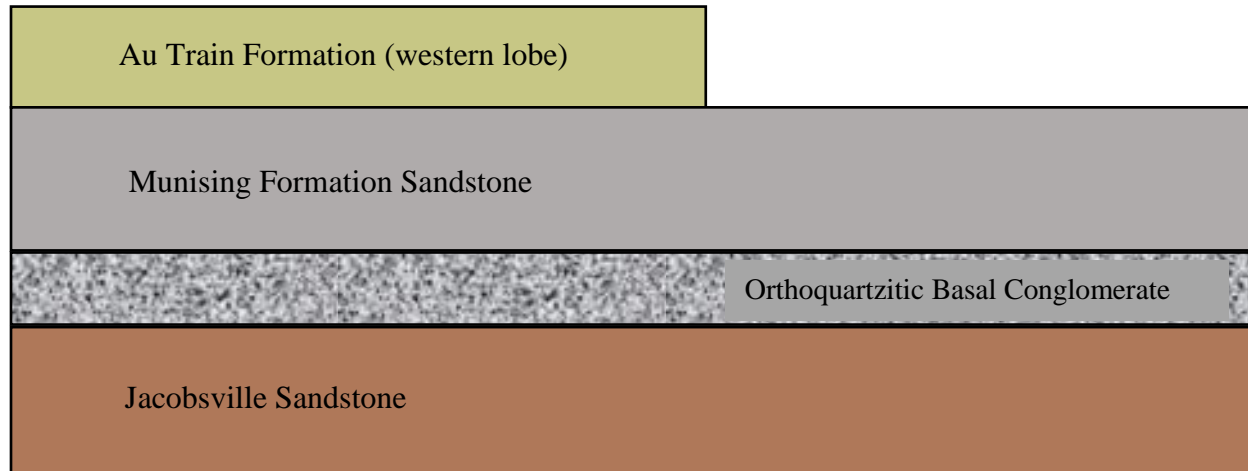


Figure 2: Diagram demonstrating an approximate cross section of Grand Island’s bedrock geology.

The Pre-Cambrian age Jacobsville Formation is overlain by the Cambrian age Munising Formation. Consisting of three distinct units, the Munising Formation is made up of: a basal conglomerate, the Chapel Rock member, and the Miner’s Castle member, in ascending stratigraphic order, illustrated in Figure 2. Of particular importance to this discussion is the basal conglomerate unit, which outcrops near water level on the eastern lobe of Grand Island (Drake et al. 2009; Hamblin 1958). This basal formation constitutes an erosional surface at the bottom of the Munising Formation made up of vein quartz, quartzite, chert, and small amounts of slate, iron, basalt, granite, and sandstone. Most of the Grand Island basal conglomerate consists of cobbles of quartzite and quartz (Anderton 2004). This area of quartzite cobble erosion was a prominent source of raw lithic material for stone tool production for prehistoric inhabitants of Grand Island, discussed in further detail later in this chapter (Drake et al. 2009).

Post-Glacial Lake Levels

Throughout the Quaternary period, continental glacial advances and retreats had considerable impacts on the landscape, and influenced the areas chosen for human activity on Grand Island. Lake-level changes in the Upper Great Lakes (including the Lake Michigan, Huron and Superior basins) involved high ice marginal levels during glaciation. As the ice sheet covering the region began to retreat during the early Holocene, isostatically depressed low basins that had been pushed down and/or excavated by the incredible weight of advancing glaciers were revealed. Over time, the melt water from the ice sheet filled these basins forming glacial lakes. As the ice sheet continued to melt, the shape and size of these glacial lakes changed as the result of isostatic uplift and increasing ice melt. Retreating ice likely first exposed Grand Island between 13,000 and 12,700 cal BP. It is probable that a complex series of high glacial lake stages occurred as the ice retreated from the Upper Peninsula. Any evidence of these glacial lakes (i.e. shorelines) that were present on Grand Island was wiped out during the Marquette Advance (Anderton 2004; Drexler et al. 1983; Farrand and Drexler 1985).

The Marquette Advance glacial retreat marked the end of glaciation in the Upper Great Lakes, exposing Grand Island again around 11,200 cal. BP (Anderton 2004, Leverett and Taylor 1915). As ice retreated, a complex series of post-glacial lakes developed, created by dropping water levels as various drainage outlets were opened or gouged out by erosion. There are six post-glacial lake phases associated with Grand Island; Post-Duluth (11,200-11,100 cal. BP), Minong (10,700 cal. BP), Houghton (8900 cal. BP), Nipissing I (5400 cal. BP), Nipissing II (4450 cal. BP), and Post-Nipissing/Modern (post-4450 cal. BP) (Table 1) (Anderton 2004).

Table 1: Temporal periods of the Upper Great Lakes and the associated post-glacial lake phases (adapted from Anderton 1999:267).

Years BP	Temporal Period	Lake Phase
10,000-9,000	Late Paleoindian	Chippewa Low (Michigan and Huron Basins), Minong (Superior Basin).
10,000-8,000	Early Archaic	Rising Nipissing (Michigan and Huron Basins), Houghton Low (Superior Basin).
8,000-5,000	Middle Archaic	Rising Nipissing Levels (Michigan, Huron, and Superior Basins).
5,000-2,000	Late Archaic	Nipissing I, Nipissing II, Algoma, and post- Algoma highs (contiguous lake basins).
AD 1-600	Initial Woodland	Minor fluctuations caused by slight climate changes
AD 600-1,600	Terminal Woodland	Minor fluctuations caused by slight climate changes
AD 1,600- present	Historic	Minor fluctuations caused by slight climate changes

The earliest human habitation of the island dates to the Late Archaic (5000-2000 BC): *Gete Odena*, Popper, Duck Lake, 914, and Trout Point I all produced Late Archaic dates (Neubauer 2016). During this time, the water levels of the Great Lakes were considerably higher than they are today. These high-water levels separated the eastern and western lobes of the island at the time. Late Archaic habitation took place during the Nipissing Lake phase when lake elevation was approximately 186-192 meters above mean sea level (AMSL), which is about 3 meters above modern lake levels. Figure 3 shows the approximate extent of Glacial Lake Nipissing around the area of Muskrat Point. The Nipissing shoreline is the location of intense Late Archaic settlement, with the heaviest concentration of sites in Murray Bay at Williams Landing, Duck Lake, and Muskrat Point. This well-drained coastal shoreline offered an excellent area for occupation from as early as 5400 to 4450 cal. BP (Anderton 2004, Dunham and Anderton 1999).

It was not until the Post-Nipissing lake phase, around 4000 BP, that the western and eastern lobes of the island were connected by a beach ridge complex, also referred to as a Tombolo (see Figure 1) (Skibo et al. 2009). After 1200 cal. BP, the southern shore of Lake Superior began to gradually rise, flooding beach ridges along Murray Bay. A number of water-worn prehistoric artifacts have been found just below modern lake levels, making it evident that inhabitants of the island during this time had to relocate coastal sites further inland. The fluctuating coastal waters meant that Woodland and later groups along the shore of Grand Island had to adapt to lake levels by establishing habitation sites on older shoreline terraces instead of immediately bordering the modern lake shore (Anderton 2004).

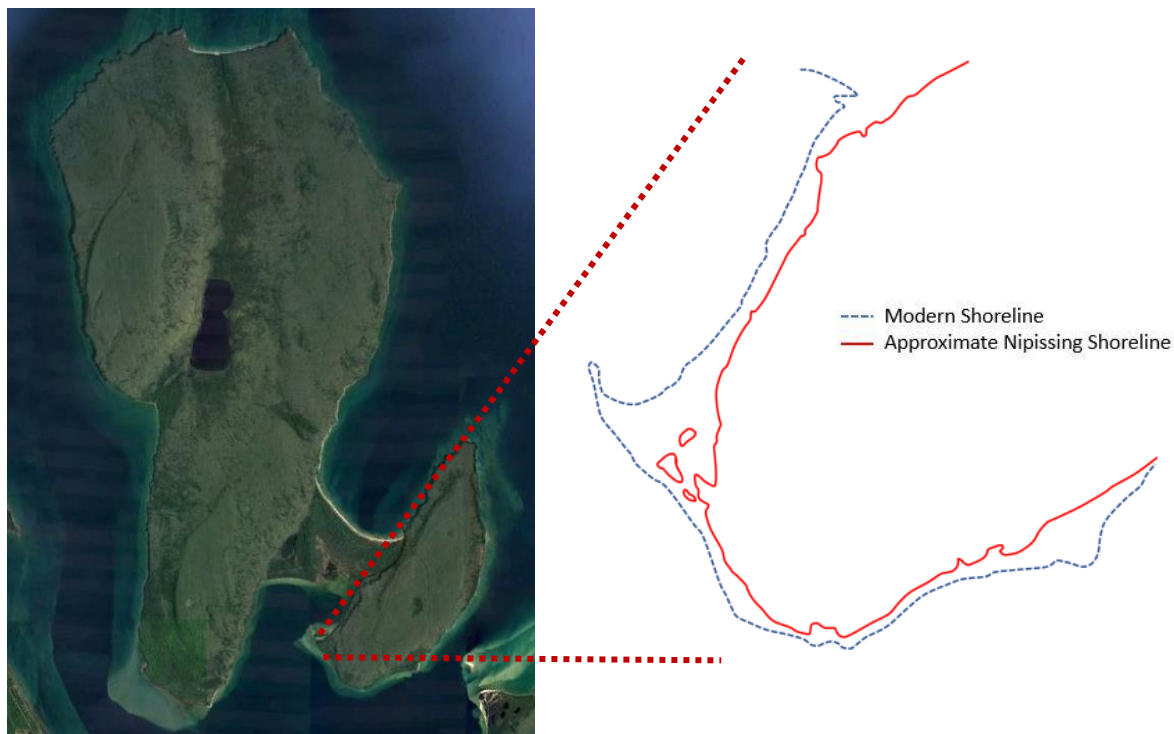


Figure 3: Approximate extent of Glacial Lake Nipissing (4500-4700 BP) around the area Muskrat Point. Satellite image on the left acquired from Google Earth Pro.

Environmental Setting

Grand Island became a hot spot for archaeological investigations after 1990 when it was placed under the management of the Hiawatha National Forest as a National Recreation Area (Dunham 2004; Franzen and Drake 2005). As of 2004, there were 169 known archaeological sites on the island (Dunham 2004:107).

Evidence of human occupation on Grand Island dates back to the Late Archaic period (5000-2000 BP). The Nipissing Maximum lake stage (5000-4500 BP), following the glacial retreat discussed above, would have submerged elevations lower than 192 m AMSL. This lake level rise made the coast of the island, and preferred location for Archaic activity, above that 192 m AMSL elevation mark. Modern land elevations on the island varies between 183 m at the shoreline and 300 m above AMSL at the highest northern portions of the island (Anderton 2004:114).

Climate

Presently, the Upper Peninsula is a cool and humid continental climate with long cold winters and short cool summers (Benchley et al. 1988). Lake Superior has a considerable influence on the climate of Grand Island because it maintains a low temperature, cooling the air temperature generating moderate summer temperatures. The island is also positioned in one of Michigan's lake-effect snow belts, with an average annual snowfall of 152 inches (U.S. Climate Data 2018). The deep off-shore waters of Lake Superior are almost a constant temperature of 4°C (39°F), with the winter ice surrounding the island lasting until May (Keen 1993).

The spring frost typically dissipates along the southern shore of Lake Superior between May 20 and June 10, cold temperatures returning in the first fall freeze between September 20

and October 1 (Janzen 1968). Under certain conditions, the consistent temperatures of Lake Superior also warms areas near the shoreline in the late fall/early winter, which can result in more frost-free days than interior areas. The summers on Grand Island are relatively cool and wet. The average high temperature in July is 23°C (74°F) and the average low is 13°C (56°F) (U.S. Climate Data 2018). The average rain fall is 38.39 inches, the peak of that occurring from August to October. The annual growing season in the northern Upper Peninsula varies between 90 to 150 days per year (Janzen 1968:12), however, the sandy acidic soils that make up Grand Island are not ideal for agriculture (Neubauer 2016).

Flora

Three biotic provinces are present in Michigan and the surrounding Great Lakes region: the Canadian, Carolinian, and Carolinian-Canadian transition zone between them. Biotic provinces are generally characterized by the occurrence of one or more important ecological associations that differ from the associations of neighboring provinces (Dice 1943:3). Except for a small portion in the southwest, the Upper Peninsula is primarily encompassed by the Canadian biotic province (Figure 4). The Canadian biotic province is composed of a vegetation environment of hardwood forests including some important subclimaxes of several varieties of coniferous forests with extensive stands of northern white pine and eastern hemlock with black spruce, tamarack, and northern white cedar developing in poorly drained areas (Dice 1943, Janzen 1968).

Glaciation between 13,000 and 9000 BP left the area covered in thick ice sheets that acted as a bulldozer to the spruce-fir forests that previously inhabited the Upper Peninsula, only tundra vegetation survived along the southern limits of the glacier (Dunham et al. 2000;

Neubauer 2016). Following the Marquette Glacial Advance (c. 9500 BP), vegetation on Grand Island would have started to re-colonize. Modern floral communities of the upper Midwest were already beginning to appear by 10,000 BP. Although there are similarities between these early post-glacial environments and modern flora, the landscape of the Upper Great Lakes at the time was still going through lake level fluctuations from isostatic rebound (Dunham et al. 2000; Silbernagel et al. 1998).

Regional pollen studies show that oak was present in the eastern Upper Peninsula by 11,000 years ago, peaking between 5,000 and 3,500 years ago (Dunham 2009; Futyma 1982). Pollen samples from north-central Upper Peninsula demonstrate a fluctuation through time in the dominating tree species. At approximately 8000 BP, spruce (genus *Picea*), red pine (*Pinus resinosa*), and jack pine (*Pinus banksiana*) were dominant. By 7000 BP elm (genus *Ulmus*), white pine (*Pinus strobus*), and white oak (*Quercus alba*) increased. This was followed by an increase in maples around 6000 BP, hemlock (genus *Tsuga*) by 4000 BP, and beech (genus *Fagus*) around 1000 BP (Ball 1993; Benchley et al. 1988). Today Grand Island is primarily wooded with dense hardwood forests on the higher elevations and coniferous forests at lower elevations (Anderton 2004).

Early Grand Island residents, as far back as the Late Archaic, would have had a variety of plant foods available to them. Maple sugar, nuts, berries, tubers, and various goosefoots (genus *Chenopodium*) are native to the area (Ball 1993; Neubauer 2016). Historically, there were also a number of plants that were utilized for purposes other than dietary sustenance. Around 325 native plant species were utilized by Native Americans in Upper Great Lakes region for uses such as: medicine making, as charms and ceremonial objects, color dyeing, smoking foods and fabrics, flavoring food and drinks, and other technological purposes (Ball 1993; Yarnell 1964).

Thirteen Late Woodland site components (twelve total sites) from the Upper Peninsula produced carbonized seeds, nutshells and/or nut meats. Of these remains, acorn has the highest occurrence at 46 percent. Followed by hazelnut and cherry occurring at 38.5 percent and other seed and nut remains at less than a quarter of the sites (Dunham 2014:75). Organic residue analysis conducted on several artifacts from two sites along Grand Island's Murray Bay indicates plant use on the island. Site 03-754, a multi-component site that was occupied from the Late Archaic through the Woodland period and site 03-929, a small Woodland period occupation. These artifact included: three Late Archaic period FCR and six Woodland pottery sherds. The fatty acids (lipids) extracted from both the FCR and pottery sherds showed high levels of fats from locally sourced nut oils, likely to be acorn (Skibo et al. 2009). These data demonstrate that acorns were a locally utilized food that was processed on the island during the Late Archaic and Woodland periods. Lipid residue analysis from two southern Lake Superior shore sites, Sand Point in the western Upper Peninsula and Naomikong Point site in the eastern Upper Peninsula, shows that animal products and low fat contents plants, such as roots, greens and berries, were cooked in Woodland period ceramic vessels (Kooiman 2012:188).

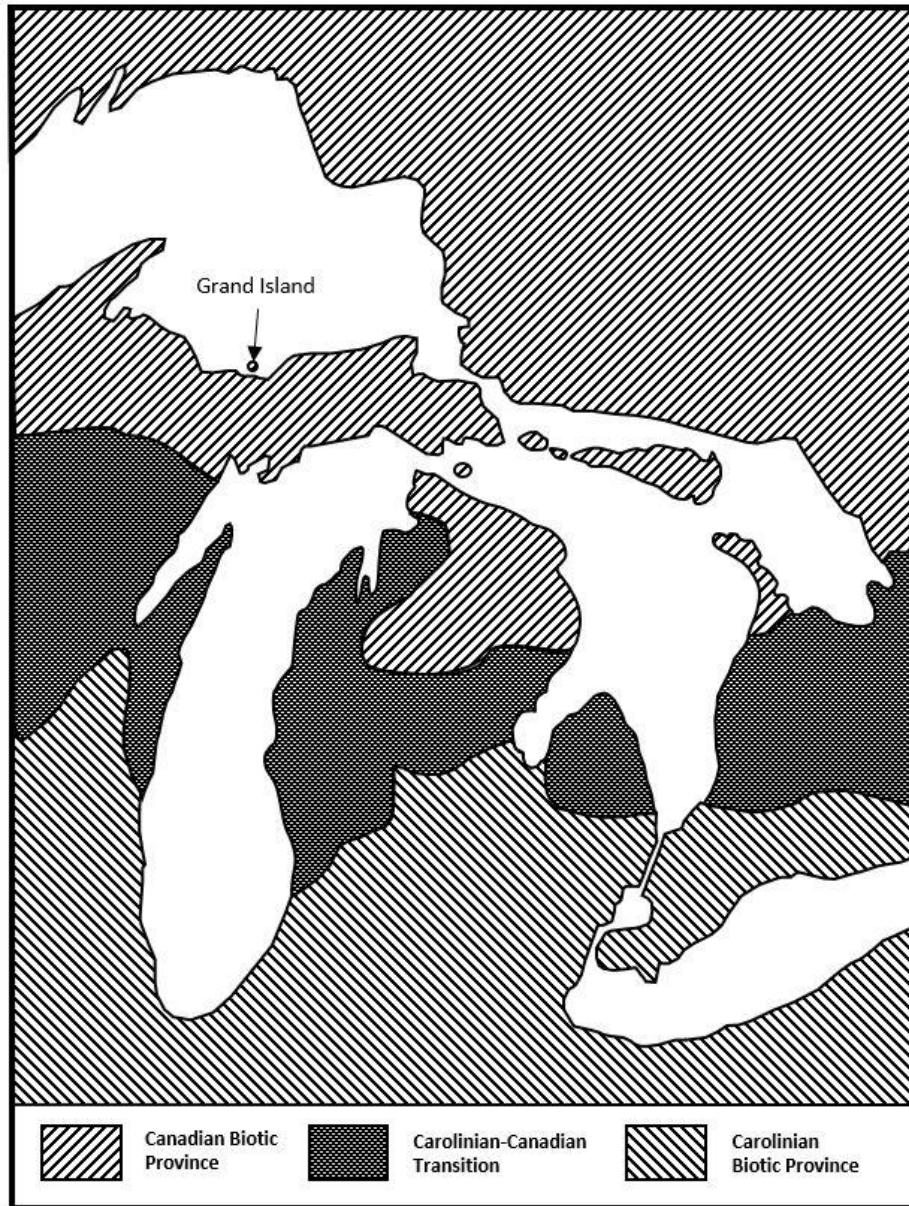


Figure 4: Modern biotic provinces of the Great Lakes region (adapted from Fitting and Cleland 1969:290).

Fauna

The environment of the Canadian Biotic Province has extreme seasonal and geographic (coastal vs. interior) variability. The extreme seasonality of the Upper Great Lakes drives peak plant and animal resource episodes into very defined and predictable cycles. Hunting would have

constituted an important source of subsistence. Megafauna species that could tolerate the extreme cold conditions near glaciers could have migrated to the Upper Great Lakes quickly following the glacial retreat, but none of these massive animal remains have yet to be found in the Upper Peninsula of Michigan. The northern limit of mammoths and mastodons in Michigan has been referred to as the “Mason-Quimby Line” (Skeels 1962), named after two well-known archaeologists, R. J. Mason and G. I. Quimby, who first mapped these northern most proboscidean remains in central lower Michigan. Apart from mastodons and mammoths, the remains of giant moose and giant beaver have also been found in the Upper Great Lakes dated to 14,000 to 11,000 BP (Cleland 1966:15).

By inferring from faunal species of present-day spruce-fir environments, it is possible to speculate about the other species of fauna that occupied the region. These include: caribou, black bear, fisher, marten, lynx, muskrat, snowshoe hare, along with modern species of moose and beaver (Burt and Grossenheider 1964; Neubauer 2016). Additionally, migratory patterns and habitats of these animals are fairly predictable (Holman and Lovis 2008:288). Aquatic birds such as gulls, loons, terns, mergansers, and various duck species (Janzen 1968), along with many important species of Great Lakes fish such as sturgeon, lake-trout, and whitefish would have been widely available as faunal resources to humans populating the area (Benchley et al. 1988).

Faunal remains have been recovered from 43 Late Woodland sites in the eastern Upper Peninsula, 27 of which produced identifiable remains including mammals, fish, birds, reptiles, and several mollusks and gastropods. Whitetail deer, sturgeon, and beaver are well represented, along with fall-spawning lake trout and whitefish, and spring-spawning walleye, sucker, and pike. The number of recovered and identifiable remains is highly dependent on the scale of

excavations, recovery technique, and technomic factors relating to preservation (Dunham 2014).

Table 2: Fish caloric content (Bowes 1985; Cleland 1982; Needs-Howarth 1991).

Fish Species	Season of Spawn	Kcal/100 gm raw
<i>Salvelinus namaycush</i> (lake trout)	Fall	241 (< 3 kg); 524 (> 3 kg)
<i>Coregonus artedi</i> (lake herring)	Fall	155
<i>Coregonus clupeaformis</i> (lake whitefish)	Fall	96
<i>Acipenser fulvescens</i> (lake sturgeon)	Spring	94
<i>Catostomus commersoni</i> (white sucker)	Spring	104
<i>Esox lucius</i> (northern pike)	Spring	88
<i>Esox masquinongy</i> (muskie)	Spring	109
<i>Ameiurus melas</i> (black bullhead)	Spring	84
<i>Micropterus</i> sp. (black bass)	Spring	104
<i>Perca flavescens</i> (yellow perch)	Spring	91
<i>Stizostedion vitreum</i> (yellow walleye)	Spring	93

The coastal waters of the Great Lakes along with inland rivers, streams, and lakes are reliable areas to fish during spawning periods in the late spring and early fall. Fish represent a nutritionally dense food supply that can be easily preserved and transported for use in the winter when other food resources are scarce (Holman and Lovis 2008:287). Lake Superior is an oligotrophic lake, meaning it is so cold and deep it has relatively low fish productivity as a result of low nutrient content. These lakes are characterized as having low algae production and often have clear, high quality drinking water. Lake Superior is also the largest of the Great Lakes and the fish are very dispersed during most seasons of the year. During the fall, the lake is stormy and difficult to travel and is ice-covered up to three or four months a year. However, there are

several features of Lake Superior that make it an extremely productive fishery. During breeding cycles of many species, fish make their way towards shallow shore waters to spawn during either the spring or fall. At this time there is an almost unlimited supply of fish.

The exact time of the spring and fall spawn and fish populations naturally fluctuate from year to year. These factors are determined by seasonally fluctuating conditions such as weather, water temperature, and lake bottom environment. Figure 5 is a diagram originally constructed by Cleland (1982) to show the relative amount of fish in coastal water by month. Fall-spawning fish species have higher nutritional values than spring-spawning species, making them the more nutrient dense of the two. Fall-spawning fish species produces 600 to 800 calories per pound of raw fish while spring-spawning fish produce 350 to 450. There are, however, more Great Lakes fish species that spawn in the spring than the fall, making volume and diversity an advantage in the spring. Table 2 shows the caloric values of common Lake Superior fish species.

Following ice breakup in open water during mid-April to early May, spring-spawning species start approaching shallow waters near lake shores or move up rivers and streams to spawn. Lake sturgeon (*Acipenser fulvescens*), northern channel catfish (*Ictalurus punctatus*), black bullhead (*Ictalurus melas*), brown bullhead (*Ictalurus nebulosus*), yellow perch (*Perca flavescens*), yellow walleye (*Stizostedion vitreum*), northern pike (*Esox Lucius*), and numerous members of the bass family (*Serranidae*) were the primary spring-spawning species used in prehistoric Native American fish economy. White sucker, abundant in large numbers, and lake sturgeon, known for its large size (up to 300 pounds), were the most valuable of these species. Suckers go up clear shallow streams or spawn in shallow bays and sturgeon spawn along shallow-water shoals or swim up large streams for spawning.

During late November to December, fall-spawning Salmonidae fish species, including lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), round whitefish (*Prosopium cylindraceum*), and lake herring (*Coregonus artedii*), spawn on shallow-water gravel shoals and reefs. Fall-spawning fish start appearing at spawning locations around late September

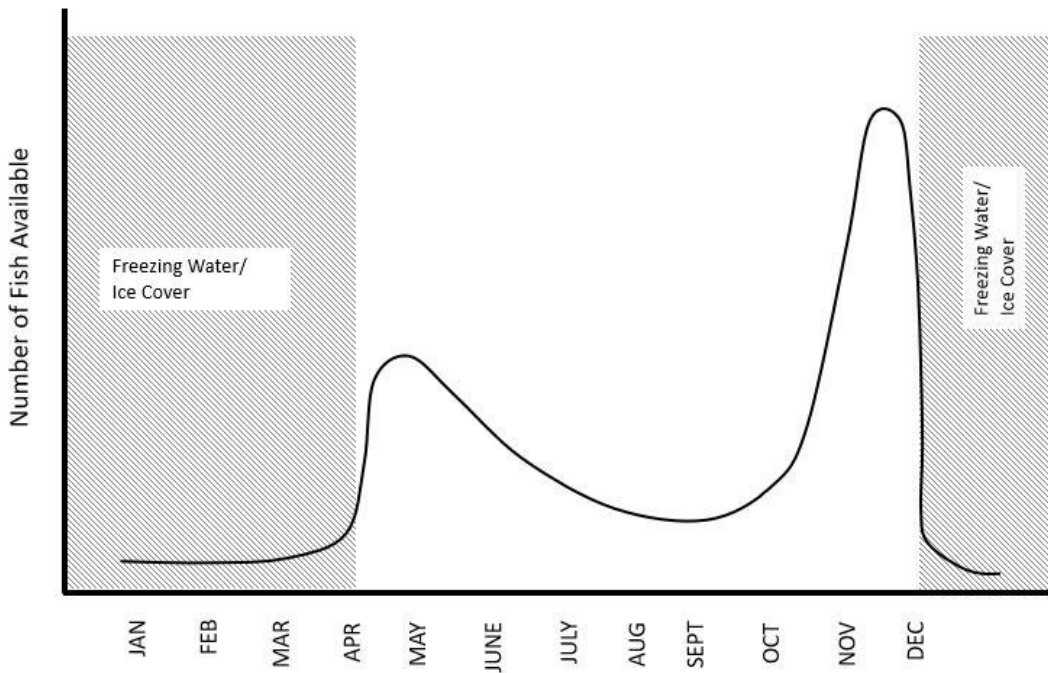


Figure 5: Estimated reconstruction of the relative amount of fish in the Upper Great Lakes by season (adapted from Cleland 1982:767).

or early October, and areas grow in productivity until extreme cold-water temperatures or ice drive fish away in mid-December. However, whitefish spawn when the temperature of the water is near freezing (0.5 - 0.6° C), laying eggs that develop over winter and hatch the following spring (Cleland 1982; Hubbs and Lagler 1958; Lawler 1965).

Lithic Raw Material Availability on Grand Island

Archaic and Woodland inhabitants of Grand Island had access to a considerable amount of lithic materials. Long-term erosion of the basal conglomerate, mentioned previously, has

distributed extensive quantities of cobbles and pebbles along the eastern beaches of Grand Island. The three most prevalent cobbles and pebbles derived from the conglomerate are quartzite, quartz, and chert. Quartzite comprises over 80%, quartz comprises 15%-60%, and chert constitutes 0%-20% of the basal conglomerate (Drake et al. 2009). Few chert pebbles have been found on the island, but extensive amounts of flakes, cores, and tools produced from a wide variety of local chert types (Drake et al. 2009, Drake and Dunham 2004) have been found. Regional exchange networks along with seasonal mobility gave inhabitants of Grand Island access to diverse chert types from the mainland derived from outcrops throughout Michigan and possibly as far away as upstate New York (Onondaga chert) (Drake et al. 2009).

Not all stone can be used productively in making chipped stone tools. Several qualities are needed to make it a practical, workable material. Stones that break in a predictable way and produce sharp edges are ideal. These stones are brittle and do not have directional-dependent properties, such as impurities or bending planes, that cause fractures to occur in irregular ways (Andrefsky 2005). Chert is a sedimentary rock composed almost entirely of fine-grained microcrystalline or cryptocrystalline silica (Dalrymple 1994). This hard, fine-grained rock allows stone-knappers to have great control over reduction. Breaking with a conchoidal fracture (Andrefsky 2005) and producing very sharp edges, this is one of the most common rock types used for stone tool production in North America.

Quartz, a silicon dioxide (SiO_2), is the most common mineral on earth and is a substantial component of many igneous, sedimentary, and metamorphic rocks forming the earth's crust (Driscoll 2011; Mallo 2016). A hard but brittle mineral, quartz is suitable for manufacturing stone tools. Quartz manifests conchoidal fracturing properties, typically not exhibiting cleavage, leaving the fracture surface with a curved shape (Driscoll 2011). However,

the fracturing properties of quartz make it a difficult material to knap (Andrefsky 2005). Yet, this did not deter prehistoric occupants of Grand Island for utilizing it, even when sources of chert and flint were nearby.

Quartzite was originally pure quartz sandstone, which was converted into quartzite through tectonic compression and heat. As the quartz sandstone is going through this conversion, the quartz grains (sand grains), along with former cementing material, recrystallize to form an interlocking mosaic of quartz crystals (Dalrymple 1994). This metamorphism converts sandstone, a rock that tends to crumble when struck, into a hard, non-foliated metamorphic rock. Depending on the sand grain size, some quartzites have invisibly small particles while in others individual particles can be clearly seen. The smaller grained quartzites fracture with more control making it easier for knapping (Andrefsky 2005). Although quartzite is the most common cobble produced by the conglomerate and is easier to knap than quartz, it was not always the preferred stone used by inhabitants of Grand Island. Even chert, the preferred stone used for tool producing throughout North American, was not always the favored stone on Grand Island.

Archaeologists working on the Island have noticed several puzzling temporal trends or raw material use by the island's prehistoric occupants (Drake et al. 2009; Dunham and Anderton 1999; Franzen 1998). Researching 16 coastal sites in the Hiawatha National Forest, Franzen (1998) discovered that in sites located at elevations above 188 meters AMSL had lithic assemblages dominated by quartzite/quartz debitage, less than eight percent of the assemblage being chert. Sites located between 185 and 187 meters AMSL had considerable amounts of chert debitage, accounting for 26 to 65 percent of the assemblage (Franzen 1998). Both quartzite and quartz, however, were readily available at post-Nipissing (post-2250 cal. BP) beach terraces, and chert, widely available in the surrounding regions, would have been easily available to Archaic

inhabitants residing at higher elevations. The results of Franzen's study prove that it is unlikely that patterns of increased use of chert over time was due to changes in raw material availability resulting from fluctuating lake levels. Consequently, the elevation, along with fluctuating lake levels during the post-Nipissing period, could not be the sole reason for this pattern in resource use.

Franzen's study drew the attention of several archaeologists working in the region (Drake et al. 2009; Dunham and Anderton 1999). Dunham and Anderton (1999) expanded upon the chronological portion of the study by drawing upon four additional Archaic period sites to add the Grand Island/Munising Bay regional contextualization of chronological trends in lithic raw material use. These four sites consisted of: the Popper site on Grand Island (radiocarbon dates of 4260 ± 50 BP and 4100 ± 60 BP), along with three Late Archaic sites from the mainland of Munising all containing Late Archaic components that are at least 1,000 younger than the Popper site. The results of this study revealed that all three of the younger mainland sites had similar raw material composition along with similar frequencies of raw material use. This research further demonstrated that developing a chronological model based on raw material preference had the potential to facilitate relative dating of coastal archaeological sites in this region (Drake et al. 2009).

In 2009, researchers Drake, Franzen, and Skibo set out to refine the chronological understanding of lithic use in the Munising Bay area by establishing an age-based model that compares frequencies of quartzite, quartz, and chert in assemblages that are well-dated using radiocarbon dates and/or diagnostic artifacts. Relative proportions of quartzite, quartz, and chert debitage were recalculated from each of the 16 coastal sites examined by Franzen (1998), along with debitage counts from six additional sites, totaling a sample size of 22 sites. Each site was

assigned to one or four broadly defined chronological categories: Archaic, Woodland, multi-component, or unknown. Using a ternary diagram, the relative proportions of quartzite, quartz, and chert debitage from each site were compared. Results from this study suggest that quartz was used extensively as a raw material for chipped-stone tool production during the Woodland period. Assemblages with 70 percent or more quartzite tend to represent sites older than those with 30 percent or less. These thresholds of 70 and 30 percent serve as indicators of the Late Archaic and Woodland periods respectively. Site assemblages with proportional quartzite frequencies between 70 and 30 percent tend to be multi-component (Drake et al. 2009). Furthermore, this study shows that relative proportions of quartzite debitage provides the best indicator for the relative age of archaeological sites in the Munising Bay area.

Cultural Background

Throughout North American archaeology, human occupations have been divided into a number of widely recognized temporal periods. These temporal periods are broadly categorized as: Paleoindian, Early Archaic, Middle Archaic, Late Archaic, Early Woodland, Middle Woodland, Late Woodland, and Historical. This study investigates Woodland period pit features with inferences drawn from historic accounts of pit use. Accordingly, this section will highlight the Historic and Woodland period cultural history of Grand Island and the Upper Great Lakes. This is followed by an overview of settlement and subsistence studies done in the Upper Great Lakes to explore how Woodland period peoples of the region lived.

Historic Period of Grand Island: Early Euro-American Accounts

Grand Island provides a variety of flora and fauna among other natural resources such as pebbles for stone tool production. Therefore, it is no surprise that the earliest Euro-American settlers chose the island for building trading posts and establishing residency (Dunham and Branstner 1995; Franzen 2004). Henry Rowe Schoolcraft was an Indian agent stationed at Sault Ste. Marie approximately, 140 miles east of Grand Island, during the early historic era. From 1822 to 1841 Schoolcraft documented oral histories from the Native Americans who visited the trading post. Schoolcraft was married to Jane Johnstone, the daughter of John Johnstone, who was one of the most active traders in Lake Superior. Jane's mother was an Ojibwe (Anishinabeg) women named *Ozhow-Guscody-Wayquary*, or Women-of-the-Green-Valley (Cleland 1992). This affinity gave Schoolcraft the means to engage with local Native Americans and record stories of their ceremonies, music, and history (Mason 1997; Skibo et al. 2007).

Schoolcraft came to the Lake Superior area in 1820 when he was asked to join the Cass Expedition. Named after Governor Lewis Cass, the superintendent of Indian Affairs in Michigan Territory, the Cass Expedition was organized to explore the southern shore of Lake Superior. Schoolcraft was asked to join the expedition as a geologist and mineralogist. In 1821, he published a detailed account of the minerals, landscapes, and narrations of Native Americans he encountered during the expedition titled *Native Journal of Travels* (Castle 1974; Schoolcraft 1821; Williams 1992). On June 18, 1820, the company left Sault Ste. Marie and traveled west along the southern shore of Lake Superior, reaching the sculpted sandstone cliffs of Pictured Rocks National Lakeshore by June 21. The group continued west moving towards Grand Island and set up camp "in a large, deep, and beautiful bay, completely land-locked" (Williams 1992:109, 415-416), the area now called Murray Bay.

Schoolcraft writes, “here we found a village of Chippeway Indians, who, as soon as we landed, came from their lodges to bid us welcome” (Williams 1992: 109). That night the company was given a warm welcome and invited to witness Chippewa dancing, singing, and storytelling. Apart from this night, Schoolcraft does not say anything else about Grand Island during the Cass expedition. He does however, on occasion, mention the Grand Island band of Native Americans in other reports he wrote on the area. In 1822 he reports that 46 Native Americans were residing on the island (Schoolcraft 1851: 102); in 1836 he wrote that the Grand Island band had 62 members; and in 1939 there were 59 reported members (seven men, eight women, and 44 children) (Schoolcraft 1953; Skibo et al. 2007). At the end of July in 1826, the Cass expedition revisited Grand Island in a journey that was recorded by Thomas McKenny, a member of the Indian Department who was accompanying the party. McKenny believed the party visited the same location of the original Cass expedition camp along Murray Bay. McKenny wrote that the group found an abandoned Ojibwe camp (McKenney 1959).

McKenney’s friend, Chandler Robins Gilman, visited the location again in 1935, noting his company “found ourselves in the midst of a deserted Indian village” (Gilman 1836: 55). Gilman went to Grand Island expecting an Indian trader. Instead Gilman found a deserted village with only the remains of Native American fish drying activity. McKenney writes, “near our tent I found the frame of a large lodge, and just back of it, the kind of frame on which the Indians dry their fish. It is built over a square hole in the ground, of about six feet by three, where the fire is built” (McKenney 1959:362).

Although the reports of these early Euro-American explorations into Lake Superior are basic and lack great detail, they do give us important information about the native groups of Grand Island and the surrounding area during the period from 1820 to 1840. We know that the

relatively small groups, in numbers ranging from 46 to 62 people, inhabited the island. We also know that the villages were abandoned at certain times, occasionally leaving the area with still-standing structures. This data supports the notion that historic and prehistoric peoples of this region had flexible settlement patterns (Martin 1989, 1999). Grand Island would have been occupied during the spring and fall but not necessarily on a regular basis. As these early reports demonstrate, Grand Island was clearly occupied on a seasonal basis, and not every year. The area of Murray Bay was a popular location for historic Native American settlement, and archeological evidence supports this favorability throughout the prehistoric period (Dunham and Anderton 1999; Dunham and Branstner 1995; Skibo et al. 2004).

Abraham Warren Williams (1792-1873) was the first permanent white Euro-American resident on Grand Island. Williams came to the island in 1840 and built his house next to the same historic Ojibwe settlement mentioned above. William kept no journal of his time on the island and much of what is known about his life and influence on the island comes from Beatrice Hanscom Castle who in 1906 interviewed Abraham's daughter, Mrs. Trueman Walker Powell, formally Anne Marie Williams. According to Mrs. Powell, the Williams family was invited to the island by the Ojibwe chief *Omonomonee*. Powell describes the Ojibwe living on the island at this time as summer residents, moving to the mainland during the winter (Castle 1974: 32). Although Williams was a jack-of-all-trades: a blacksmith, cooper, carpenter, farmer, and fisherman, he was most notably a trader. Williams was active in the fur trade and was even successful in taking business away from the Lake Superior American Fur Company trading outpost. Williams also purchased from and traded with the local Ojibwe for fish. During the 1850s Williams secured hundreds of barrels of fish each season, each barrel containing around 200 pounds of fish (Roberts 1991:102).

General Overview of the Woodland Period in the Upper Peninsula

The Early Woodland time period in the Midwestern United States is typically marked by the adoption and intensification of pottery use. Differing slightly from the traditional temporal categorizations mentioned in the introduction to this section, the classifications for the Woodland Period in the Upper Great Lakes region are subdivided into just two periods, Initial (ca. AD 0 – AD 600) and Terminal Woodland (ca. AD 600 – AD 1600). This distinction is made because of the later adoption of ceramic technology across the Upper Peninsula and northern Lower Peninsula of Michigan (Brashler et al. 2000; Brose and Hambacher 1999; Drake and Dunham 2004; Fitting 1975; Mason 1981).

Throughout much of the Upper Great Lakes region, Woodland period (ca. 0 – AD 1600) populations implemented seasonally based subsistence economy including hunting, collecting, horticulture, and an intensification of seasonal aquatic resource exploitation (Brashler et al. 2000; Cleland 1982; Drake and Dunham 2004; Dunham 2004; Fitting 1975). The subsistence regimes and settlement patterns also differentiate these northern cultures apart from archaeological complexes in southern Michigan, which engaged in Hopewellian influenced agricultural practices and traditions (Brose and Hambacher 1999; Fitting 1975). The extreme seasonal diversity in resource availability of these northern climates required Woodland groups to be flexible and readily adaptive to their environment.

Shifting Settlement and Subsistence Patterns During the Initial To Late Woodland

The Chippewa Pattern - an Oversimplification

Fitting and Cleland (1969) proposed an ethnohistory-based settlement model for prehistoric sites in the Hiawatha National Forest area. This model was largely based on the historical narrative of Alexander Henry (Quimby 1962), a Euro-American explorer and trader around Michilimackinac and Lake Superior. Henry documented accounts of the seasonal movements of a Chippewa family during the 1760's, a narrative that suggests that late prehistoric village sites include summer through fall fishing villages near lake shores made up of extensive multi-family groups and smaller winter and early spring sites in interior areas (Franzen 1986), this very general model has been termed the "Chippewa Pattern." Fitting and Cleland (1969) believe the Chippewa Pattern can be extended back into the early Late Woodland period.

Susan Martin (1977) conducted a major settlement pattern study during the initial cultural resource management efforts in the Hiawatha National Forest. This study was not structured to test the Chippewa Pattern, however it consisted of a detailed analysis of the environmental settings of previously identified prehistoric archaeological sites located along the shores of the Upper Great Lakes. Martin extended this initial analysis by performing a representative sample survey of areas within the Hiawatha National Forest that had similar environmental settings at these known sites. Tests of this preliminary model located no prehistoric sites. This study demonstrates that there is a low density of archaeological sites relative to the size of the Hiawatha National Forest. It also suggests that broad-strata sampling schemes are not suitable for this kind of predictive model testing, demonstrating a need to focus on more specific micro-environments where sites are more likely to be located (Franzen 1986).

Since Martin's study (1977), there have been a number of sites found on inland lakes and streams within the Hiawatha National Forest (Dunham 2014; Franzen 1986; Martin 1999). There were also Woodland period sites found adjacent to the study area that have characteristics of warm season fishing villages, like those modeled by the Chippewa Pattern (Brose 1970; Martin 1980, 1982). There are also several proposed examples of cold season interior settlements discussed by Fitting and Cleland (1969): Pic River, Michipicoten, and Shebishikong sites (Wright 1965), however, there is little information provided to support this hypothesis (Franzen 1986).

In 1978, Margaret Holman completed her Ph.D. dissertation "The Settlement System of the Mackinac Phase," as detailed analysis of the Chippewa Pattern using data from the northern Lower Peninsula of Michigan. Based on a catchment analyses, she tested the following hypotheses for the Early Late Woodland Mackinac Phase: 1.) sites found in the interior will be high in winter resource potential, 2.) sites found on the coast will be high in late fall resource potential, 3.) sites found on the coast will be high in summer resource potential, 4.) sites found in the interior will be high in early spring resource potential (Holman 1978:42). High winter resource potential for interior site catchments, and high summer and late fall resource potential for coastal site catchments was proven. However, summer and late fall resource potential was also high at interior site locales and early spring resource potential as high ubiquitously (Holman 1978:153-155). Although this research confirmed high winter resource potential at interior site locations and high warm season resource potential at coastal sites, this does not rule out the possibility of alternative warm season and early spring settlement and mobility patterns (Holman 1978:155).

Settlement Patterning for Flexible Hunter-Gatherer Groups – Something Fishy is Going On

Contradicting the rigidity of prehistoric Native American group movement outlined by the Chippewa Pattern, a more flexible settlement-subsistence pattern is expected for Woodland period groups living in the dynamic environments and resource fluctuations of the Upper Great Lakes. In fact, the word “pattern” may be unrealistic terminology for trying to describe the way these groups lived. However, models are simplifications of complex observations.

Archaeological models serve to provide a structure for answering the questions of “how and why archaeological materials are differentially distributed across the landscape” (Franzen 1986:6). A productive model can help guide survey and excavation along with the analysis and interpretations of data collected. Franzen (1986, 1987) reconsidered settlement patterns of the central Upper Peninsula using ethnohistoric, ethnographic, and environmental data, instead of focusing entirely on locational characteristics. A verbal/descriptive method was used by Franzen to develop a preliminary model allowing for more flexibility in settlement interpretation.

Ethnographic work done among subarctic groups cited flexibility in settlement and subsistence patterns during times of food scarcity. Site locations were chosen based on not only resource availability, but also other considerations such as distance to travel routes. Storable food is valuable and can draw the attention of groups towards the locations where storable food is available. However, there have been ethnohistoric accounts of starvation, indicating that stored food was not always reliable. While these groups may have been more than capable of processing and storage of small surplus, it is possible that internal socio-culture factors were significant enough to outweigh any potential for increase of storable foods. Effective processing and storage favors the organization, group structure, and centralized control of static groups (Schalk 1977:235-237). This type of static organization may hinder the type of organization

required for exploiting other resources during time of scarcity when flexibility and mobility are valuable (Franzen 1986:45-46).

From the available data, some broad predictions about site distribution were made for the area. This model suggests the use of winter interior swamp/conifers sites for hunting white-tailed deer and fire-disturbed habitats populated by moose and beaver. Winter groups are expected to be made up of two or three nuclear families or 12-30 individuals (Franzen 1986; Rogers 1983:98). These winter resources were supplemented using Great Lakes shorelines for procuring spring and fall-spawning fish species. Warm season sites located at productive fishing shores are expected to be made up of larger groups, although smaller groups could have engaged in small scale fishing activities such as sturgeon spearing. The use of water features for transportation and fishing would be a major draw for groups of the area. This draw resulting in a tendency for settlements to be located closest to the “most dense and least mobile resources” (Franzen 1986:50) near coastal area and rivers with sizeable spawning runs. The practicality of limiting the amount of travel between spring and fall fishing areas may lead to winter settlement being located closer to coastal areas and major rivers (Franzen 1986:50).

Although Franzen (1986) focused his subsistence/settlement model on a more descriptive and flexible basis, the model’s foundation is the intense harvest, creation of surplus, and consequent storage of spring and fall-spawning fish. In 2014 Sean Dunham revisited the debate surrounding Late Woodland settlement and subsistence patterns arguing for a subsistence practice that utilized a suite of potential resources instead of a single primary resource. This research focuses on the eastern Upper Peninsula of Michigan, representing the entire sample of all known Late Woodland sites, 81 sites in total, 49 of which are in the Hiawatha National Forest. A spatial analysis of these Late Woodland site locations, resource distributions, and

configuration of site assemblages was studied to establish what relationships can be found between resources and site locations (Dunham 2014).

By creating a diversity use index (DUI), resource attributes of Late Woodland sites in the eastern Upper Peninsula were considered and compared. A Late Woodland predictive model (LWPM) was also created to demonstrate the relationship between specific environmental variables (distance to water, habitat, and proximity to wild rice patches) and the location of Late Woodland sites. This research supports the hypothesis that Late Woodland site locations were used for the exploitation of fish as well as the potential use of a wide variety of plant and animal resources. There is clearly an emphasis on spring and fall-spawning fish in the diet of Late Woodland people in the eastern Upper Peninsula, but the evidence also suggests a supplementation of highly productive food resources such as wild rice, acorns, and large game into the subsistence and settlement system (Dunham 2014). The procurement of wild rice and acorns fits within the seasonal subsistence rounds suggested by previous scholars, fitting in with the scheduling of fall spawn fishing (Cleland 1968, 1982; Dunham 2014; Holman 1978; Fitting 1969; Franzen 1986; Martin 1977, 1985; Smith 2004). The inclusion of these resources into the Late Woodland diet offers a reliable buffer against a possible failure of the fall fishery. Furthermore, the synthesis of interior resources, such as wild rice, and coastal resources, such as acorns and fish, may have provided a convenient opportunity to gather, process, and store resources for winter consumption (Dunham 2014:191).

Storage is a critical component to this interpretation. Mobile groups who have access to aggregated resources and have the ability to store surplus are able to extend the use-life of that acquired resource. In Dunham's study, sites associated with limited and intermediate diversity levels are interpreted as representing logistical camps, where people gathered to exploit a

specific resource such as fish. These logistical camps are where the resources were collected and presumably where initial processing took place. These resources were likely stored at residential camps, logistical camps, or at discrete locations away from camps (Dunham 2014). There is evidence of Late Woodland caching in storage pits in northern lower Michigan (described in the next chapter). Furthermore, regional ceramic trends show a great deal of similarity in early Late Woodland becoming more diverse in the later Late Woodland, likely reflecting greater social integration and greater inter- and intra-group social networks functioning as risk buffering methods. A shift towards the harvest of deep-water fall fish in the Upper Great Lakes region and a greater use of the interior during the winter could indicate a restructuring of settlement and subsistence patterns in response to more dynamic variations in lake level fluctuations during the Medieval Climatic Optimum (after AD 900) (Anderton 2004; Dunham 2014; Lovis et al. 2012).

Importance of Fish and Netting Technology in The Woodland Period in the Great Lakes

There is a shift in settlement and subsistence patterns during the Late Woodland that suggest seasonal hunting, collecting, and fishing emphasizing harvesting deep-water fall species (Brose and Hambacher 1999; Cleland 1966, 1982; Drake and Dunham 2004). The Initial Woodland components of Summer Island (Brose 1970), Winter (Martin 1980; Richner 1973), and Naomikong Point (Jenzen 1968) have been interpreted as being warm-season fishing villages where spears, hook-and-line, and seines were used to harvest sturgeon and sucker (Cleland 1982; Drake and Dunham 2004; Dunham 2002). The Terminal Woodland of the Upper Great Lakes is characterized by a series of regional adaptations to the unique local environment. Woodland people continue using a diverse subsistence economy that is flexible for extreme seasonal changes. There is a shift in settlement patterns towards the formation of large, seasonal

aggregation sites located at productive resource procurement locations, thought by Cleland (1982) to be extended family groups aggregated at fall-spawning fish locales.

Fish are a valuable source of protein, vitamins, and minerals, but lack the carbohydrates found in berries, nuts, cereal grains, and fruit (Cleland 1982). Fishing has been recognized as an important subsistence strategy in the Upper Great Lakes during the Middle Woodland through the Late Woodland periods. In 1982, Charles E. Cleland published an influential essay entitled “The Inland Shores fishery of the Northern Great Lakes: Its Development and Importance in Prehistory,” which introduces a macroscale evolutionary model of technical changes in fishing strategies from the Late Archaic through the Late Woodland periods (Cleland 1982; Smith 2004). In this model, the Late Woodland period brought a significant change in settlement pattern and social relations, largely owing to the development of the gill net used in the mass capture of fall-spawning fish species. The gill net is a mass fishing technology that uses a single netting wall kept vertical by a float line along the top and a ground line held down by net sinkers. As the fish swims into the net it becomes stuck in the mesh, when the fish tries to swim backwards to escape its gills become stuck in the netting. Therefore, the size of the mesh determines the size of the fish that will become entangled in it. If the fish is too small it will be able to swim through the holes of the netting, and if it is too big it will simply bounce off. In Cleland’s model, this mass fishing technology provided large amounts of storable food, which supported population growth from the Initial Woodland (AD 0–600) to the Terminal Woodland (ca. AD 600–1600) inspiring new forms of work organization in order to meet the labor demands of intensified fishing specific to the fall-spawn (Cleland 1982, 1989; Drake and Dunham 2004). These changes led to larger populations, stronger delineations of group identity and boundaries, and increased exchange of ideas across the region.

Susan Martin (1989), criticized Cleland's model arguing that there was more of a continuation in subsistence strategies and use of coastal locales throughout the Woodland period in the Upper Great Lakes. Martin analyzed the specifics of site location data and conducted statistical analysis on environmental variables at Middle and Late Woodland sites in the Upper Great Lakes region. Martin found little evidence to support Cleland's model, noting that sites belonging to both time periods are located near both spring and fall-spawning fish habitats. This lack of substantial change in site location goes against Cleland's idea of a sudden appearance of the gill net followed by significant change in settlement pattern and social relations in the Terminal Woodland (Martin 1985, 1989).

Beverley Smith (2004) draws attention to several critical errors in the assumptions made by both models. First, the mere presence of any salmonid fish remains, a fall-spawning fish, does not definitely prove that the peoples inhabiting the sites were using gill nets. There are ethnohistoric accounts from all over the Upper Great Lakes region demonstrating Native American's using spears, harpoons, hook-and-line, along with other types of nets, including the seine and dip nets, to capture these types of fish. Second, the presence of net sinkers is not incontrovertible evidence of gill nets. Seine nets also used net sinkers. Unlike the gill net, seines are typically made of a finer mesh netting used to corral fish towards the shore where they were scooped up (Cleland 1982). Seine nets were commonly used to catch spring-spawning fish such as suckers. Furthermore, unless net sinkers are recovered from archaeological sites with side notches still present it is hard to differentiate them from a common smooth rock (Smith 2004).

In addition to these assumptions, Smith (2004) argues that both models do not produce satisfactory evidence because they both fail to present a systematic review of the actual empirical evidence of fish remains in any archaeological sites they consider. In her article, Smith

reconsiders both sides of the gill net argument through a comprehensive analysis of fish remains at 24 Woodland period sites in the northern Lake Michigan basin. Smith concludes that the Mackinac phase (AD 800-1100) of the Juntunen site is the earliest example of an archaeological site showing enough evidence to support the use of nets for mass capture of fall-spawning fish.

The fish remains found here, during the Mackinac phase through the Bois Blanc phase (AD 1100-1250) to the Juntunen phase (AD 1250-1450), are relatively diverse in species and size. There were 18 different types of fish identified, making up 80 to 99 percent of the total faunal assemblage at the site. It is clear that by the Late Woodland fish become a key part of the Upper Great Lakes economy. However, the diversity in fish species and size found in the archaeological assemblage suggests that if this increase in fish production was due to the adoption of the gill net, the first prototypes must have closely resembled the seine net (Smith 2004). The fish remains analyzed from these Woodland period sites demonstrate several observable trends: 1.) inland sites have less diversity in fish species than those at coastal sites. This high diversity in fish found in coastal sites is present throughout the Middle and Late Woodland. 2.) The Yellow Walleye, an important fish species in the Middle Woodland, declines in significance during Late Woodland while there is an increase in the amount of sucker species (Smith 2004).

Archaeological Evidence of Fishing on Grand Island

Although there is evidence of fishing using barbless copper fishhooks and gorges dating back to the Old Copper Culture during the Late Archaic (3000-1000 BC), fishing with netting technology does not appear in the archaeological record of the Upper Great Lakes until the Middle Woodland period. Net sinkers have been found at the Summer Island site (Brose 1970),

the Mero site (Mason 1966), the Heron Bay site and Pays Plate site (Wright 1967), the Middle Woodland component of the Naomikong Point site (Janzen 1968), and at *Gete Odena* on Grand Island (Dunham and Branster 1995).

Grand Island is surrounded by some of the most productive fishing waters along the southern coast of Lake Superior. Coastal settings with highly productive fisheries such as this are thought to have been significant locations where extended family groups seasonally gathered to take advantage of spring and fall fisheries (Drake and Dunham 2004). The Grand Island ferry, the pontoon boat that currently transports visitors back and forth from the mainland to the island, runs from late May until October 9th. USDA nautical reports state that “the lake is generally unsafe for travel to Grand Island from mid-November through December because of thin ice conditions or very rough water” (U.S. Department of Agricultural Forest Service 1992). Because the modern-day weather and water conditions are comparable to the Woodland period weather it can be expected that Woodland period peoples could travel by boat to the island from April or May to October. This period of navigable waters would allow Grand Island inhabitants to travel to and from the island during both spring and fall fish-spawning periods.

All of the Woodland period sites on Grand Island are located along the shoreline near shallow and deep-water fish habitats, the majority of these sites are located along Murray Bay. The acidic sandy soils that make up Grand Island have inevitably devastated much of the fragile faunal remains of fish. What follows is a brief description of the archaeological sites on Grand Island and the adjacent mainland that present evidence of fishing activity.

Popper Site (03-825)

The Popper site is located on the southern end of Grand Island's western lobe. First discovered in 1990 the site was named after Fred Popper, a former island resident. The Popper site is a large multicomponent site (150,000 m²) with evidence of prehistoric and historic occupations (Dunham and Anderton 1999). The site is positioned on a terrace (192 m AMSL) made of Rubicon sand overlooking Murray Bay, 9 meters above the modern lake level (Anderton 1999). The area of the site is presently home to a red pine forest, interspersed with hardwood, red maple and oak (Dunham and Anderton 1999). This location would not have been available for human habitation before 4700 BP because of the fluctuating lake levels of Lake Superior.

Excavations in 1990 conducted by the Commonwealth Cultural Resource Group, Inc. (CCRG), exposed 25 positive shovel tests and three 1 m² excavation units. Cultural materials found were highly dispersed and low density and it was determined to be a low-density site at the time (Robinson et al. 1991). The site was excavated again in 1991 and 1994 by Great Lakes Research Associates (Anderton 1993; Dunham and Branstner 1995). The 1994 excavations constituted 50 positive shovel test pits covering an area of 40,000 m², and five 1 m² test units indicated a higher density of cultural material than previously understood (Dunham and Branstner 1995). The assemblage is primarily made up of artifacts dated to the Late Archaic period with seven pottery sherds having Terminal Woodland characteristics (Dunham and Anderton 1999).

In the summer 2007 the Popper site was revisited in excavations by the Grand Island Archaeological Program (GIAP). Thirteen test units were dug totaling 45 m² of excavation. There were several features observed during this excavation. Feature 4, a Late Archaic hearth feature containing animal bones, is of interest here. Feature 4 was located 32-47 cm below

modern surface level. The hearth feature was 48 cm in length, 42 cm wide and 15 cm thick. The feature contained a copper fragment that was associated with 74 of the 76 (NISP) faunal remains. The faunal remains from the Feature 4 excavation were analyzed by Elizabeth Scott at Illinois State University (Table 3). In addition to the faunal remains collected during the excavation, Neubauer floated 20 liters of soil samples collected from Feature 4 and recovered 418 additional bone fragments. The bone fragments from the flotation samples were analyzed by Terrance Martin at the Illinois State Museum (Table 3). The identifiable fish remains represent lake whitefish or round whitefish, both fall-spawning species that spawn in shallow waters (approx. 0.15 to 15 m), but live most of their lives in depths between 55 to 200 m or greater. Whitefish lay their eggs on sand or gravel bed and leave soon after spawning, making autumn the best time to fish (Stewart et al. 2007). Round whitefish spawn in early October through late November in water temperature between 36 and 40°F, while lake whitefish spawn from September through January (Neubauer 2016).

Table 3: All faunal remains identified by GIAP (2007) at the Popper site. Analyzed by Elizabeth Scott and Terrance Martin (Neubauer 2016:362).

Analysis of Excavated Faunal	NISP	
Lake whitefish or round whitefish calcined vertebra	6	
Unidentified fish (vertebra fragments)	2	
Unidentified calcined large mammals	8	
Unidentified large mammals	10	
Unidentified calcined medium mammal (badger-sized, phalanx (toe bone) fragment, distal portion	1	
Unidentified calcined mammals	2	
Unidentified mammals	11	
Unidentified bone (very small fragments)	36	
Total	76	
Analysis of Flotation Derived Fauna	NISP	Weight (g)
Lake whitefish or round whitefish calcined vertebra	1	0.1
Unidentified calcined small fish vertebra	1	< 0.1
Unidentified calcined fish rib	1	< 0.1
Beaver, calcined right proximal radius	1	0.4
Unidentified calcined medium mammal, phalanx 1 fragment, distal portion	1	< 0.1
Unidentified calcined medium/large mammal	138	5.3
Unidentified burned/calcined medium/large mammal	145	5.2
Unidentified calcined vertebrata (very small fragments)	130	0.3
Total	418	< 11.3
Total Number	494	-

The majority of bones found at the Popper site were calcined, suggesting they were exposed to high temperatures. However, calcification of bone would not usually occur during cooking “unless people wanted to eat ‘burned’ meat or prepared a burnt offering” (Reitz and Wing 2008:132). It is more likely that these faunal remains were burned as the result of waste

disposal, being used as fuel, or on accident (O'Connor 2008:45; Reitz and Wing 2008:132). The unique preservation of this faunal material was likely due to the small piece of copper, which naturally inhibits organic deterioration (Schiffer 1996). It can be expected that the majority of the bones at the site decomposed. As Neubauer points out in her dissertation (2016:366), "this rare glimpse of preserved organic remains may represent a more accurate picture of what the possible ground surface at Popper looked like – a surface covered in a higher density of organic food remains."

The recovery of bones associated with the Late Archaic is a significant find along the southern shore of Lake Superior because fish remains dating to this time period have been found only at one other site, Trout Point I on Grand Island. Because whitefish live in deep waters and would have been uncatchable with Late Archaic fishing technology, Neubauer suggests that Popper was likely repeatedly occupied during the fall at the height of whitefish spawn in the shallow waters of Murray Bay. Neubauer also proposes that the expedient lithic artifacts from Popper were being manufactured for the processing of mammals and fish (Neubauer 2016).

Feature 4 appears to be a hearth feature measuring 48 cm in length, 42 cm wide, and 15 cm thick. Because of the fish remains found in association with this hearth it is possible it functioned as an oven used for cooking or smoking meat and fish. Using smoke to cure meat was a specialized food preparation activity utilized to dry and store meat. The process of smoking meat uses low-intensity fires often referred to as smudge pits, utilizing direct heat exposed to

open air. Curing meat with smoke takes an extended period of time dependent on the type and amount of meat being cured (Petraglia et al. 2002).

Table 4: Flotation-derived flora analyzed by Kathryn Parker (Neubauer 2016:354).

Site Name	Duck Lake	Popper	914	914	Total
Sample provenience	Feature 1	Feature 4	TU-2, Level 3	TU-4, Level 3	
Sample volume (liters)	5	10	1	1	17
Total Wood (N.)	600	64	8	52	724
Total Weight (g)	5.79	0.73	0.06	0.61	7.19
Taxon (N.)					
Picea sp. (spruce)	2	-	-	1	3
Pinus sp. (pine)	2	-	-	-	2
<i>Quercus</i> sp. (red oak subgroup)	-	6	3	-	9
<i>Taxus canadensis</i> (Canada yew)	-	2	-	-	2
Bark	3	-	-	-	3
Conifer	9	3	1	13	26
Diffuse porous	2	-	-	-	2
Ring porous	-	3	2	1	6
Unidentifiable	1	26	2	5	35
Total misc. botanical materials (N.)	92	5	-	7	104
Breakdown by type (N.)					
Prunus sp. (cherry) seed	-	1	-	-	1
Dicot. Stem	32	4	-	2	38
Gracile tendril	28	-	-	5	33
Partially uncarbonized bark	32	-	-	-	32

The flora recovered from the flotation samples from the Popper site (Feature 4) were analyzed by Kathryn Parker, along with several other Grand Island site samples (Table 4). Feature 4 samples revealed the presence of a single fragmentary cherry seed, likely to be a pin

cherry also known as a fire cherry. The pin cherry and the chokecherry (*Prunus virginiana*), are both species collected by the ethnohistorically documented Ojibwe inhabitants of the island during the summer (Ball 1993; Silbernagel et al. 1998; Yarnell 1964). Pin cherry and chokecherry were available from July to August and used as a food source by the Ojibwe of Grand Island. Pin cherries are recorded as being dried for the winter (Ball 1993). Chokecherries have also been documented as being saved and used during winter. Densmore (1929:317 and 321) notes that the Ojibwe would pound chokecherries between two stones and dry them on birchbark, so the fruit could be stored and consumed during the winter. The twigs from chokecherry shrubs were used to make flavored hot beverages. The seasonal overlap in faunal and flora data collected from Popper suggest that the site was seasonally occupied in late summer/autumn (Neubauer 2016).

Trout Point I (20AR189)

Trout Point I is located on the northern tip of Grand Island's eastern lobe. The site lies on a cliff that is currently 20 m above Lake Superior. Site size is about 600 m², an area that is slowly decreasing as the northern boundary gradually erodes into Lake Superior. Exactly how much of the site has been lost to bank erosion is unknown. Based on available data, Benchley and collaborators (1988) interpret Trout Point I as being the location of a diverse set of activities. Local stone cobbles were being collected and brought to the area of settlement. Lithic were heated, possibly to provide residential heating or for the processing of food and other materials. Timbers were collected from nearby sources for heat and processing of foods, at least some of which being fish. Refuse was disposed of in a midden located at the lowest elevation of the site.

The midden contained accumulations of FCR, debitage, fish, and preserved wood charcoal (Benchley et al. 1988:166-117).

No hearth features were identified in the 45 m² excavation area, however flotation recovered carbonized botanical remains and calcined animal bones. Faunal remains recovered produced a limited number of fish bone. The identifiable fish species at Trout Point I represent one calcined vertebra of lake whitefish or round whitefish, and eight calcined vertebra of lake whitefish or lake trout (Benchley et al. 1988). Lake trout typically spawn from early September to mid-November. Recent studies in Otsego Lake in northern Lower Michigan show that lake trout spawn from October 20 to November 1 (Tibbits 2007). Both lake trout and whitefish are deep water species that spawn near the coast during the fall, indicating that the site was most likely occupied during the fall (Benchley et al. 1988; Neubauer 2016). Benchley and colleagues (1988) describe the site as procurement area where people came to extract lithic materials for the production of expedient tools, likely used for processing fish and/or plant foods.

Powell Point (03-04)

The Powell Point site was discovered during a 1968 survey conducted by the University of Michigan. The site is located on the mainland across the bay from Grand Island's southernmost end, near the modern day Grand Island ferry service. Due to modern construction and paving, all that remains of the site today is a small triangular-shaped section that is roughly 375 m². The 1968 excavations of the site recovered various pieces of quartzite and chert debitage, a stemmed chert projectile point, several sherds of cordmarked pottery, and a copper fishhook (Bigony 1968; Drake and Dunham 2004). Because of the cordmarked pottery recovered from this excavation, the site was assigned to the Terminal Woodland period (Martin 1977).

More recent excavations supported a Terminal Woodland occupation along with identifying an Initial Woodland component of the site (Drake and Franzen 2004). Nineteen Laurel drag-stamped sherds were found, eight of which fit together to form three groups of conjoining sherds, suggesting that all or most of the sherds originated from the same vessel. Residues from the interior of one of the sherds produced an AMS date of 1740 ± 40 BP, with a two-sigma calibrated age of AD 225 and AD 405. A radiocarbon date of 1710 ± 70 BP was also collected from a wood charcoal sample from a possible living surface recovered from a test unit located at the southern end of the site (Drake and Dunham 2004; Drake and Franzen 2004). Both of these dates indicate an Initial Woodland component fitting in the spatial-temporal dimensions of the Laurel ceramic tradition of the Upper Great Lakes (Brose 1970; Brose and Hambacher 1999; Drake and Dunham 2004; Janzen 1968).

The remaining assemblage from the site indicate a number of subsistence related activities, including fishing. The lithic assemblage is made up of various chert scrapers, bipolar lithics made from chert nodules, two projectile points, a quartz core, along with a small amount of FCR. Artifacts related to fishing include a copper fishhook and two end-notched sandstone net sinkers. One of the net sinkers was found in associated with the Laurel drag-stamped pottery suggesting the fishing technology was used during the Initial Woodland occupation of the site (Drake and Franzen 2004). The coastal location and artifact assemblage from Powell Point suggests that the site was used as a seasonally occupied small fishing and hunting camp throughout the Woodland period (Drake and Dunham 2004).

Gete Odena (03-803)

Located on the southern tip of Grand Island, *Gete Odena* is near Murray Bay. *Gete Odena*, meaning “ancient village,” has undergone several excavations in 1990, 1994, and again in the summers of 2001 and 2002 (Dunham and Branstner 1995; Robinson et al. 1991; Skibo et al. 2004). *Gete Odena* was occupied from the Late Archaic through the historic period, with the most intensive use taking place during the Terminal Woodland Period. The 2001 and 2002 excavations exposed dozens of features and around 10,000 artifacts. Radiocarbon dates from a hearth feature, Feature 8, indicated the site was first occupied during the Late Archaic. Feature 8 contained one unidentifiable bone fragment, various fragments of wood charcoal, blackberry seeds, and an individual partridge berry (Skibo et al. 2004:170). In total, several dozen features were exposed during 2001/2002, six of these were unique pit features discussed in more detail in chapter three.

Over 1,400 faunal remains were recovered during the 2001 and 2002 field seasons (Table 5). Mammals made up the majority of the assemblage, representing 89.6 of the specimens. The conversation of bone weights into biomass showed that mammals supplied over 95 percent of the estimated meat diet. Biomass estimates also indicate that moose was probably the largest part of the human diet due to its large size (Skibo et al. 2004:175). Black bears, beaver, white-tailed deer, muskrat, river otter, marten, canid remains resembling a domestic dog, and a snowshoe hare complete the mammal assemblage. Birds, waterfowl, and aquatic species are underrepresented. Given that *Gete Odena* is located in an area ideal for fish exploitation, it is surprising that only seven individuals from four species of fish were recovered (Skibo et al. 2004). The paucity of fish remains along with the plethora of large mammal remains from fur-bearing species seems to indicate that *Gete Odena* was an area where groups gathered to hunt

and process meat and hides from mammals including moose, black bear, white-tailed deer, beaver, and other small fur-bearers (Skibo et al. 2004:189).

Table 5: Species composition of animal remains from the *Gete Odena* site, 2001 and 2002 seasons (Skibo et al. 2004:175-176).

	NISP	MNI	NISP Wt. (g)	Biomass (kg) ³
Mammals	1,265	23	1,675.8	26.279
<i>Lepus americanus</i> (Snowshoe hare)	1	1	0.1	0.003
<i>Castor canadensis</i> (Beaver)	42	3	76.6	1.306
<i>Ondatra zibethicus</i> (Muskrat)	13	2	5.7	0.126
<i>Canis cf. familiaris</i> (cf. Dog)	15	2	50.0	0.889
<i>Urus americanus</i> (Black bear)	22	4	199.9	3.096
<i>Martes Americana</i> (Martin)	1	1	0.9	0.024
<i>Lutra canadensis</i> (River otter)	6	2	16.9	0.335
Unidentified med./large carnivore	2	-	1.3	0.033
<i>Sus scrofa</i> (Swine)	10	1	47.4	0.848
<i>Alces acles</i> (Moose)	36	2	420.2	6.041
<i>Acles acles</i> (cf. Moose)	5	-	16.1	0.321
<i>Odocoileus virginianus</i> (White-tailed deer)	16	3	67.2	1.160
<i>Bos taurus</i> (Cattle)	9	1	111.2	1.826
<i>Bos taurus</i> (cf. Cattle)	2	-	47.0	0.841
<i>Ovis/Capra</i> (Sheep/Goat)	3	1	12.8	0.261
Unidentified very large mammal	3	-	12.7	0.259
Unidentified large mammal	324	-	334.9	4.925
Unidentified medium/large mammal	687	-	237.6	3.160
Unidentified medium mammal	34	-	13.2	0.268
Unidentified small/medium mammal	11	-	1.8	0.045
Unidentified small mammal	23	-	2.3	0.056
Birds	83	16	40.6	0.689
<i>Gavia immer</i> (Common loon)	4	1	3.8	0.069
<i>Branta canadensis</i> (Canada goose)	4	1	9.7	0.161
<i>Anatinae</i> (Duck sp.)	8	3	3.0	0.055
<i>Gallus gallus</i> (Domestic chicken)	51	8	17.3	0.273
<i>Columba livia</i> (Rock dove)	8	2	3.3	0.061
<i>Ectopistes migratorious</i> (Passenger pigeon)	1	1	0.2	0.005
Unidentified large bird	1	-	1.5	0.030
Unidentified medium bird	6	-	1.8	0.035
Reptiles	1	1	0.6	0.022
<i>Emydidae</i> (Semi-aquatic pond turtle)	1	1	0.6	0.022
Fish	30	7	11.7	0.247
<i>Acipenser fulvescens</i> (Lake sturgeon)	18	2	8.8	0.168
<i>Ictalurus punctatus</i> (Channel catfish)	1	1	0.4	0.008
<i>Coregonus clupeiformis</i> (Lake whitefish)	2	2	0.2	0.008
<i>Stizostedion vitreum</i> (Walleye)	3	2	0.4	0.013
Unidentified fish	6	-	1.9	0.050
Unidentified vertebrata	20	-	2.2	-
Bivalves	13	4	2.7	-
Unidentified mussel	13	4	2.7	-
Grand totals	1,412	51	1,733.6	27.215
Total identified	284	47	1,118.1	17.931
Percentage identified	20.1		64.5	65.900

Background Discussion

The objective of this chapter was to provide an overview of the environmental and cultural background for this research. The existing Woodland settlement and subsistence models of the Upper Peninsula suggests that Middle Woodland groups (AD 1 – AD 600) were more residentially mobile, engaging in a more diverse diet than their Late Woodland counterparts (AD 600 – AD 1600) (Brasher et al. 2000; Brose and Hambacher 1999; Cleland 1983; Dunham 2016; Martin 1985). With expanded technological abilities, Late Woodland groups became more dependent on seasonally abundant aquatic food resources, particularly, there was an intensification of fall-spawn fisheries into the seasonal subsistence round. This model argues that this more resource specific focus lead groups to become more territorially constrained, socially organized, and socially integrated (Cleland 1982, 1992; Holman and Lovis 2008; Martin 1985, 1989).

The archaeological data from previously excavated site on Grand Island and mainland Munising, testify to a focus on fishing at these coastal sites. This thesis considers the role of storage at a coastal logistical camp on Grand Island. The settlement and subsistence models discussed in this chapter will help in the analysis and understanding of the activities that took place on the island that lead to the need for storage. The following chapter provides a literature review of studies considering pit feature function in Michigan. These studies give important archaeological data to help establish and compare pit feature performance characteristics considered in the results of this thesis.

CHAPTER III

OVERVIEW OF RECENT MICHIGAN PIT FEATURE RESEARCH

The existing pit feature literature from the Lower Peninsula of Michigan predominantly focuses on Late Woodland storage of surplus foods as a risk buffering strategy. This research has been in support of a seasonally mobile Late Woodland settlement pattern discussed in the previous chapter. Seasonal movement between coastal and interior sites to exploit storage food resources that have predictable spatial, environmental, and temporal constraints is supported by strategic placement of food storage pits along travel routes, at winter habitation sites, and summer procurement areas. This chapter will review a number of these recent pit feature studies from the Lower Peninsula examining the role of food storage, along with a unique study from Grand Island itself discussing smudge pits found at the Historic component of *Gete Odena*. This is followed by a review of an experimental study at Michigan State University (MSU), recreating subterranean food storage. The purpose of this literature review chapter is to provide the reader with a background of the archaeological research related to pit feature function conducted in the region.

Northwest Lower Peninsula

In a 2001 study of pit features from a collection of Late Woodland period sites in the western Lower Peninsula, researchers examined the role of food storage among seasonally mobile groups inhabiting a seasonally and geographically variable environment (Holman and Krist 2001). Historic records testify to the use of storage as a systematic approach employed

during each season of the year as people moved from place to place. Using these ethnohistoric accounts of storage and mobility to guide their research, Holman and Krist (2001) analyzed pit features, the environmental characteristics of where they are located, and the association of pit sites with the habitats where key resources can be found, with potential travel routes, and with other site types in the local area (Holman and Krist 2001:7).

Twenty-four previously recorded Late Woodland pit sites in western lower Michigan were mapped, and characteristics of their locations including floral and faunal distributions were analyzed using Geographic Information Software (GIS). Using ArcView, the researchers were able to identify relationships between resource distributions and cache pit placement. This spatial analysis demonstrated that cache pits in west-central Lower Peninsula were located where seasonal resources are likely to be found and where resource habitats overlap. Pit features located in areas of high availability of autumn foods were also high in the availability of spring foods. Pit features in autumn/spring resource habitats were situated where groups would travel on their way to interior winter resource habitats. Additionally, pit feature in autumn/spring resource habitats may also be found with mounds, earthworks, and other geographic markers such as near water channels or between streams, or existing as specific cache pit locales. The distribution of pit features near interior winter resource habitats and close to geographic markers such as waterways, reflects placement in areas along travel routes (Holman and Krist 2001:19).

The distribution of Late Woodland pit features in west-central Lower Peninsula is evidence of the seasonally mobile group movement indicated by historic sources. Holman and Krist state that the “storage along with seasonal movement conferred the flexibility needed to react to environmental contingencies and at the same time have backup supplies of food at key locations” (Holman and Krist 2001:20). This research supports the idea that food storage was

used among seasonally mobile hunter-gathers who employed flexible subsistence and settlement patterns as a risk buffering system to combat seasonal food scarcity.

Western Lower Peninsula

The *Ne-con-ne-pe-wah-se* site, located in Newaygo County in Michigan's Lower Peninsula, is a multicomponent site retaining both Late Woodland and 19th century archaeological components. This site has the remains of at least 20 pit features, 10 of which were tested. In a case study published in 2000, Sean Dunham explores the role of these features by using the application of models derived from data related to ethnoarchaeology, ethnohistory, and historical archaeology (Dunham 2000:226). The site is positioned within a beech-maple forest along a terrace overtop a small stream. The soils at this site consist of well-drained sandy loams, underlain in some areas by a layer of clay within one meter of the surface. The pit features found here were circular with subsurface diameters ranging from 51-131 cm, with a mean diameter of

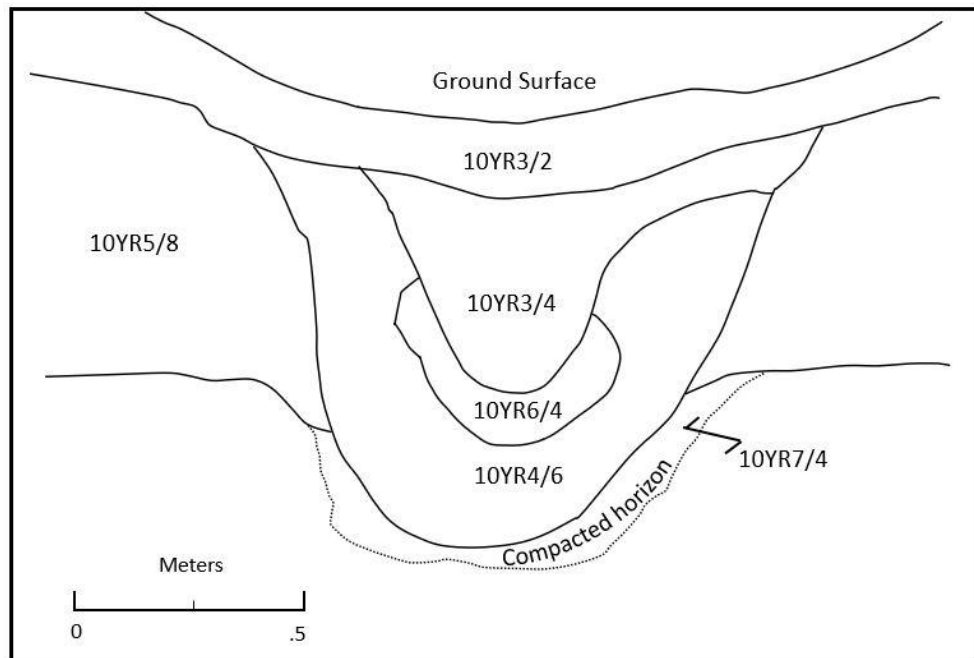


Figure 6: Profile view of Cache Pit 9 from the *Ne-con-ne-pe-wah-se* site (Dunham 2000:237).

just over 1 m. The subsurface depth ranged from around 42-121 cm below the modern ground surface, with a mean depth of 68.5 cm. Eight of these features were bisected in 1994 excavations, two additional pits were excavated completely. Table 6 shows the dimensions of excavated pit features from this site.

All the pit features excavated were circular in plan-view and had cylindrical or basin-shaped profiles. Many of the features had uncomplicated stratigraphy displaying an upper zone of collapsed fill (naturally occurring soils, debris, and leaf mat), and a subsurface soil stain associated with the outline of the pit. However, some of the pit features had more complex stratigraphy, likely indicating stages of multiple use or at least an intricate depositional sequence. One of the more complex pit stratigraphies brought to attention in this article is from “Cache Pit 9,” a large bell-shaped feature exhibiting four distinct fill zones (Figure 6). The uppermost zone coincides with the modern O horizon. The three zones beneath this are likely different deposits associated with secondary pit use.

Pit excavations contained only a few artifacts dating to the Late Woodland or Historic periods. The pits themselves are associated with the Historic component of this multi-component site based on the recovery of historic artifacts from seven of the ten tested features (Dunham 2000:238). Floatation samples taken from three of the features (Cache Pits 5, 9, and 17) produced high amounts of uncarbonized edible nuts and fruit seeds, including beechnuts, cherry, sumac, raspberry, elderberry, grape, and an uncarbonized maize cob (Dunham 2000:238-239). Additionally, carbonized and uncarbonized bark fragments were recovered from the features. The large amounts of edible seeds and bark remains indicates that the pit features are the *Ne-con-ne-pe-wah-se* site were used as food storage pits.

Following this archaeological evidence, Dunham then goes on to outline research giving the pit features and their interpreted function context within the area and time period they were used. Historical documentation concerning land ownership, Ojibwe and Ottawa social organization, settlement and subsistence practices, nuts and wild berries used by Native American in the Great Lakes region, along with ethnohistoric examples of food storage pits (cache pits) use in the Midwest all build a framework for contextualizing pit feature function at the site.

Table 6: Pit feature dimensions of the excavated cache pits from 20NE331 (Dunham 2000:237).

Pit Feature #	Surface diameter (cm)	Surface depth (cm)	Subsurface diameter (cm)	Subsurface depth (cm)
1	200	27	99	79
2	200	25	114	78
5	180	20	85	60
6	152	15	108	42
7	140	15	100	51
9	190	26	105	121
11	180	25	110	63
12	160	20	131	52
14	200	25	128	60
17	100	17	51	62
Feature 3	-	-	110	86
Mean	170.2	21.5	103.7	68.5

Nuts and fruits recovered from the pits with documented cultural uses made up about 97.5 percent of the botanical assemblage. The seasonality and requirements for plant growth of the botanical remains indicates that the pits were used for scheduled, seasonal collecting of nuts and berries from multiple environments for storage of surplus in particular locations. These types

of subsistence rounds are confirmed by ethnohistoric literature from the 19th century. The bulk of the botanical remains are uncarbonized, suggesting that these pits were used to store dried fruit, a storage practiced supported by ethnographic sources. Uncarbonized food remains are not expected to survive at pre-Contact sites due to decomposition. However, at this and other mid-late 19th century sites uncarbonized food remnants are often still intact. Cache Pit 17 had the highest number of recovered uncarbonized seed remains, accounting for over 74 percent of the total floral remains with potential cultural uses. These unusually high numbers and variety of food remains left in the pit suggests that Cache Pit 17 was not emptied of its contents prior to abandonment of the site. See Table 7 for the complete list of floral remains with potential cultural uses. Using ethnohistory, ethnography, botanical remains, and archaeological evidence, Dunham was able to present a strong case for food caching at the *Ne-con-ne-pe-wah-se* site (Dunham 2000).

Table 7: Floral remains with potential cultural uses from 20NE331 (after Dunham 2000:238; Egan 1995).

Cache Pit/Feature	CP 5	CP 5	CP 5	CP 9	CP 9	CP 9	CP 17	CP 17	F 3
Level #	5	6	7	8	10	11	5	7	9
Flot Vol. (liters)	10	10	10		10	10	7	5	10
cf. <i>Aronia arbutifolia</i> Chokeberry	-	-	-	-	-	-	3	-	-
<i>Cornus canadensis</i> Bunchberry	-	1	-	-	2	2	66	6	-
<i>Cornus stolonifera</i> Red-Osier Dogwood	-	-	-	-	-	-	-	-	3
<i>Fagus grandifolia</i> Beechnut	-	-	-	-	-	-	62	-	-
cf. <i>Hamamelis virginiana</i> Witch-hazel	-	-	-	-	-	-	1	-	-
cf. <i>Lindera benzoin</i> Spicebush	-	-	-	-	-	-	2	-	-
<i>Lonicera</i> sp. Honeysuckle	-	-	-	-	-	-	1	-	-
<i>Potentilla</i> sp. Cinquefoil	-	-	-	-	-	-	7	-	-
<i>Phytollaca americana</i> Pokeweed	-	-	-	-	-	-	29	77	-
<i>Prunus</i> spp. Cherry	-	-	-	-	-	-	106	-	-
<i>Prunus pennsylvanica</i> Pin Cherry	2	5	-	-	-	-	70	4	4
<i>Prunus serotina</i> Black Cherry	-	5	-	-	3	-	5	2	3
<i>Rhus</i> sp. Sumac	1	-	-	-	-	1	44	4	1
<i>Rubus</i> spp. Raspberry	11	3	-	-	-	-	30	6	-
<i>Sambucus canadensis</i> Elderberry	1	-	-	-	-	-	25	3	-
<i>Solanaoaeae</i> Nightshade Family	3	2	-	-	-	-	-	7	-
cf. <i>Sorbus americana</i> Mountian Ash	-	-	-	-	-	-	1	-	-
<i>Vitis</i> sp. Grape	2	3	-	-	-	2	39	1	1
<i>Zea mays</i> Maize	-	-	-	1	-	-	-	-	-

Douglas Lake – North Central Lower Peninsula

Shovel test survey at Douglas Lake in an area with a high concentration of pit features identified two discrete zones of cultural materials along a low terrace on Grapevine Point on the southern shore of Douglas Lake (Howey and Parker 2008). The two discrete zones were determined to be two separate sites and pit feature excavations of the more northern site (20CN63) were conducted. Radiometric dates and cultural materials shows the site dates to the Late Woodland period (ca. AD 1310-1430), quite typical of pit features in Michigan. The Late Woodland peoples inhabiting the Douglas Lake area are described by Howey and Parker as a non-complex society, employing a “fisher-forager-horticultural subsistence system” (Howey and Parker 2008:22).

Based on the dense cultural material such as fire cracked rock, burned posts from a large structure, and the presence of sumac seeds, 20CN63 was a substantial occupation site. Artifacts from the site include, eight copper tools, a polished axe together with net weights, and evidence of cooking, including hearths and ceramic production. Along with the sumac seeds, floatation samples also recovered carbonized acorns and small maize fragments in low frequencies. Suggested from the high frequency of acorns and the low amounts of maize remains found at this site, Howey and Parker (2008) suggest acorns (whole or ground) as an important storable food resource at this site. Faunal remains included bear, deer, turtle, beaver and several fish species.

The pit features excavated 20CN63 were part of two distinct spatial clusters, one on a high terrace and one on a high outwash plane. Two pits from the cluster of 20 on the high terrace were cross sectioned, and one from the cluster on the high outwash plane. Measurements were taken based on Dunham 2000, see Table 8. The pit features excavated at this site had complex

Table 8: Measurements of pit features bisected and sampled on Grapevine Point (Howey and Parker 2008:32).

Grapevine Point cache pit	Diameter at surface	Diameter estimated at subsurface base	Maximum depth of pit on surface	Maximum depth of pit subsurface	Total estimated depth of pit (surface + subsurface depth)
High Terrace 1	148	69	17	82	99
High Terrace 2	220	96	70	115	185
High Outwash	200	94	55	85	140

stratigraphy suggests reuse. One of the excavated pits shows evidence of being opened, left open while it naturally infilled, then was recut at least once in a 30-year interval (Figure 7). It is suggested that these pits are the result of socioeconomic change which resulted in the movement away from costal sites, inland to sites which were occupied for generations. The reuse of pits is evidence of coming back to the same site to exploit seasonally available food resources that can be stored. Flotation samples were taken from each strata but no botanical remains or datable materials were recovered from any of the pits. Only a single ceramic rim sherd and one small calcined bone make up the artifact assemblage from the 20CN63 pit features. Based on similar research done on pit feature in the Lower Peninsula (Dunham 2000; Holman and Krist 2001), Howey and Parker interpreted these features as cache pits used for food storage.

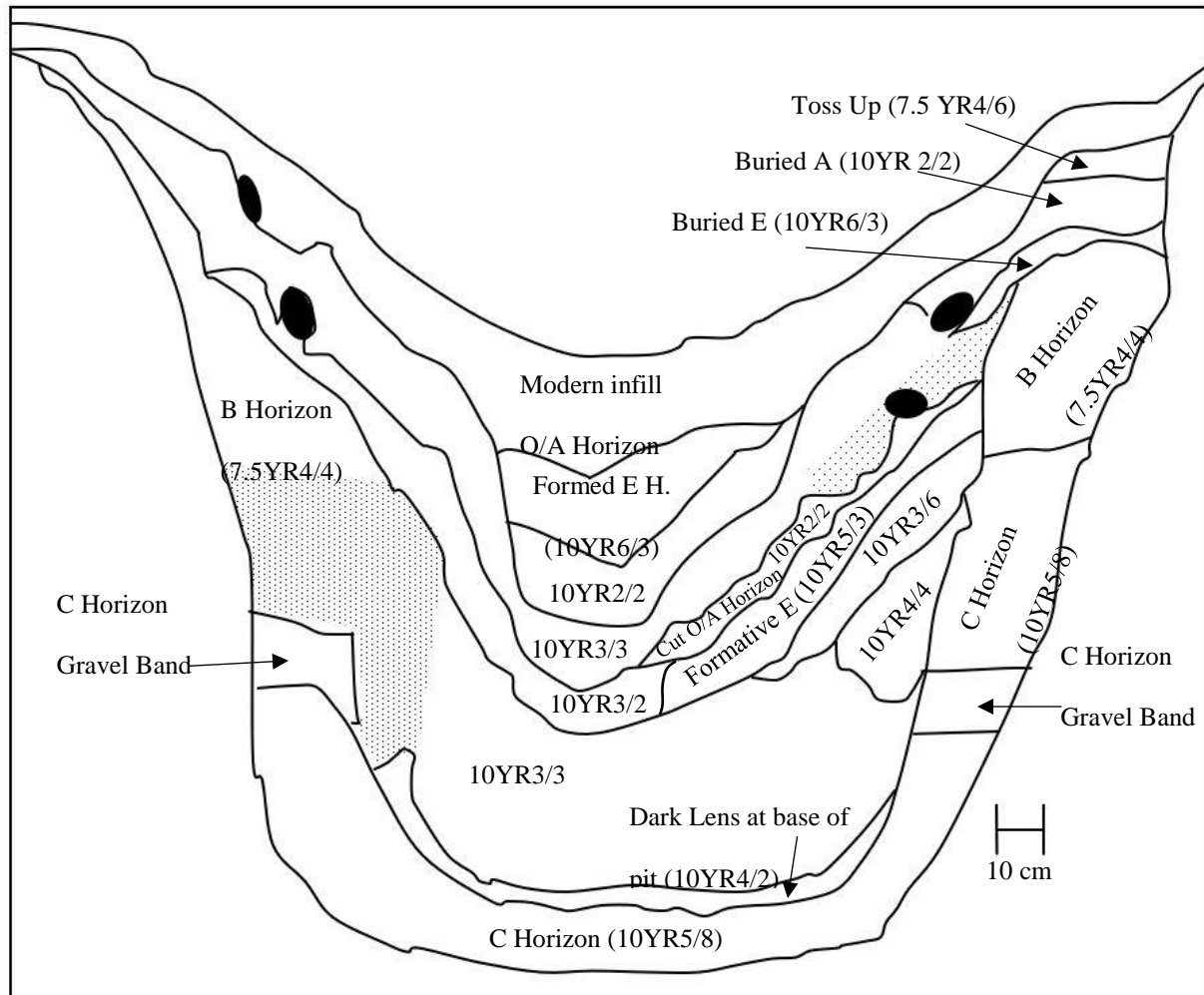


Figure 7: North wall profile of High Terrace Pit 2, stratigraphy suggesting reuse (Howey and Parker 2008:33).

Grand Island - Gete Odena (03-803)

The Grand Island Archaeological Project and the Hiawatha National Forest conducted excavations at *Gete Odena*, on the southwest shore of Murray Bay, in the summers of 2001 and 2002. The site is dominated by Terminal Woodland and contact period materials, with a single hearth feature that dates to the Late Archaic (Feature 8). Wood charcoal recovered from the feature produced a radiocarbon date of 860-1008 cal. BC (Beta-163723) (Skibo et al. 2004). Feature 8 was found about 60 cm below the modern ground surface, representing the deepest cultural material at the site. In plan view, the feature was circular, measuring 60 cm in diameter.

The feature contained a single unidentifiable bone fragment, numerous pieces of wood charcoal, blackberry seeds, and one partridge berry. The hearth appears to have been constructed on what was at the time the beach. Presently, the closest beach is located 30 m southeast of the feature. There were no other Late Archaic artifacts or features found at this site (Skibo et al. 2004).

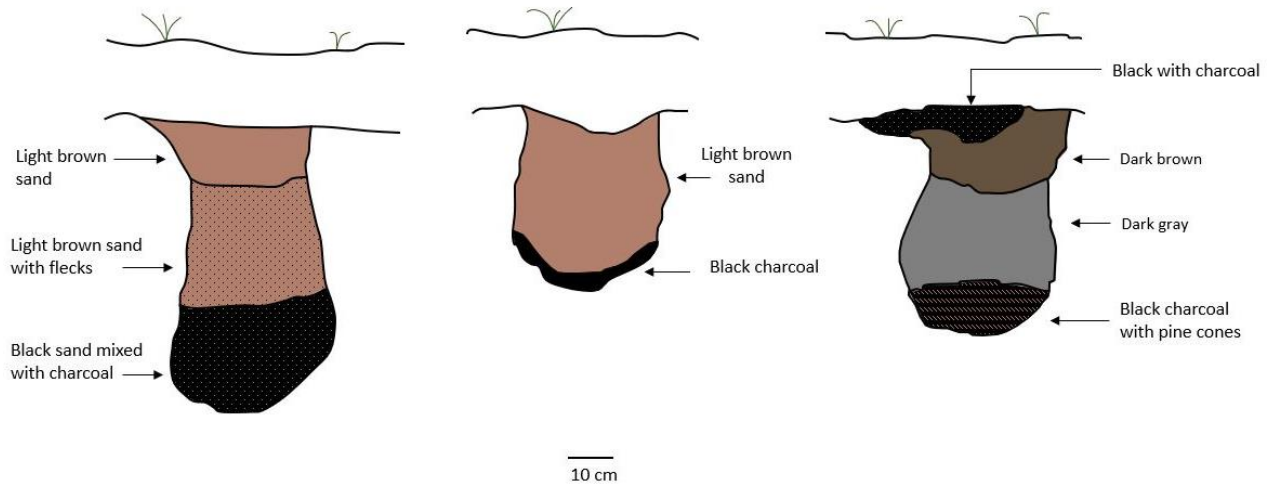


Figure 8: Profile drawing of representative smudge pits found at *Gete Odena*, each showing charred materials at the base (adapted from Skibo et al. 2007:82).

Six distinctive pit features were excavated at *Gete Odena*, two of these features were truncated by later disturbance and the exact morphology of them is unknown. The remaining four had an average width of 36 cm and depth of 46 cm. Figure 8 illustrates three of these shallow, slightly bulbous pits all containing a layer of partially burned timbers at their base. Similar features were again recorded by Frances Densmore as hide smoking pits. These single use features were used to maintain a smoldering fire producing smoke to process animal hides. Faunal remains at this site were dominated by large mammal bones, instead of fish, which were expected at this productive Great Lakes fishing village. Radiocarbon dates from two of these features dated to the Historic time period. Based on these data, these pits were determined to be smudge pits, used during the Historic period to smoke hides (Skibo et al. 2004, 2007).

Experimental Research

Kathryn Frederick, graduate student of Michigan State University, conducted an experimental archaeology project on the construction of food storage pits in Michigan for a project called the Subterranean Storage Experiment. This experiment took place over the course of three seasons and information on how to construct the pits was gathered from ethnohistoric, ethnographic, and archaeological data. Frederick's 2015 presentation at the SAA meeting shows that creating a successful food storage pit is challenging.

Careful attention was paid not only to the construction of the pits, but also the environmental setting in which they were dug (Frederick 2015). Frederick and the MSU Subterranean Storage Experiment team took factors such as soil type, distance to water, and seasonal use into consideration. Pits were dug and sealed in late September after the acorn harvest and then reopened in late March/early April. They were filled with foodstuffs contained in ceramic vessels, insulated with grass, and covered with logs and/or a layer of soil.

It took three seasons of trial and error before the team was able to construct a food storage pit that produced edible food upon reopening. Determination of edible foods was based on testing of aerobics, yeasts, molds, general coliforms, and E. coli levels. Pits were also tested for moisture and water penetration in to the pit and soils making up the walls of the pits. Dried blueberries, parched acorns, and smoked salmon were the food sources used in this experiment (Frederick 2015). During the first two seasons the team ran into problems with animal scavenging and moisture build up. The smoked salmon was easily discovered by animals, resulting in no food left in the pits upon reopening. In fact, coyotes had made a den out of two of the pits. To prevent against animal intrusion meat was not stored in the following seasons.

The logs and soil layer placed on top of the pit did not keep water out. After a rainfall in early April, moisture sunk into the pit and caused molding. As a solution the pits were opened earlier in the spring season and a sandy, more absorbent soil was used to seal the pit. After modifying the dates of reopening, pit cover, and food types stored in these pits, they obtained successful results (Frederick 2015).

It is clear that successful food storage was dependent on the pit construction and knowledge of the land. Unsuccessful pits could have been devastating to the community of people relying on them as a food source. These pits were a tool for survival and failure to store food could have resulted in deprivation. The results from this experiment draws into question whether fish would have been a practical food to be stored in pits. Smoking fish only provided short-lived preservation, although freezing during the winter month may have extended the time the meat kept for a short period.

Discussion of Previous Pit Feature Research

Evaluations of pit features in Michigan often leans on a presumed food caching function, which is primarily explained by a lack of material remains. This assumed function, while an important consideration for pit feature research, can lead to a misinterpretation, ignoring the possibility that pit features served a range of functions. For example, Howey and Parker (2008) undertook the Douglas Lake research with the assumption that these pit features were food storage pits stating, “these depressions are the single most common archaeological feature encountered in Michigan and scholars have sufficiently demonstrated that food storage was their intended function” (Howey and Parker 2008:22). While it may certainly be true that the pit features at Douglas Lake, and many other pit features from the Lower Peninsula are in fact food

storage pits, I do not think an overarching assumption that all Michigan pit features were intended for food storage is a productive research agenda. In the following chapter I will discuss the performance-based approach taken to evaluate pit feature function at the Muskrat Point site. A performance-based analysis supported by archaeological data and historic accounts of pit use sets up a framework for recognizing and understanding patterns in pit feature manufacture and use. This approach draws attention to variability, allowing for a more comprehensive understanding of pit feature function.

CHAPTER IV

PIT FEATURES: A THEORETICAL AND HISTORICAL DISCUSSION OF FUNCTION

It is common for archaeological literature pertaining to pit features to gloss over or neglect a discussion of theoretical approaches used to help guide the dialogue about their interpreted function. A principal objective of archaeological research is the reconstruction of past lifeways. This process is accomplished by bridging the gap between the physical data we uncover and the understanding of the activities that created them. The theoretical framework is a tool used to bridge that gap and draw inferences about past behavior. Pit features typically produce limited material evidence apart from the morphological characteristics of the pits themselves. Therefore, it is particularly important to lay out a theoretical approach that will aid in the understanding of the features.

For this research, a performance-based approach is taken to explore the role of the pit features at the Muskrat Point site (03-910). In this chapter, I examine the life history concept of technology based on the behavioral chain of Schiffer (1992), and Schiffer and Skibo (1997). The study of pit feature function is well suited to the behavioral approach. This conceptual framework is applied to this study in order to recognize and understand patterns in performance characteristics. A performance matrix is used to help identify and compare the performance characteristics for pit features of various functions seen throughout Great Lakes historical literature. The theoretical overview is followed by a discussion of storage among small-scale hunter gatherers utilizing logistical mobility patterns. Lastly, I examine historical accounts of pit feature use in the Great Lakes region. These accounts are used to provide contextual information

for the interpretation of technical choices and performance characteristics of features. This model will provide a framework for understanding peoples' choices related to pit feature manufacture and use.

This theory of artifact or feature design answers the question, "Why was this feature made in this way?" Isolating the technical choices along the feature's entire life history provides the clues to understand performance characteristics. We can infer these technical choices by the stratigraphic information, pit content, and other contextual information [Skibo et al. 2007:84].

Performance Based Approach

Life History/Behavioral Chain

All artifacts, features, and other technological constructions have a life history, meaning that the entity has an active role among people that is constantly being contextualized and recontextualized (Skibo 2013:7). In order to fully understand a technology, it is important to focus on individual activities taking place throughout the entire life history of the object. This focus on the entire life history is referred to as the "behavioral chain" (Schiffer 1975, 2004; Skibo 2013; Skibo and Schiffer 2008). The behavioral chain has many similarities to the French concept of "*chaîne opératoire*" (Dobres 2000:154; Stark 1998:6), first introduced in English by Lemonnier (1986, 1992, 2002). *Chaîne opératoire* is known as the operational sequence concerned with an object's manufacturing process. This concept has a lot in common with the behavioral approach, used in understanding the relationships between people and things. Unlike *chaîne opératoire*, however, the behavioral chain is concerned with understanding of use, maintenance, reuse, deposition, and other post-manufacture processes, not restricted to solely the manufacture processes. Behavioral chain studies in archaeology attempt to isolate the "links"

along an object's life history, each individual link could represent an important factor in its design (Skibo and Schiffer 2008). "Each link is composed of an activity, which consists of specific interactions between people and artifacts, people and people, and even between artifacts" (Skibo and Schiffer 2008:10).

Technical Choices

The decisions made by individual(s) in response to anticipated interaction along the behavioral chain are called "technical choices." Technical choices, in turn, determine the formal properties of a technology (Skibo and Schiffer 2008). In the case of pit features this would be the size, shape, presence or absence of a lining, material for lining, etc. Technical choices are the result of available resources and knowledge (Skibo 2013). Examining the technical choices can then provide clues about performance characteristics (see below).

Performance Characteristics

For each activity that takes place along the behavioral chain there are performances that cultivate interactions between people, artifacts, and the environments they occupy. In a performance-based approach, the focus lies on the activities associated with the manufacture, use, disposal, and post-dispositional history of the artifact or feature. With this frame of thinking the division between style and function is no longer useful because the material object itself is just one element in the overall picture of how it functions or what it means (Skibo and Schiffer 2008). "The social, symbolic, and utilitarian functions of an object are defined by its performances in activities all along its behavioral chain" (Skibo and Schiffer 2008:12). For example, a Hopewell pit feature found at a shell mound site on the northern gulf coast of Florida,

filled with the remains of water fowl played a much different role than a Woodland pit feature found on an island in Lake Superior that contains burned wood remains.

“People make decisions about their technology based on their knowledge, experiences, and the social and natural environment in which they live” (Skibo and Schiffer 2008:23). The cultural meaning of an object can only be known through the examination of the actions, or performances it played throughout its behavioral chain. Meaning is found not only in the artifacts themselves, but also in the activities that produce them. The function of an artifact changes as it moves along the behavioral chain, therefore it is necessary to consider, whenever possible, how an artifact performs during each link in the behavioral chain (Schiffer and Skibo 1987, 1997; Skibo and Schiffer 2001, 2008).

Performance Matrix and Life History Framework

An effective way to assess performance characteristics is through a performance matrix. A performance matrix allows the investigator to visualize patterns in technological compromises, to see what activities were favored and what activities were disadvantaged (Schiffer 1995). By comparing the performance characteristics from various pit feature functional attributes, patterns in design, placement, and morphology become apparent for different intended functions.

Storage Among Small-Scale Hunter-Gatherers

Previous research has often associated storage with increased levels of social complexity and sedentism. In evolutionary terms, storage is viewed as an adaptive behavior discussed within the framework of social and cultural change (Stopp 2002:305). Following this line of thinking, storage of food would inhibit mobility (Cunningham 2011). Among northern peoples,

maintaining a hunting-gatherer/foraging subsistence strategy, the absence of food storage was expected. Within this limited notion, hunter-gatherer societies primarily sought immediate return only seeking provisions when needed, viewing the environment as a food depository (Ingold 1983; Stopp 2002). In actuality, storage and mobility go hand in hand. Storage among small-scale hunter-gatherers is a socioeconomic response to short-term intervals of food scarcity.

In the higher latitudes of the Upper Great Lakes, there are pronounced variations in resource availability from season to season. Halstead and O'Shea (1989) recognize four basic options in the response to risk: *mobility* to find and exploit resources in different locations during different seasons; *diversification* of the conventional resources used to include other food types; *exchange* to create a network for food revenue, and *storage*. The storage of food extends the period that a resource is available. The storage of food procurement related supplies, such as hunting/fishing gear or food processing supplies, saves on energy expenditure and provides concealed protection for valuable equipment. Direct evidence of storage is unlikely to survive in the archaeological record; however, mass capture technology is put forwarded as indirect evidence (Rowley-Conwy and Zvelebil 1989). Mass capture technology, such as fishing nets, required a substantial amount of time and energy to manufacture. The presence of such a technology in the archeological record suggests that the group was greatly invested and adept in that procurement activity. This type of technological investment is validated by a high resource return that will provide a storable food surplus that can be put aside for use during a period of resource scarcity. For this reason, we would not expect to find evidence of mass capture technology among hunter-gatherer groups who did not employ storage as a risk response.

Small-Scale Storage

The type of storage relevant to this study is referred to by Cunningham (2011) as small-scale storage. This refers to food storage that involves fewer storage facilities and less development and planning than large-scale storage with the ability to serve only a limited number of people. Small-scale storage is usually not attributed to the storage of food surplus for replanting as seen among farmers but may be storage of food for a period of seasonally low food availability or for exchange. Short-term storage refers to storage for some duration less than three months (Cunningham 2011:137).

In the subarctic, food storage pits, or caches, are typically located at procurement areas, habitation sites, or even along travel routes (i.e. coastal periphery or interior water ways). This strategic placement provides security when groups revisited an area, supporting mobility within a wide-ranging resource province (Stopp 2002). Diamond Jenness, a western Arctic ethnographer, noted the strategic placement of caches saying:

In every region there are certain well-known highways that lead into the interior, and the native naturally makes his caches at the entrance to the one which leads to the particular district that he has chosen for his summer home; then in the fall he returns by the same route. The spring cache-sites therefore are often the same as the winter-assembling places [Jenness 1970:122].

Ethnographies from the Canadian Arctic give several historic examples of the use of cache pits among seasonally mobile populations. In a narrative from Michel Grégoire (1989) describes the use of strategic storage of food, tools, and personal items at the end of the winter season in the interior. These storage pits were often placed at the junctions of rivers flowing into main travel routes (Richard 1989; Stopp 2002).

Historic Perspectives

There are several types of pits mentioned in historical accounts throughout the Great Lakes region. These narratives provide important contextual information for the use of pit features among Native Americans in this region. Discussed below, these documented descriptions of pit use will help conceptualize the technical choices and performance characteristics in the design decisions made by Woodland period groups of the Upper Peninsula of Michigan.

Cache Pits

Storing food in subterranean pits is a well-documented activity in Great Lakes regional ethnographic works (Blackbird 1887; Densmore 1929; Hilger 1951; Kohl 1985; Parker 1968; Waugh 1916). One of the earliest mentions of the use of pits for food caching was recorded by French missionary Pierre Charlevoix in 1721. Charlevoix observed the Miami of the St. Joseph Valley in southern Michigan reporting that “their corn and other fruits are preserved in receptories (sic), which they dig into the ground and which are lined with large pieces of bark” (Charlevoix 1923:112-113). During the 1930’s, Ojibwe in Wisconsin and Minnesota used similar caches to store dried corn, maple sugar, dried berries, wild rice, dried vegetables, and dried meat and fish. These stores were dug near the wigwams, the foods being retrieved for winter consumption (Hilger 1951:149). In August of 1933, Hilger witnessed the opening of a cache to retrieve stored potatoes a person wished to sell. “The cache, 6 feet deep and nearly 3 feet square, was lined with hay to about the depth of 8 inches... each jar was so placed that it could be surrounded with hay.” Hilger noted that the woman had three caches. The informant goes on to

say “The food I need for the winter, I keep in my house...whatever I put in the caches stays there until the snow melts. That’s the hardest time of all the year” (Hilger 1951:150).

Overtop of the caches the woman made a heap of earth at least 18 inches above the ground level. This was covered by several armfuls of cornstalks and dead leaves. These were placed on top of the pit to “fool the deer.” She remarked that deer will not walk through dead leaves and cornstalks because their feet will catch on them. If these measures were not taken, the deer would feel a soft spot in the earth and would be made aware of the food hidden underneath their feet (Hilger 1951:149). Hilger (1951) also recorded the use of a much smaller food cache used to store a few potatoes at the Red Lake reservation. This small pit was 3 feet 7 inches long, 3 feet 5 inches wide, and 4 feet 2 inches deep. The cache was covered by heavy timbers and 18 inches of dirt was thrown over top (Hilger 1951:150).

As reported by Frances Densmore (1929), an American anthropologist and ethnographer who worked among the Chippewa, it was customary to store foodstuffs procured during the summer in caches or pits dug near the village. “The food kept perfectly, the pits were never disturbed, and this method of storage was safe and practical” (Densmore 1929:40). A cache pit was typically around six feet deep and lined with birch bark. Food items such as rice and sugar were kept in birchbark containers, or *makuks*, stored within the pit, and the spaces between them were filled with hay/dry grass. Dried fish were packed together and tied in bundles and other dried meats were stored in bags. After pits were filled they were covered with birch bark or hay. Then wooden timbers were laid across with mounded dirt piled on top. This work was done by the women of two or three families, often putting each food item in its own separate pit (Densmore 1929:40).

Charles Eastman (1902) wrote of his Santee Dakota childhood growing up in Minnesota. At winter camps, caches of dried buffalo meat hunted during the summer were stored in different places so they could be accessed when needed. “Caches were dug by each family in a concealed spot, and carefully lined with dry grass and bark” (Eastman 1902:237). Eastman emphasizes how important it was to conceal the surplus of food and notes the great measures the women would take to protect their underground hiding places. Similarly, Charlevoix (1923) discussing the Miami, and Atwater (1831) an early Euro-American researcher of Northwestern Indians, made clear the seriousness of concealing underground stores to protect food surpluses from being stolen from enemies.

Hide Smudging Pits

Smoking animal skins was often accomplished by slowly smoking the hides. There are ethnographic cases among the Ojibwe for smoking hides using small pit features. According to Hilger (1951), the Ojibwe soaked the hide in water for three days. After soaking, the skin was stretched taught to scrape off fur and fat, the skin was then left to dry in the sun. After being dried, it was hung over a smoldering fire allowing the hide to fill with smoke (Figure 9). When the hide was sufficiently smudged and reached a desirable color, it was turned over to tan the other side. Densmore (1929) recorded early twentieth century Ojibwe smudging hides stating:

if several hides were to be smoked, they were sewn together in such a manner that they formed... [a] conical shape... A hole was dug about 18 inches in diameter and 9 inches deep. Over this a framework was constructed [t]hat resembled a small tipi frame. The hide was suspended above the framework and drawn down over it... A fire had previously been made in the hole... using dry corncobs for the purpose. This fire smolders slowly, the smoke giving the hide a golden yellow color [Densmore 1929:164-65].

Similar smoking of hides was recorded among a number of bordering groups including the Iroquois (Mason 1891:573; Morgan 1901:13), and Menominee of Wisconsin (Skinner 1921:228). Smudging animal skins with smoke was done to waterproof hides used for clothing and moccasins (Skibo et al. 2007). The golden-brown color it produced also prevented the garment from looking soiled rapidly (Ritzenthaler and Ritzenthaler 1983:82).

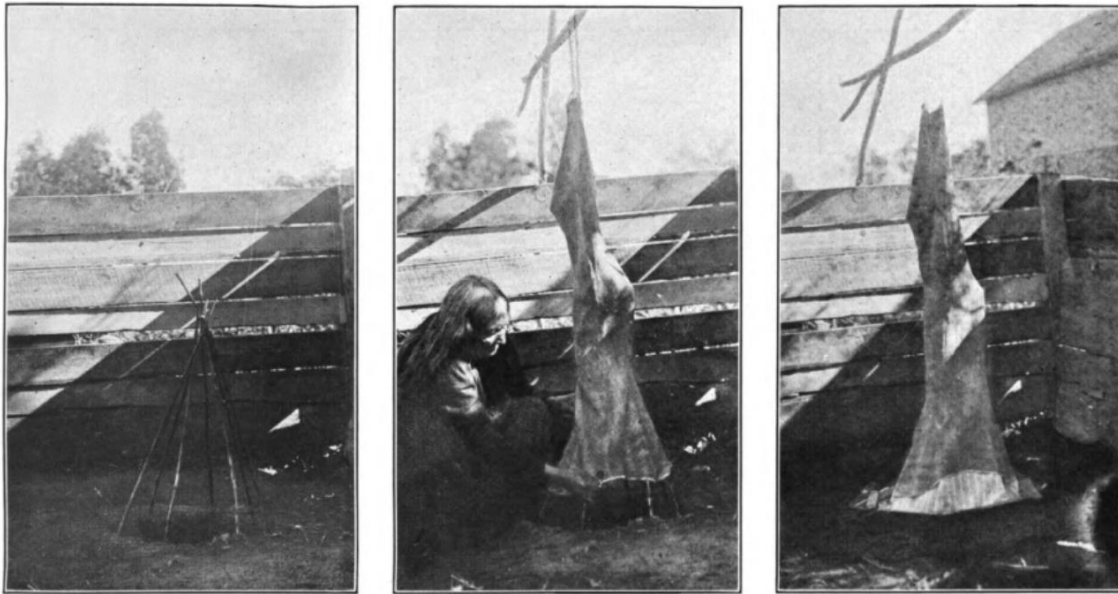


Figure 9: Photos of an Ojibwe women smoking deer hide (Bureau of American Ethnology, Bulletin 86, pl. 75).

Food Processing

Earthen oven: Using pits to cook food is a widely used practice and archaeological remains of such pits are common. These earthen ovens are well depicted in the ethnographic literature of the Great Lakes. Waugh (1916) wrote about these features used among the Iroquois saying, “pits of suitable size were frequently dug in the side of some convenient bank or clay deposit” (Waugh 1916:56). Inside the pits, a fire was built then the coals were removed and food items such as corn, squash, and roots were placed inside the pit and covered with ashes and

allowed to bake with what heat remained in the ground. Also writing about Iroquois food processing, Parker (1968) writes “for cooking food anciently the fires were generally made in sunken pits, variously called fire pits, pots or sunken ovens” (Parker 1968:60). Similarly, Kohl (1985) writes about the Iroquois along the southern shore of Lake Superior stating “these pits are first filled with burning wood and hot stones, heated, and then cleaned out. Then they are lined with the husks of the young corn, and the corn laid upon them and covered over with leaves, and upon them earth” (Kohl 1985:300). The Hiawatha National Forest recorded a series of oral histories from the early 20th century. Two of these histories come from *Sand Town*, an area near Nahma, Michigan, just 30 miles south of Grand Island (Moses 1994:36; Winberg 1994:24). In these histories, pit features were described as being used as shallow earthen ovens to bake bread, along with a reference to a larger roasting pit used to cook a pig for a communal feast.

Maple Sugaring: Maple sugaring camps are another example of mass food processing with pits. This was once an important activity in the Native American seasonal rounds of Great Lakes residents. Ethnographic sources indicate small family groups conducted this practice for about one month during the spring at the time of the sap run. Camps were located close to or within a sugar grove (Dunham 2000). Once the tree was tapped and a spout was placed in the wound, the sap was collected in birch-bark baskets (Thomas 2005). At the end of the season, large boiling kettles and other sugaring equipment was cached at the sugar bush (Densmore 1929, 1974). The sap itself was stored in shallow pits lined with animal skins or in wooden troughs. When it came time to reduce the sap, it was placed in iron kettles, which were hung over a fire (Dunham 2000). According to Dunham (2000), these sap storage vats would be physically similar to the food storage pits described in ethnographic literature, “a circular skin-lined pit 1 m in diameter and 1 m deep could hold approximately 155 gallons of liquid, suggesting that the

scale of such storage vats would be similar to [food storage pits]” (Dunham 2000:233). The only difference may be the pit locations, contents, lining, and possibly time period used. To date, there has been no archaeological evidence of maple sugaring prior to the historic period in the Great Lakes region (Mason and Holman 2000). Writing about early 20th century Native Americans of the western Great Lakes, Ritzenthaler and Ritzenthaler (1983) stated that after the sap was cooked by placing heated stones in the birchbark containers. After the contact period, these birchbark containers were replaced with metal kettles (Ritzenthaler and Ritzenthaler 1983:19).

Rice Threshing: Previous research has found limited evidence of wild rice consumption in the Upper Peninsula of Michigan. In fact, only a single grain of rice had ever been found at an archaeological site in the eastern Upper Peninsula (Egan-Bruhy 2007). Recent work in this region by Dunham, however, showed a correlation between documented wild rice beds from the 19th and 20th centuries and Late Woodland site locations, most of these in interior locales (Dunham 2014). Historically, rice camps were smaller aggregation locations including multi-generational extended family groups that came together to harvest and process the grain (Dunham 2014; Lofstrom 1987; Vennum 1988). Processing wild rice requires hulling the grain, which ethnographically has been performed in small pits dug in the ground lined with hides, clay, wood slats, or a small wooden container (Densmore 1974; Ritzenthaler and Ritzenthaler 1983; Vennum 1988). “The average treading pit measured about 18 inches deep and perhaps 2 to 3 feet in diameter” (Vennum 1988:123-4). Rice was placed in the pit and was stomped on with feet or was pounded with a mortar (Densmore 1929, 1974). Removal of the husks by stomping on the grains was called “dancing the rice” by historic western Great Lakes Chippewa (Ritzenthaler and Ritzenthaler 1983:26). Archaeologically, threshing pits generally present as basin-shaped features of varying depths, usually about one meter in diameter (Gobbin 1976;

Jenks 1990; Johnson 1969a). These pits are positioned on elevated, well-drained areas at the inlets and outlets of ricing lakes (Johnson 1969b).

The Fall Spawn

The settlement and subsistence pattern discussed in Chapter 3 emphasized seasonal mobility that focused primarily on spring and fall-spawning fish. The ethnographic record supports this notion. Densmore (1929) wrote extensively on the lifeways of the Chippewa. She notes that autumn was an important fishing season because it was the time when groups secured a supply of fish for use during the winter. During November, just before the lakes froze, women would begin to set their nets. “Much care was taken with this industry, as fish, both fresh and dried, constituted an important food of the Chippewa” (Densmore 1929:125). Densmore specifies six methods the Chippewa used to catch fish: seine nets, spearing at night with a torch, spearing through the ice with a decoy, traps, and by using bait on a fishhook or by trolling. “In early time the nets or seines were made of nettle-stalk twine, the lighter twine being used for the fish nets and the stronger twine used to tying the nets to the poles” (Densmore 1929:154). Seines were the most common method for obtaining fish because it captured the greatest number and variety of fish. Ritzenthaler and Ritzenthaler (1983) noted that “sometimes the nets, after being thoroughly washed, were dipped in a liquid made from sumac leaves.” This solution would kill any odors clinging to the net left behind by the fish. “Indians said no fish would come near a net with the slightest odor on it,” this treatment would “insure a good catch” (Ritzenthaler and Ritzenthaler 1983:22).

In autumn, women placed the nets in the water at night and retrieved them in the early morning. After the fish were gathered, the women would spread out the mesh of the nets to dry

them (Figure 10). If the fish were going to be used for immediate consumption they were cleaned and cooked, and fish that were to be stored for the winter were frozen without cleaning (Densmore 1929). This suggests that the only fish remains that would be found at capture sites would be the remnants of fish that were consumed for immediate use, the butchery of fish for winter storage did not take place at, or near the procurement location.

Andrew Jackson Blackbird, an Ottawa tribal leader, authored a book called “History of the Ottawa and Chippewa Indians of Michigan” (1887). This manuscript provides a wonderful history of many native peoples living throughout Michigan, particularly in the Mackinac Straits area. Detailed information is given on traditional hunting, fishing, sugaring, and trapping practices and the seasonal tasks that they require. Blackbird eloquently wrote about the spawning season in the Mackinac Straits saying:

And in these waters the fishes were so plentiful that as you lift up the anchor-stone of your net in the morning, your net would be so loaded with delicious whitefish as to fairly float with all its weight of the sinkers. As you look towards the course of your net, you see the fins of the fishes sticking out of the water in every way [Blackbird 1887:11].

Other historical accounts describe similar sentiments, demonstrating strong evidence that fish were a substantial component in Native American seasonal mobility patterns. The perspective that coastal aggregation sites used for the exploitation of fish consisted of larger multi-family and extended family groups is well illustrated by anthropologist Alfred Hallowell (1976) who wrote about the cultural adaptations of the northern Ojibwe in the areas of Manitoba, Canada.

Hallowell states:

As compared with the 32 winter hunting groups of the inland band... during the summer the same population was concentrated in five fishing settlements... There was no superordinate community organization in these summer fishing settlements.

Ostensibly they were simply aggregates of the members of the winter hunting groups who camped near each other at traditional spots during the season of open water. Numerically, this was the time of year when the largest number of Indians were to be found together, and opportunities for social interaction on a wider scale occurred [Hallowell 1976:337].

Johann Georg Kohl, a German traveler and historian, spent time in 1855 touring the southern shore of Lake Superior studying the lives of Ojibwe peoples.

People of the interior came at times long distances to profit by the fisheries. The migrations of the fish, their regular arrival and departure, the periods of their spawning being out of season and becoming in condition again, hence have a material influence on the movements of the population. [Kohl 1985:328].

These historical accounts make it evident that Native Americans of the Great Lakes followed seasonal logistic mobility patterns that put high importance on the fish spawn.



Figure 10: Chippewa women spreading fish nets to dry (Bureau of American Ethnology, Bulletin 86, pl. 44).

Discussion

These historic accounts likely reflect a logistical mobility pattern that originated in the Late Woodland. Maple sugar, wild rice, preserved produce, and dried fish are all fall seasonal subsistence resources that were harvested in surplus and stored for winter consumption. Pit features have played many important roles in the lives of Upper Great Lakes Native Americans.

The ethnographic accounts discussed here demonstrate that intended function of a pit feature gives information about the activities and behaviors of the group that led to the need for the feature.

Limited archaeological work has been done to explore the functions of pit features in the Upper Peninsula of Michigan. This research is an introductory step to understanding the role of pit features in this region. By isolating the technical choices along the features life history we can better understand the performance characteristics. These technical choices were inferred from the stratigraphic information, pit contents, and other contextual information. Radiocarbon dates, botanical data, and the ethnographic record gave contextual information to guide the functional interpretation. This approach was taken to answer the fundamental questions, Why were these pit features manufactured during this time period, in this location, and what was their function? By answering these questions there will emerge a new line of settlement and subsistence information from a coastal island setting on Lake Superiors southern shore.

CHAPTER V

METHODS

Overview

Muskrat Point (site 03-910) was located in 1991 during a Cultural Resource Survey for the Manistique, Munising, and Rapid River Districts of the Hiawatha National Forest (Goltz 1992). The site was identified based on numerous positive shovel tests, artifacts eroding at the lake's edged, and exposed material remains found along the small two-track road that travels along the southern side of the islands western lobe. There were 260 pieces of lithic debitage, various cores, the tip of a biface, Middle Woodland ceramics, and fire cracked rock recovered from shovel tests. There were also several surface depressions briefly mentioned in the report. The ceramics recovered from the south-central locality of the site are "obviously Middle Woodland, resembling Laurel ware" (Goltz 1992:47). The ceramics recovered from the west-central locality appear to be Late Woodland and the materials from the uppermost Nipissing beach ridges contained only dense scatters of fire cracked quartzite debitage, which suggests a Late Archaic occupation. Because this was a relatively large site, covering several successive beach ridges, and the characteristics of the artifacts recovered, it was determined to be a multicomponent site. Under the guidance of the Grand Island Archaeological Program, a collaborative program between Illinois State University and the Hiawatha National Forest, a pit feature survey was conducted in the summer of 2017 to further investigate the pit features identified during this 1991 survey at the Muskrat Point site (03-910).

Spatial Analysis

Forested landscapes, like Grand Island, introduce major challenges in retrieving a comprehensive understanding of past human activities because of the limited visibility of the anthropogenic landscapes former inhabitants produced. Field surveys can be difficult and time consuming, which can result in limited coverage. Light detecting and ranging (LiDAR) technology has proven to be a cost-effective tool for detecting anthropogenic landscapes. Howey et al. (2016) was successful in detecting pit features using LiDAR derived data in Geographic Information Systems (GIS) software. Following the LiDAR collection techniques outlined by Howey and colleagues, I attempted to use this method to detect pit features at 03-910 on Grand Island. A bare-earth DEM and hill-shade raster clip derived from LiDAR data (2x2 ft cell resolution) were acquired from the Hiawatha National Forest. Using ArcGIS 10.2, I created a Digital Terrain Model (DTM) using classified point clouds and conversion toolsets.

Howey and colleagues (2016) acquired discrete return LiDAR data during leaf-off conditions. With this data non-vegetation returns were better than 1 m resolution. From this they were able to create a DTM from filtered subset points that classified bare earth points with an output cell resolution of 1 ft. By doing this Howey et al. were able to correct for tree cover. Unfortunately, limited spatial analysis capabilities and limited penetration of LiDAR pulses in the 03-910 study resulted in a DTM that did not sufficiently penetrate the tree canopy. The dense tree canopy in the research area resulted in a triangulated surface, in which non-ground vs. ground points were not able to be filtered (Figure 11). The only subterrestrial features I was able to delineate were borrow pits used to create historic roads near Duck lake (Figure 12).

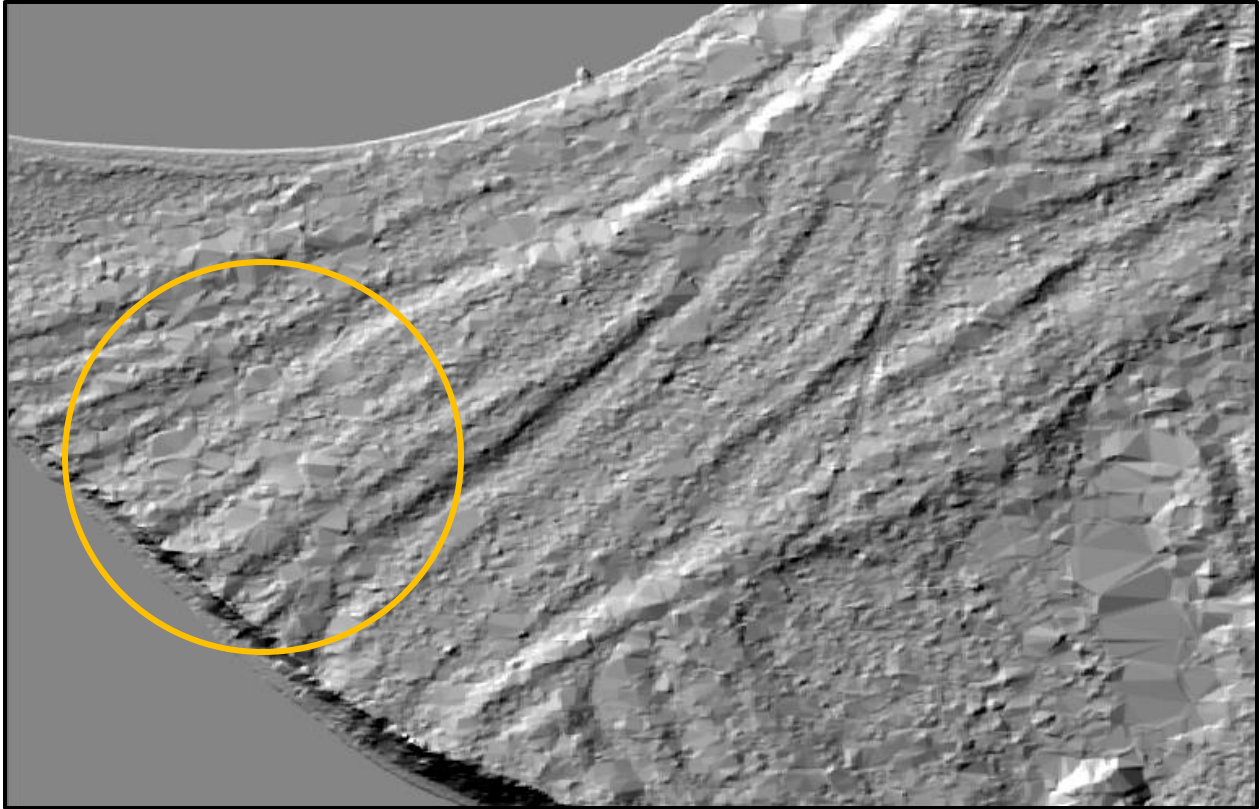


Figure 11: Triangulation caused by tree canopy in study area.

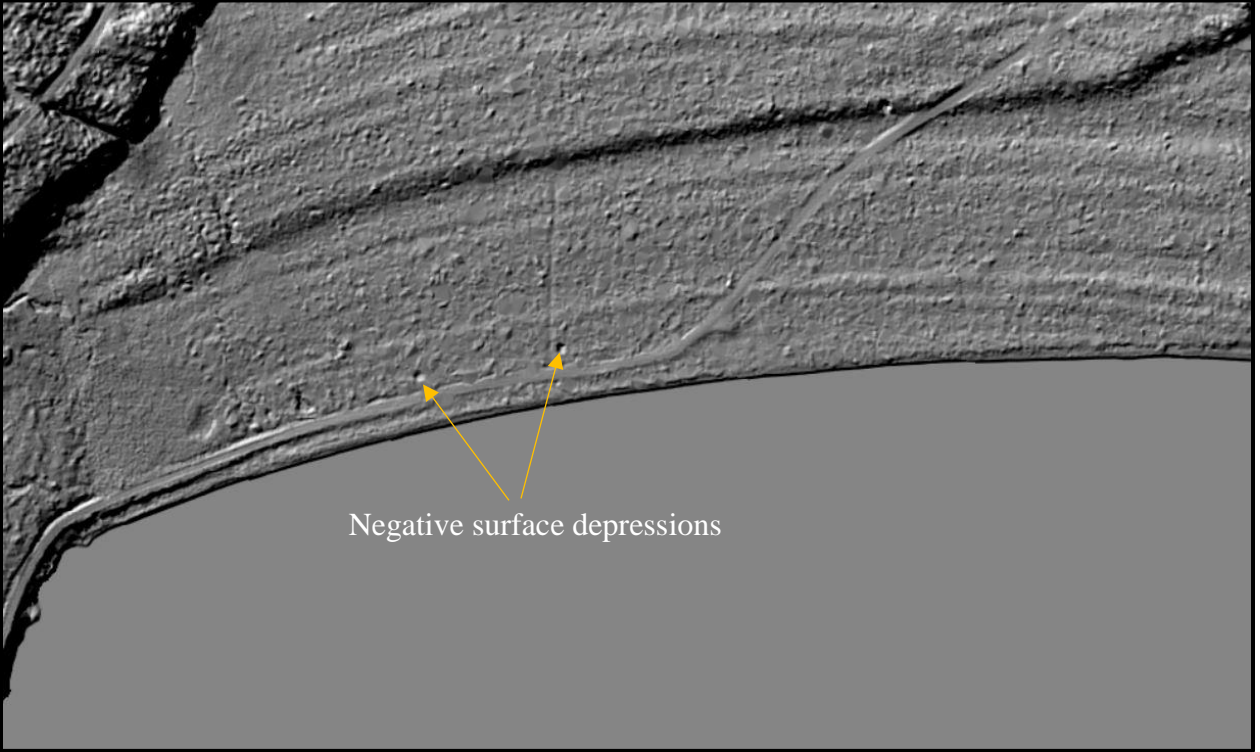


Figure 12: Borrow pits detected by terrain model.

Pedestrian Survey

In June of 2017, a pedestrian survey was conducted to identify visible surface depressions expected to be pit features. Because these circular depressions can look very similar to tree-tips, the margins of these features were examined carefully to look for 'D' shaped outlines with bulging or evidence of tree remains on one side (Schaetzl et al. 1988). A combination of walkover transects, and surface examination was employed, and probable pit features were recorded using a hand-held GPS device. The GPS device was placed in the center of the pits to collect northing, easting, and elevation data (N, E, Z respectively). Three or more GPS points were collected for each pit at increments of 90 minutes or greater to increase the accuracy of the point data. During this walking survey, 23 surface depressions likely to be pit features were identified (Figure 13), with features numbered consecutively in the order they were found. Four of these pits were profiled at modern ground surface to gain a better idea of pit surface morphology. Ideally, profiles of each pit would have been taken at the surface, but rain and a limited crew hindered the ability to completion of this undertaking.



Figure 13: Locations of the twenty-three surface depressions identified during pedestrian survey. The westerly groups, marked with the star, are the pits found at the Muskrat Point site (map created using Google Earth Pro satellite imagery).

Excavation

Primary excavations took place in early July of 2017. A soil core was used to observe stratigraphy suggestive of a pit feature and to look for evidence of burning/charcoal. Three of the surface depressions were cored, but this method was unsuccessful in providing any distinguishable changes in soil color or stratigraphy, other than change between the modern organic horizon and an ambiguous sandy horizon below it. The limited size of the core was one of the main reasons it did not provide useful data. The tool was only able to go down about three feet, not reaching the bottom of the pit features. Ultimately, even with a longer tool, this method may not have discerned the very subtle stratigraphy that defined the boundaries of the pit. Such faint color changes in the sand soils of these features would not be picked up by a coring tool.

Instead of the coring method, features chosen for excavation were based on their surface characteristics. Overall, the goal was to select surface depressions representing diverse surface morphologies: one shallow pit feature located at a moderate elevation (Pit Feature 21), one surface depression representing an intermediate depth located in an area of lower elevation (Pit Feature 3), and two relatively deep surface depression at a higher elevation (Pit Features 10 and 12) (Figure 20). One quarter of each surface depression was excavated, quartering was set up based on cardinal directions. Excavation levels followed stratigraphic layers as closely as possible until the base of the pit feature was located. All soils from each level were screened using 1/4-inch mesh, materials were bagged according to level, and 10 L soil samples taken from each level for flotation. All three of the surface depressions excavated in June showed outlines of pits and were determined to be cultural features.

The first quarter (northeast) excavation of Pit Feature 21 was followed by a second quarter (southeast) being dug and soil screened without the concern for stratigraphy, with the purpose of gaining a full view of the west wall profile down the center of the feature. This decision to excavate half of the feature was made after discovering a complex stratigraphy, one which was better informed by the profiles of three walls, along with a direct look at the cross section of the feature down its center. Pit Feature 21 was the only feature with carbonized wood remains, and four samples were taken for radiocarbon dating. The location of the samples taken were piece plotted. Results from radiocarbon dating are discussed in Chapter 6.

In August of 2017 a fourth surface depression was excavated following the same method outlined above. This feature was also determined to be a pit feature (Pit Feature 10). There was a massive root disturbance that impeded the bulk of the pit, but careful steps were taken to keep

the walls of the unit intact during excavation, along with preserving the root to save the tree. Because of the root disturbance, only one wall profile was drawn.

Shovel Testing

Extensive shovel testing was conducted during the 1991 archaeological survey (mentioned above) and again in 2010 (only field notes are available for the later work). Because of the large scale of the shovel testing done in previous years it was thought that no additional information could be gathered with additional shovel test pit (STP) transects. In August 2017, however, a small number of STPs were placed around the locale of Pit Feature 21 to find the extent of the feature boundaries and to see if the buried A horizon could be followed outwards from the feature (see Figure 14). In addition, a transect of STPs were put in starting at the shoreline bank along the south side of the site heading northeast towards the southern wall of the Pit Feature 21 excavation unit. These shovel tests were put in to provide further insights on a possible buried A horizon seen along the shore line at the southern end of the site. STPs were dug as deep as possible, approximately 70 cm, and were not terminated unless roots were impassible, each of the shovel tests was excavated to a minimum depth of 53 cm.

Six STPs were placed on the transect extending from Pit Feature 21 southwest towards the shoreline. A total of 10 STPs were placed in small transects north, east, and west of Pit Feature 21. A 0.5 x 1 meter trench was chosen to locate the southern extent of Pit Feature 21 boundaries because the STPs on the transect running from the bank to the southern edge the excavation unit did not locate the buried A horizon. Figure 14 shows the placement of the 2017 STPs and trench excavation in relation to the Pit Feature 21 excavation unit.

Modern Surface Diameter of Pit – This measure is the diameter at of the pit feature as it exists at the modern ground surface. The two positions for this measure are the for this measurement are the point where the ground surface (top of duff) begin to slop downward, A to A’.

Modern Surface Depth of Pit – This measure is the depth of the pit feature at it exists at the modern ground surface. For this measurement a line is drawn across the modern surface diameter (A to A’), then the depth is measured form this line to the lowest point of the pit at modern ground surface (D).

Top Diameter of Pit at Use – This measure is the diameter of the pits top at the time of use. The two positions for this measurement are the points where the outline of the pit feature begins to slope downward, B to B’.

Base Diameter of Pit at Use – This measure is the diameter of the pits base. This is done by finding the two points at the bottom of the feature where the outline of pit begins to slope inward, C to C’.

Depth of Pit at Use - This measurement is a calculation of the depth of the pit feature at the time of its use. To estimate this measure, a line can be drawn from B to B’, the diameter of the pit features outline. The depth is then measured from the B to B’ line to the central base of the pit (E).

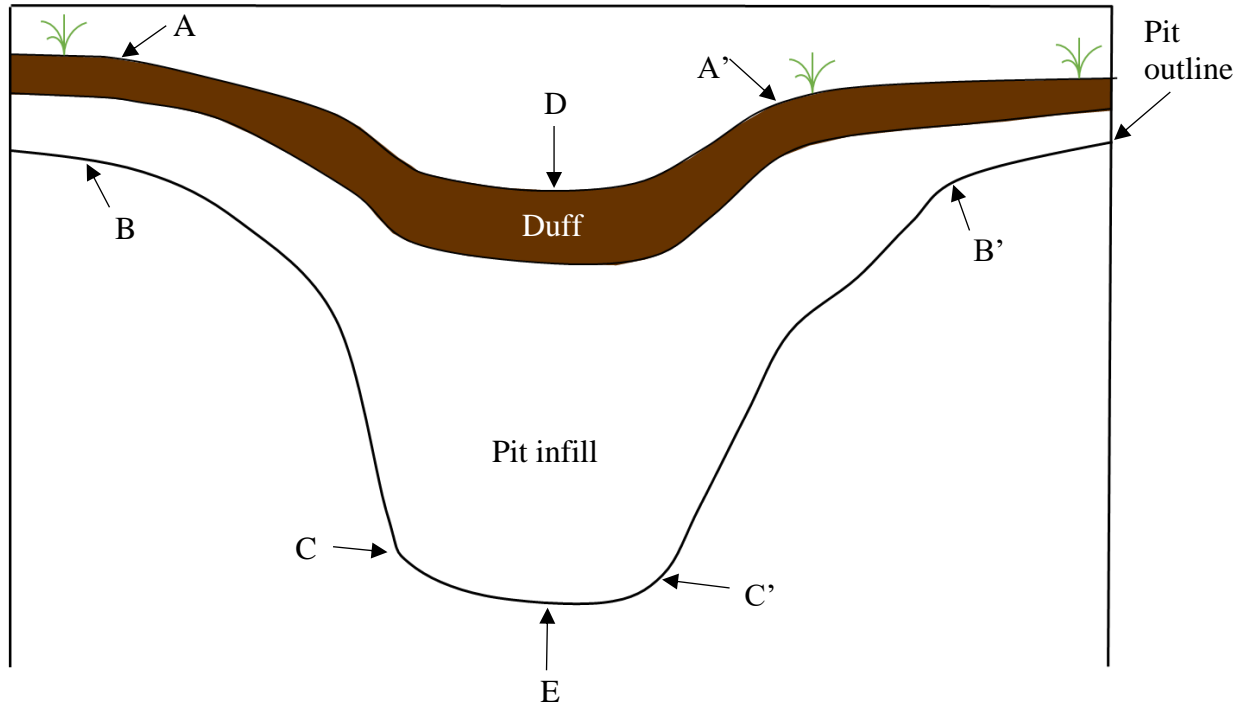


Figure 15: Diagram showing important points of measure for pit feature morphometrics.

Estimated Volume of Pit at Use – An estimated volume of the pit is a significant measure in the consideration of its capacity. This estimate is done using a conical frustum volume calculation,

$$Volume = \frac{1}{3} \pi h (R1^2 + R2^2 + R1 \times R2).$$

This measure is done by using the top radius (top diameter at pit use divided by two), bottom radius (base of pit diameter divided by two), and height (depth of pit at time of use) (Figure 16).

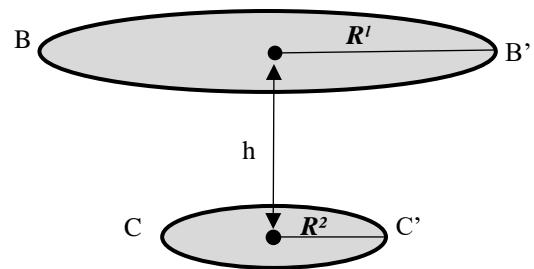


Figure 16: Diagram showing measurements used for calculating pit volume.

Microbotanical Analysis

Flotation samples were taken from Pit Feature 3, 12, and 21. One or more 10-liter samples were taken from each of the feature levels of each pit, totaling 13 samples. These samples were processed in early August on the lawn behind Schroeder Hall at Illinois State University using a continuous flow of water and bucket technique (Figure 17). This device was made using a 10-gallon plastic bucket with a spout placed near the top. One soil sample was processed at a time, rinsing out the bucket after every use. After the sample was placed at the bottom of the bucket a hose with a controllable nozzle was used to fill the bucket with water and then control the flow of water during the flotation process. Underneath the spout were three finely meshed soil sieves of various mesh size, largest mesh size at the top in descending order of size. These sieves were elevated slightly off the ground to allow for water to pass through them. As the water reached the level of the spout, the water then poured out moving through the sieves, taking any floating material with it. The hose nozzle was used to control the flow of water, and a kayak paddle was used to agitate the sample, freeing materials to float to the top.



Figure 17: Bucket technique flotation method (photo courtesy of James M. Skibo).

The organic materials collected from the largest mesh size sieve (5 mm) were recovered as large fraction, and the materials from the two smaller mesh sizes (2.5 mm and 1 mm) were

recovered as light fraction. Recovered materials were allowed to dry in the Illinois State University Prehistoric Archaeology Lab for three days. After samples were dried, they were picked through to find carbonized organics using tweezers and a magnifying lamp. These materials were sent to Kathryn Parker for analysis, the results are discussed in Chapter 6.

Fire Cracked Rock Analysis

The research goals for this artifact analysis were to compare the relative amounts of campfire/dry cooling and stone boiling/wet cooling. Fire cracked rock (FCR) is a pervasive artifact type in the Upper Great Lakes. For the purposes of this analysis, FCR is defined as any rock that exhibits morphological or physical characteristics of thermal alteration. As rocks are heated, the color and texture of the rock alter in easily recognizable ways. In addition to changes in color and texture, rocks frequently fracture, crack or shatter, forming distinctively irregular fracture surfaces and a considerable amount of debris (Neubauer 2016:355; Speth 2015:22). The methods used for this analysis were developed by Neubauer (2016), who established her methodology based on experimental studies of heat altered cobbles from Grand Island and archeologically retrieved FCR from two Late Archaic sites on Grand Island. I visually examined all FCRs from 2017 excavations and shovel tests of 03-910 to look for the following characteristics of campfire/dry cooling and stone boiling/wet cooling.

Campfire/Dry Cooled

Fracture of expansion is more commonly associated with rocks that are heated and dry cooled in a fire hearth. This type of fracture is the result of the rocks exterior heating and expanding faster than the relatively cooler interior (see Figure 18). FCRs that have dry cooled have smooth flat, convex or concave breakage faces (Neubauer 2016).



Figure 18: Example of expansion fractured FCR from 03-910 that have smooth interior faces, characteristic of dry cooling (photograph taken by author).

Stone Boiling/Wet Cooled

Fracture of contraction is more commonly associated with rocks that are cooled rapidly in water and have been associated with stone boiling. Wet cooled FCRs have very distinctive irregular wavy/jagged fractures on the breakage face, exhibiting two or more ridges on the inside of the rock (Figure 19). The breakage face of wet cooled FCRs is rough to the touch and have undulating interior surfaces (McParland 1977:32). This type of fracture is the result of the rocks' exterior cooling quickly, causing stress contractions as a result of the temperature shock (Jackson 1998:39-41). In Neubauer's experimental study using cobbles from Grand Island, she discovered that *fine crazing* was only observed on stone boiled/wet cooled FCR (Neubauer 2016:246). Fine crazing is the "presence of a delicate network of very shallow surface cracks, comprised of fine, non-linear or latticed cracks on the surface" of the rock (Figure 19) (Neubauer 2016:201).



Figure 19: (Left) Example of FCR exhibiting fine crazing from 03-910; (Right) Example of contraction fractured FCR from 03-910 exhibiting wavy/jagged interior faces. Both characteristic of wet cooling (photographs taken by author).

Discussion

In this chapter I outlined the different methodologies used in the locating, excavating, and analyzing pit features and associated material from the Muskrat Point site on Grand Island, Michigan. I have also discussed the different methods of identifying the different fracture patterning used to determine the type of heating used in FCR. In the next chapter I discuss the results of these analyses, reviewing the evidence and investigate how the data contributes to the research question answered in this thesis.

CHAPTER VI

RESULTS OF ANALYSIS

In this chapter, I will review the results from the pit feature excavations along with an analysis of the artifact assemblage. This is followed by contextual information related to the Muskrat Point locale and a set of performance matrices created based on historic literature and archaeological investigations. These performance matrices help to isolate performance characteristics to highlight patterns and relationships between the physical, contextual, and temporal aspects of pit feature function in this region. These isolated performance characteristics will be considered in the following chapter (Chapter 7) in the interpretation of function of the Muskrat Point pit features.

Fifteen surface depressions likely to be pit features were identified in the Muskrat Point locale and four were chosen for further study. These pits were selected based upon a diverse selection of location and surface characteristics. Pit Feature 3 was the most westerly located pit with an intermediate depth at the surface, Pit Feature 10 was in the eastern portion of the site and extremely deep at the surface, Pit Feature 12 was also a larger westerly pit that was very near to the cliff edge, and Pit Feature 21 was extremely shallow at the surface and centrally located.



Figure 20: Map of pit features identified at the Muskrat Point site (03-910) with attention drawn to the pit features that were excavated during summer 2017 field season (map created using Google Earth Pro satellite imagery).

Pit Feature 3

Pit Feature 3 is one of the most westerly pits found at the site, approximately 40 m northeast of the Lake Superior cliff edge (Figure 20). Pit Feature 3 is an intermediate size pit with a modern surface diameter of 195 cm, and a modern surface depth of 41 cm (Figure 21). A 1x1 meter test unit was dug in the southwest quarter of the pit feature. The quartered test unit was excavated until the base of the pit was clearly identified. Pit Feature 3 is straight sided with a squared bottom (Figure 22). The top diameter at time of pit use is 132 cm, the base diameter is

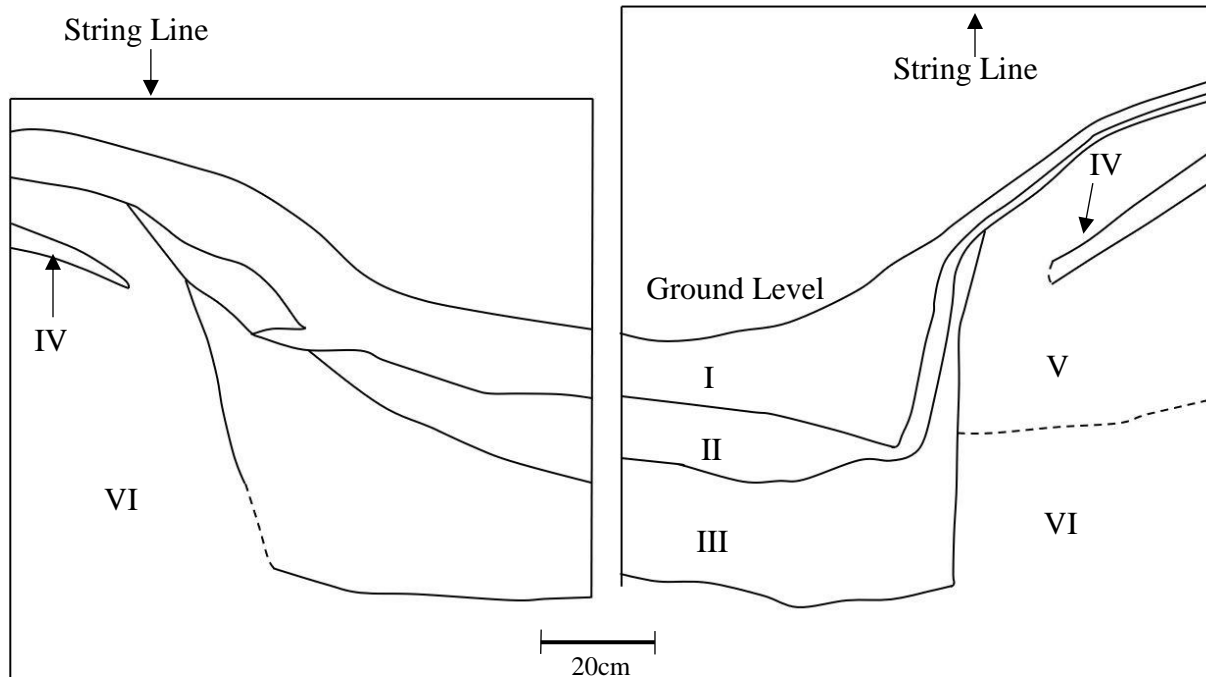
103 cm, the depth at time of pit use is 61.5 cm, and the estimated volume of the pit at use is 0.67 m³. Stratigraphic interpretation of the profile walls identified distinct soil color changes showing a period of natural infill (level III). This is a sterile sandy loam 10YR8/2, very pale brown soil. Superior to that is sandy loam 10YR5/1, a gray sandy soil (root leech), stained by roots and duff level above it. This is covered by 10YR2/2, the black modern organic horizon with dense root mass (duff). On both sides of the feature, 22-25 cm below the surface, are interrupted bands of 10YR4/2 dark grayish brown soil, representing the buried A horizon (buried living surface).



Figure 21: Pit Feature 3 prior to excavation, modern ground surface (photo courtesy of James M. Skibo).

East Wall Profile

South Wall Profile



Level	Munsell	Description
I	10YR2/2	Duff/Organic layer. Very dark brown dead plant matrix with roots.
II	10YR5/1	Gray loamy sand. Root leech.
III	10YR8/2	Very pale brown sand.
IV	10YR4/2	Buried A horizon. Dark grayish brown loamy sand.
V	10YR6/2	Light brownish gray sand.

Figure 22: East and west wall profiles of Pit Feature 3 (photographs taken by author).

Pit Feature 10

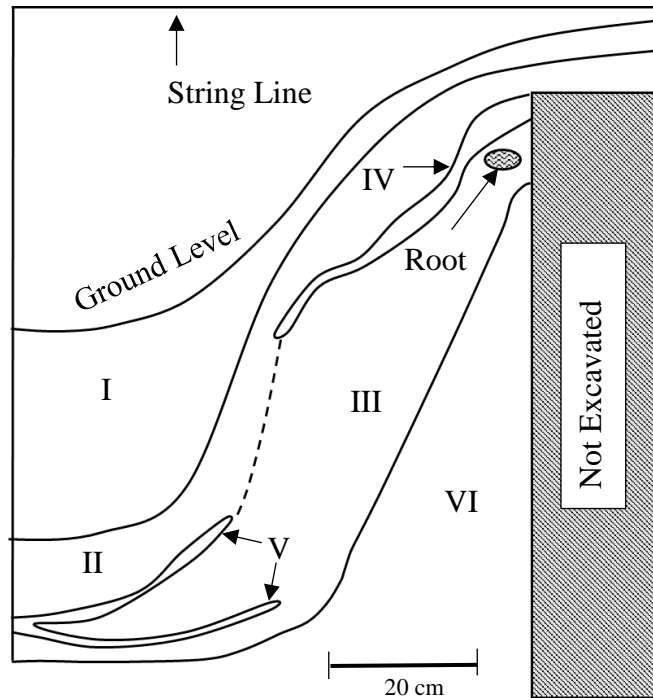
Pit Feature 10 is located in the eastern portion of 03-910 (Figure 20). The feature is approximately 28 meters northeast of the shoreline. A 1x1 meter test unit was dug in the southeast quarter of the pit feature. Pit 10 was the largest surface depression excavated during this field season, with a modern surface diameter of 250 cm and modern surface depth of 68 cm (Figure 23). The northwest quarter of this feature was excavated until the base of the pit was clearly identified. There was a massive root intrusion that greatly affected the ability to excavate this unit and view the north and west profile walls. Because of this intrusion, only the north wall could be profiled. Subsequently the diameters, depth, and volume of pit at time of use had to be estimated by doubling the measure of the north wall profile. The outline of Pit Feature 10 is basin shaped with a rounded bottom (Figure 24). The top diameter at time of pit use is 228 cm, the base diameter is 124 cm, the depth at time of pit use is 107 cm, and the estimated volume of the pit at use is $2.68 m^3$. These measures could be an overestimation of the pit dimensions because of the root intrusion. Stratigraphic interpretation of the profile wall identified three distinct soil color changes that suggest different periods of natural pit infill. At the base of the pit is sandy loam 10YR6/2, a light brownish gray sandy soil. Within that soil layer is a likely decomposing root (level V). Above that is a level of 10YR5/2 grayish brown loamy sand. Above that is a level of 10YR2/52, the black modern duff layer with dense root mass. On the right side of this north wall profile is the likely buried A horizon, an interrupted band of 10YR3/2, very dark grayish brown soil with a root mass.



Figure 23: Images of Pit Feature 10 prior to excavation, modern ground surface (photographs taken by author).



North Wall



Level	Munsell	Description
I	10YR2/2	Duff/Organic layer. Very dark brown dead plant matrix with roots.
II	10YR5/2	Grayish brown loamy sand.
III	10YR6/2	Light brownish gray loamy sand.
IV	10YR3/2	Buried A horizon. Very dark grayish brown sand with plant matrix.
V	10YR3/3	Dark brown plant matrix. Decomposing root.

Figure 24: North wall profile of Pit Feature 10 (photograph taken by author).

Pit Feature 12

Pit Feature 12 was the most easterly pit excavated during this field season. The feature is approximately 12 meters northeast of the shoreline, representing the pit excavated closest to the Lake Superior shoreline (Figure 20). A 1x1 meter test unit was dug in the southwest quarter of the pit feature. Pit Feature 12 was the second largest surface depression excavated, with a modern surface diameter of 210 cm and a modern surface depth of 60 cm (Figure 24). The top diameter at time of pit use is 170 cm, the base diameter is 66 cm, the depth at time of pit use is 71 cm, and the estimated volume of the pit at use is 0.83 m^3 . Overall, the outline of the pit feature was basin-shaped with gradually sloping walls (Figure 25). The stratigraphy of this feature is a little more complicated than the previously mentioned pits, particularly the eastern wall profile. The bottom level of the pit is sandy loam 10YR6/2, a light brownish gray soil (level II). At the base of this level are two thin layers of dark soils with an organically rich matrix (10YR2/2), thought to have been a bark or woody pit lining (level IV). A sample of this was taken from both layers and analyzed by Kathryn Parker. The upper most 10YR2/2 organically rich layer had no botanical remains, and was likely to be a decaying root, not a cultural occurrence. The organically rich matrix at the extreme bottom of the pit outline had remains of bark and conifer (Table 11 and Figure 30). This could be evidence of a pit lining, or it could be naturally occurring decayed tree matter. The buried A horizon is only visible on the east wall profile.

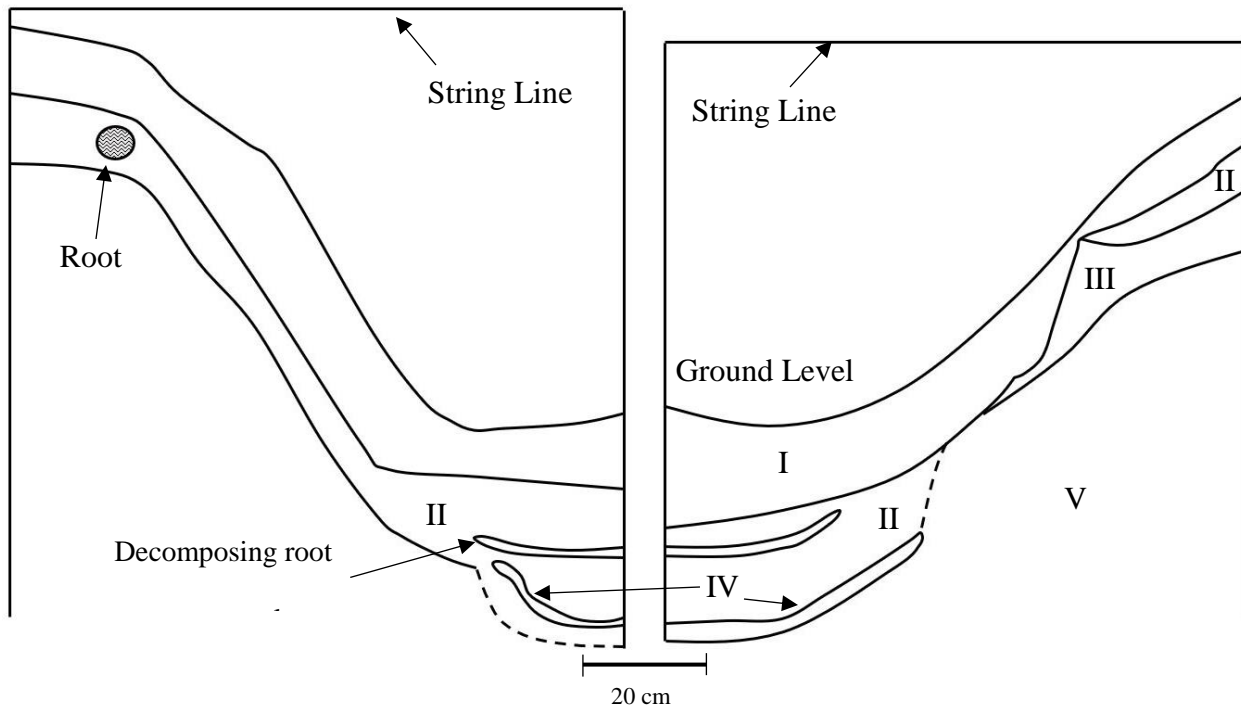


Figure 25: Images of Pit Feature 12 prior to excavation, modern ground surface (photographs taken by author).

North Wall Profile



East Wall Profile



Level	Munsell	Description
I	10YR2/2	Duff/Organic layer. Very dark brown dead plant matrix with roots.
II	10YR6/2	Light brownish gray loamy sand.
III	10YR4/2	Buried A horizon. Dark grayish brown sand with plant matrix.
IV	10YR2/2	Very dark brown plant matrix.
V	10YR8/2	Very pale brown sterile sand.

Figure 26: North and east wall profiles of Pit Feature 12 (photographs taken by author).

Pit Feature 21

Pit Feature 21 is centrally located within the pit complex at 03-910 (Figure 20), approximately 35 meters northeast of the shoreline. A 1x1 meter test unit was dug in the northeast quarter of the pit. Pit Feature 21 was the shallowest surface depression excavated with a modern surface diameter of 180 cm and a modern surface depth of 29 cm (Figure 26). This is a basin-shaped pit with relatively steep walls. Carbonized wood remains were found in the southwest corner of the test unit, about 30-42 cm below the center of the pits surface, a C14 sample was taken from this area. These carbonized remains were surrounded by a gray ashy matrix with many charcoal flecks. Because of the unique burning evidence in this feature, a second 1x1 meter unit was dug in the southeast quarter of the feature to attain a clear bisection of the pit feature down its center (Figures 27 and 28). The stratigraphy suggests there was a secondary use associated with this pit feature. The outer pit dimensions are: top diameter at time of pit use is 166 cm, the base diameter is 52 cm, the depth at time of pit use is 85 cm, and the estimated volume of the pit at use is $0.87 m^3$.

Interestingly, the pit feature is outlined by the buried A horizon (level IV). This level continues in to the north and south walls of the test unit. Directly above the buried A horizon is a level of 10YR6/4, sterile light yellowish brown sandy loam (level III). Above level III, in the center of the pit feature, there is a basin-shaped area with ashy soils containing a great amount small charcoal flecking (level V), surrounded by a layer of 10YR4/1 dark gray loamy sand heavily mottled with medium sized charcoal flecks. Superior to this is levels I and II, the duff level (I) and a layer of gray root leech (II), respectively. Three additional C14 samples were taken from the west wall profile, locations of carbon and samples take are illustrated in Figure 6.6. In total, two of the four samples were selected for dating, both from the west wall bisection,

one coming from level V and one from level VI, the results from the C14 dating are discussed below.

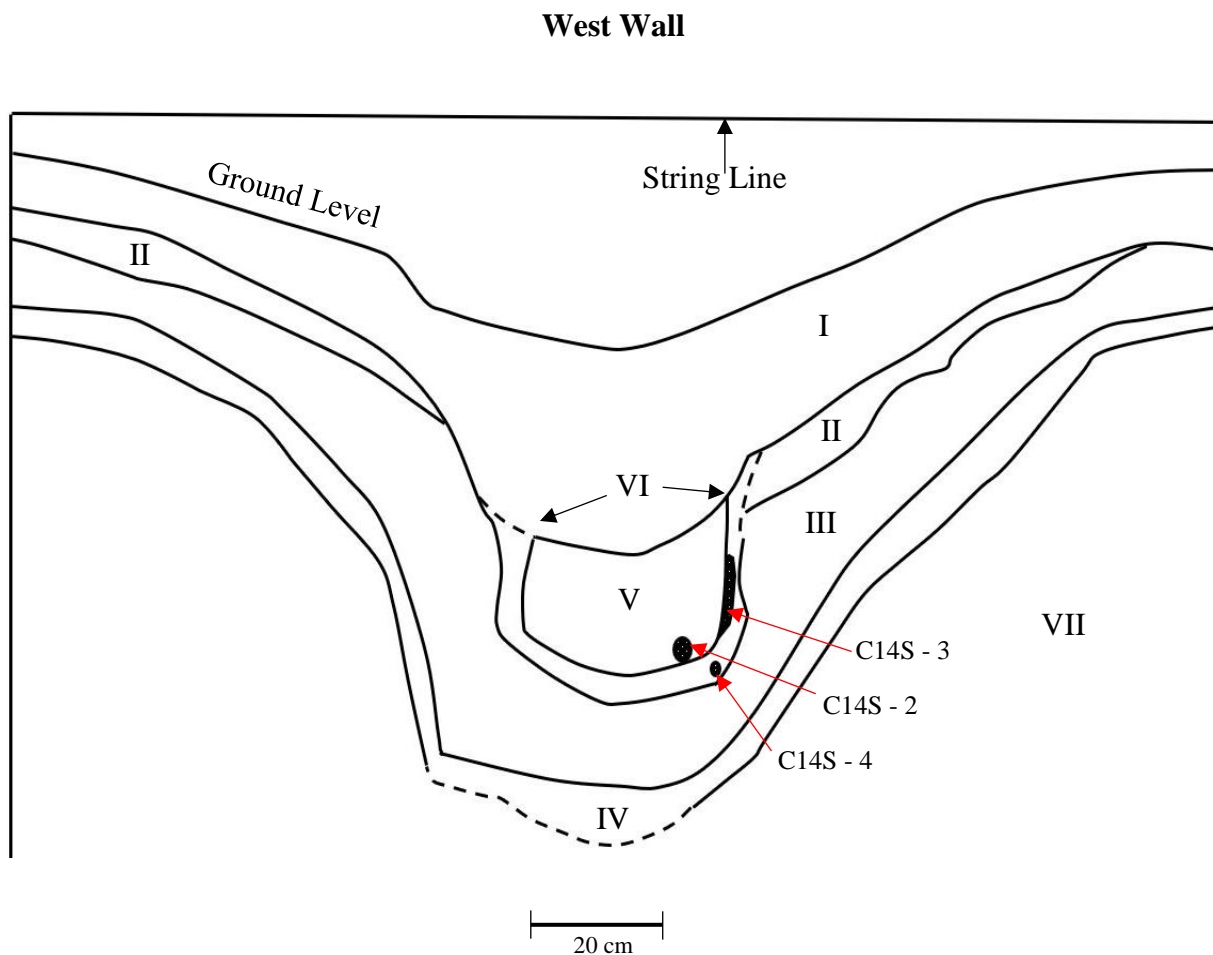
The buried A horizon (level IV), showing the outline of the pit, is covered by level of sterile soil. It appears that once the original pit was dug, there was a period of abandonment when windblown sands naturally deposited in the feature (level III). At a later time, the pit was revisited. During the return to this pit there was a burning event in the pits center (levels V and VI). The C14 date for sample 2 is ca. 1301-1413 AD, and the date for sample 3 is ca. 1193-1277 AD, dating Pit Feature 21 to the Terminal Woodland period (Table 9). The inner pit has a top diameter at time of use of 44 cm, a base diameter rat time of use of 28 cm, a depth at time of use of 35 cm, and an estimated volume at time of use of $0.04 m^3$.



Figure 27: Image of Pit Feature 21 prior to excavation, modern ground surface (photograph taken by author).



Figure 28: Photographs of Pit Feature 21 west wall profile (photos courtesy of James M. Skibo).



● Charcoal/ areas where C14 samples (C14S) 2 - 4 were taken.

Level	Munsell	Description
I	10YR2/2	Duff/Organic layer. Very dark brown dead plant matrix with roots.
II	10YR5/1	Gray loamy sand with dense root mass. Root leech.
III	10YR6/4	Light yellowish brown sterile loamy sand.
IV	10YR4/2	Buried A horizon. Dark grayish brown sand with plant matrix.
V	10YR5/1	Gray loamy sand. Ash layer heavily mottled with small charcoal flecks.
VI	10YR4/1	Dark gray loamy sand heavily mottled with medium charcoal flecks.

Figure 29: West wall profile of Pit Feature 21.

Table 9: Radiocarbon results from two carbon samples derived from Pit Feature 21. Analysis done by the Radiocarbon Collaborative. Dates provided with a 2 sigma, or 95% confidence.

Sample #	Fraction modern	±	Δ 14C (‰)	±	14 C age (BP)	±	Calibrated date
P21 S2	0.9295	0.0030	-78.0	3.0	585	30	1301-1413 AD
P21 S3	0.9059	0.0030	-101.4	3.0	795	30	1193-1277

Table 10: The surface and subsurface dimensions of the excavated pit features at 03-910. *Only one wall profile was sufficient for profiling. Measurements estimated for pit use dimensions based off a single wall.

03-910 Pits	Modern Surface Diameter	Modern Surface Depth	Top Diameter at Pit Use	Base Diameter at Pit Use	Depth of Pit at Use	Volume of Pit
Pit 3	195 cm	41 cm	132 cm	103 cm	61.5 cm	0.67 m ³
Pit 10*	250 cm	68 cm	228 cm	124 cm	107 cm	2.68 m ³
Pit 12	210 cm	60 cm	170 cm	66 cm	71 cm	0.83 m ³
Pit 21 outer	180 cm	29 cm	166 cm	52 cm	85 cm	0.87 m ³
Pit 21 inner	N/A	N/A	44 cm	28 cm	35 cm	0.04 m ³

03-910 Assemblage Analysis

Macrobotanical Analysis Results

Flotation samples were recovered from three of the four pit feature excavations and macrobotanical remains were analyzed by Kathryn Parker (Table 11). The botanical remains include three different tree taxa: white cedar (*Thuja occidentalis*), pine (*Pinus* sp.), and a single fragment of black ash (*Fraxinus nigra*). Figures 29 - 31 illustrate the locations of flotation samples and the recovered wood remains derived from them. Most of the wood in this

assemblage, about 95%, was from the Pit Feature 21 samples. All the white cedar fragments came from Pit Feature 21. This high frequency of white cedar suggests that the 49 wood fragments only identifiable as conifer from pit 21 are likely white cedar. However, two fragments of pine also came from Pit Feature 21, and a portion of the conifer remains may reflect this taxon. Apart from wood, miscellaneous remains included burned narrow dicot stems, small buds, nondescript woody seed fragments, a flower calyx, and glossy epidermis or plant cuticle. The remains of a charred beetle, though not botanical, complete the assemblage.

Table 11: Macrobotanical remains recovered from 03-910 Pit Features (analysis done by Kathryn Parker).

Sample Prov.	P3	P3	P3	P12	P12	P12	P21	P21	P21	P21	P21	P21	Total	
Sample Number	3	4	5	11	12	13	1	2	6	7	8	9	-	
Sample Volume (lit)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	120.0	
Total Wood (N)	24	5	4	5	2	5	420	74	11	*	350	125	58	1083
Total Wood wt. (g)	0.45	0.03	0.01	0.03	0.02	0.02	4.65	2.0	0.05	19.04	18.8	0.9	46.04	
Breakdown by taxon (N)														
<i>Fraxinus nigra</i> (black ash)	-	-	1	-	-	-	-	-	-	-	-	-	-	1
<i>Pinus sp.</i> (pine)	3	-	-	2	-	-	-	2	-	-	-	-	-	7
<i>Thuja occidentalis</i> (Northern white cedar)	-	-	-	-	-	-	-	5	-	10	6	1	22	
Bark	-	5	-	-	2	1	-	1	5	1	2	15	32	
Conifer	10	-	1	3	-	4	20	12	6	9	12	2	79	
Diffuse porous	-	-	-	-	-	-	-	-	-	-	1	-	1	
Ring porous	-	-	-	-	-	-	-	-	-	-	-	1	1	
Unidentifiable	7	-	2	-	-	-	-	-	-	-	-	-	9	
Misc. Botanical Materials	1	3	5	5	0	5	1	3	13	4	9	13	62	
Breakdown by type (N)														
Bud	-	-	-	2	-	-	1	-	-	1	-	2	6	
Calyx	-	-	1	-	-	-	-	-	-	-	-	-	1	
Cuticle/epidermis	-	-	-	-	-	-	-	-	-	-	-	1	1	
Dicot stem (gracile twig or tendril)	-	3	4	3	-	5	-	2	13	-	9	10	49	
Insect (beetle)	-	-	-	-	-	-	-	-	-	1	-	-	1	
Woody plant seed	1	-	-	-	-	-	-	1	-	2	-	-	4	

Note: All samples contained abundant rounded mineral nodes. Very small twigs were consistently present. Sample #10 (Pit Feature 12) had no botanical material.

* denotes presence of partially unburned wood in samples #7 and #9 (Pit Feature 21).

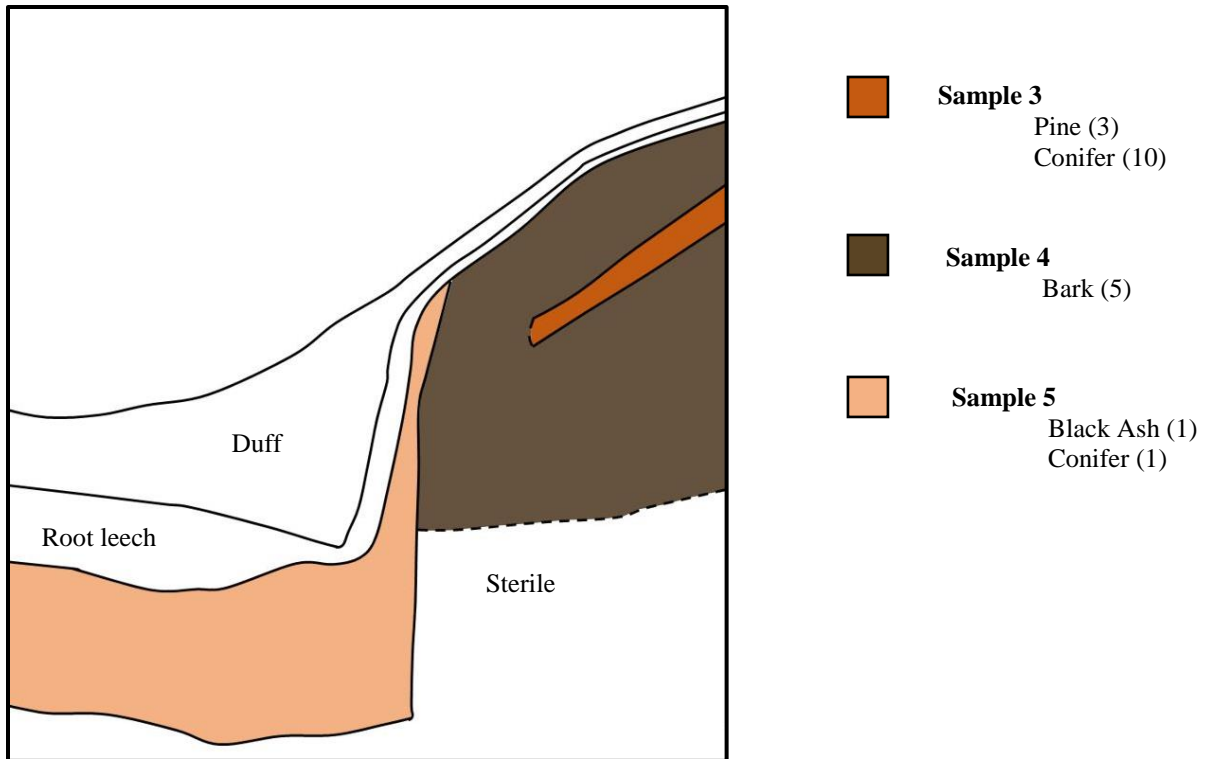


Figure 30: Pit Feature 3 south wall level representation of flotation sample locations and wood taxon identified in macrobotanical analysis.

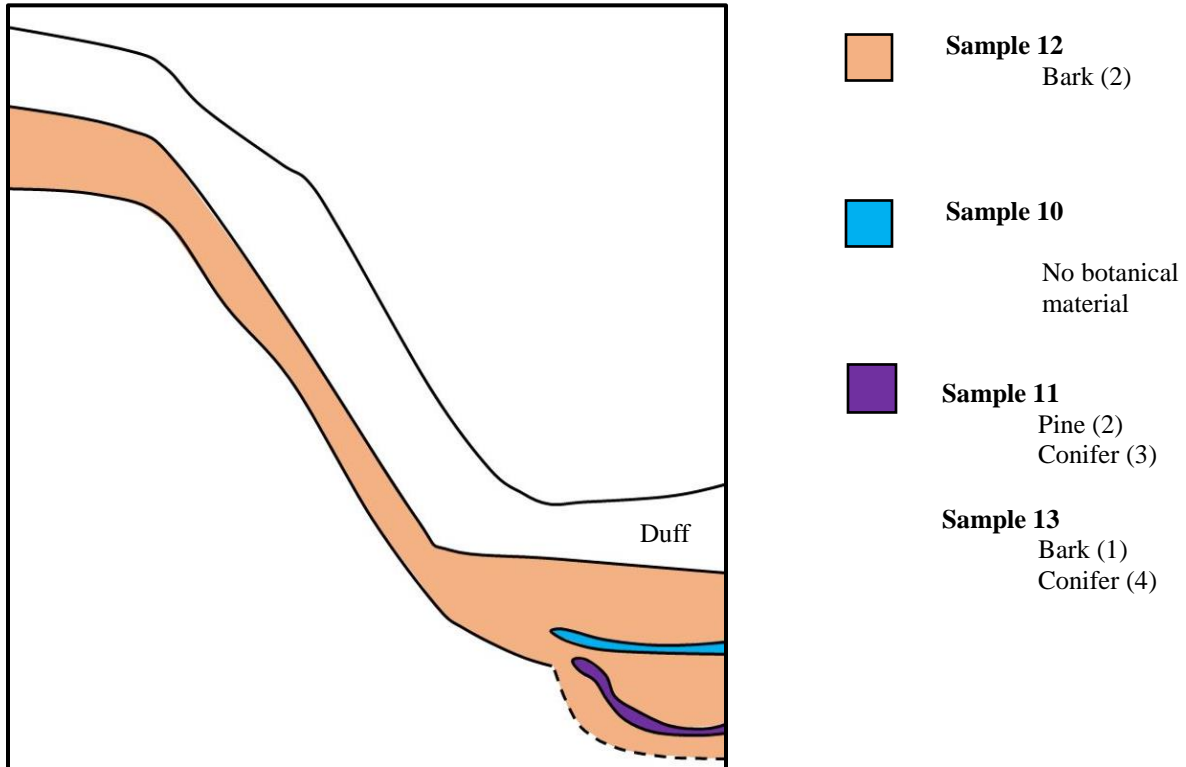


Figure 31: Pit Feature 12 north wall level representation of flotation sample locations and wood taxon identified in macrobotanical analysis.

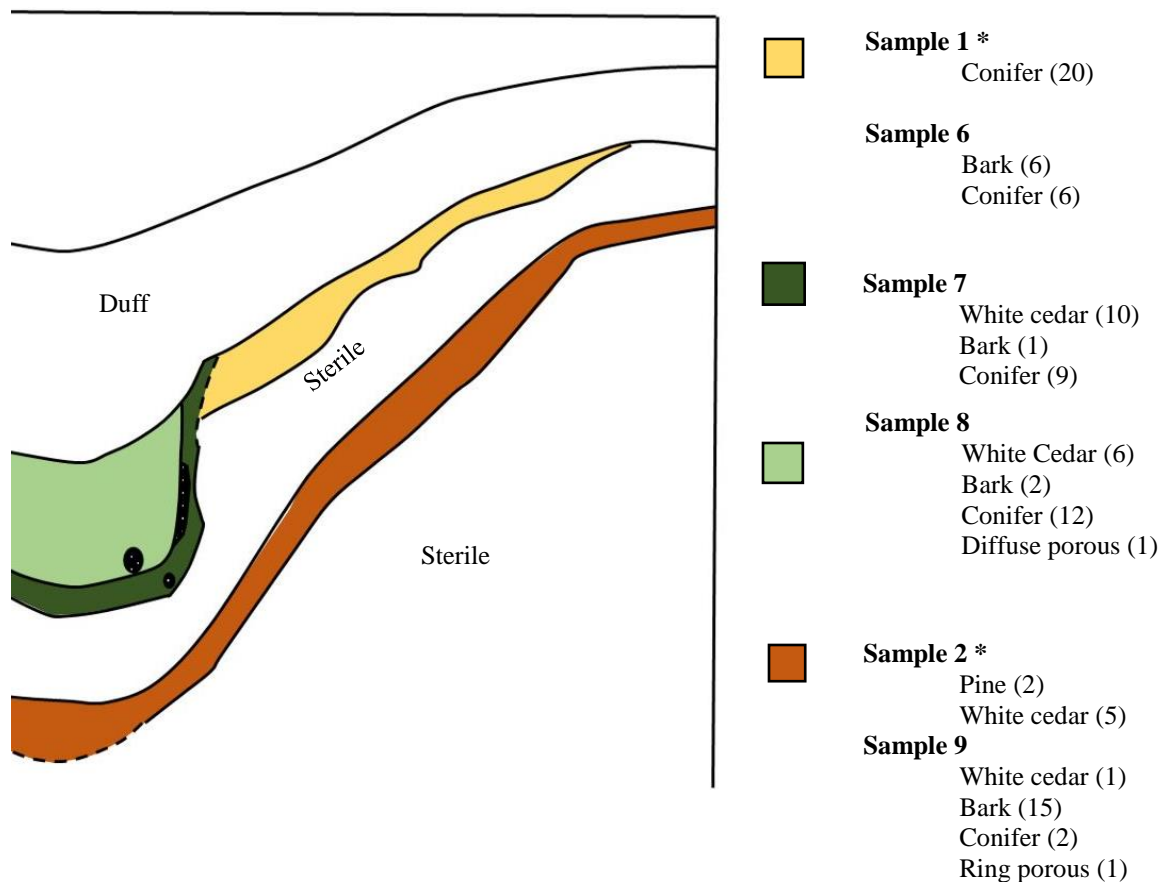


Figure 32: Pit Feature 21 west wall level representation of flotation sample locations and wood taxon identified in macrobotanical analysis.

* indicates samples that were taken from the south wall of the northeast test unit.

Significance of Northern White Cedar

During the ceremonies of the medicine lodge, if it is necessary to purify sacred object and the hands and persons of participants, a plate of live coals is used and dried Arbor Vitae leaves placed upon them. The servitor wafts the incense over sacred objects by fanning the smoke with his hands. Others hold their hands over and in the smoke, waving it upon their persons. The Pillager Ojibwe... also use it as a purifying incense, and as an ingredient for the sweat bath with White Pine, Balsam, Hemlock and other plants. They drink the boiled leaves claiming that the stream goes through the blood and purifies it [Smith 1932:380].

Northern white cedar, or Arbor-vitae, was, and is still, considered by many Native American groups to be a sacred tree used in ritualic ceremonies and as a medicinal plant (Moerman 1986, 2009). “The Ojibwe worship the Arbor Vitae or white cedar and the Paper or Canoe Birch, as the two most useful trees in the forest” (Smith 1932:421).

White cedar, pine, and black ash are not high quality deciduous fuel woods, and if the purpose of this burning even was to produce heat there was an abundant number of fire wood to choose from on Grand Island including maple, birch, and white ash, none of which were found in this assemblage. Volatile oils within the wood produce smoke with a distinctive soothing aroma ethnohistorically recorded as used for purification or sanctification ceremonies (Adams 1987). The leaves and branches of northern white cedar were, and still are, used among Anishinaabe in ceremonial smudging, incense, and as an insect repellent (Danielsen 2002). White cedar, much like frankincense, produces a distinct aromatic scent that creates a spiritual ambience. Among the Anishinaabe, burning white cedar in a smudging ceremony is the cleansing of the mind, body, and heart. The scent fills the atmosphere and has a calming effect that sets the environments when connecting with the ancestors (Shawanda 2017:11). The pit features at the Muskrat Point site did not show any evidence of cooking food. The only burning was in the secondary use of Pit Feature 21, and there were no faunal macrobotanical remains in this burning apart from wood. This burning episode appears to be related to a ritual smudging rather than utilitarian use.

Lithic Assemblage

Pit Feature 3 - Excavations yielded one piece of FCR, coming from level two, approximately 16-39 cm below the surface. These FCR did not come from within the pit features, instead coming from the pits exterior. There was also a hammerstone found external to

the pit. This hammerstone has percussion wear on all three of its edged surfaces with four flat surfaces with removed cortex as a result of flake removal.

Pit Feature 10 - There are 18 pieces of FCR that came from this test unit, because of the excessive root disturbance it is difficult to determine if these rocks came from inside or outside of the pit feature. In addition to the FCR, there was one non-utilized quartz flake.

Pit Feature 12 - There are 11 pieces of FCR that came from this test unit, but they came from outside of the pit feature.

Pit Feature 21 - There are 41 pieces of FCR that came from the Pit Feature 21 test units, all FCR from this excavation came from the base of the buried A horizon, and only one of these came from inside of the pit itself. In addition to the FCR, there are three pieces of sandstone that were bagged as possible sandstone net sinkers. Examinations of these stones shows no evidence of side-notching or any other human modifications

STPs and Trench – STP #5, 5 meters south of Pit Feature 21 had one piece of FCR. STP #6, 2.5 meters north of Pit Feature 21, had one piece of FCR. STP #12, 5 meters east of Pit Feature 21, had one piece of FCR. The trench unit extending off the southern end of Pit Feature 21 southeast unit excavation had three pieces of FCR.

FCR Analysis

In total, 86 fragments of fire-cracked rock were recovered during the 2017 excavations at the Muskrat Point site. Eighty-five of those FCR came from outside of the pit and are not associated with the pit context. Previous excavations from Late Archaic sites from Grand Island have produced massive amounts of FCR, but smaller relative quantities of FCR have been observed in Woodland period sites. This reduction in the appearance of FCR was likely the result

of an increased trend in cooking with ceramic vessels instead of hot rocks during the Woodland period (Skibo et al. 2009), a trend observed across North America by Thoms (2003). Ceramic technology used in cooking allows for higher temperatures and extended cooking times (Skibo et al. 2009).

Following an analysis strategy developed by Neubauer (2016), the majority of FCR at the Muskrat Point site 2017 excavations (72%) were heated and cooled in water, the remaining 28% exhibit expansion fractures (dry cooling) (Figure 32). The cool stone boiling/wet cooling FCR found on Grand Island were likely used to heat and boil water for cooking (Neubauer 2016), or to provide a source of residential heat for enclosed spaces such as a dwelling (Benchley et al. 1988).

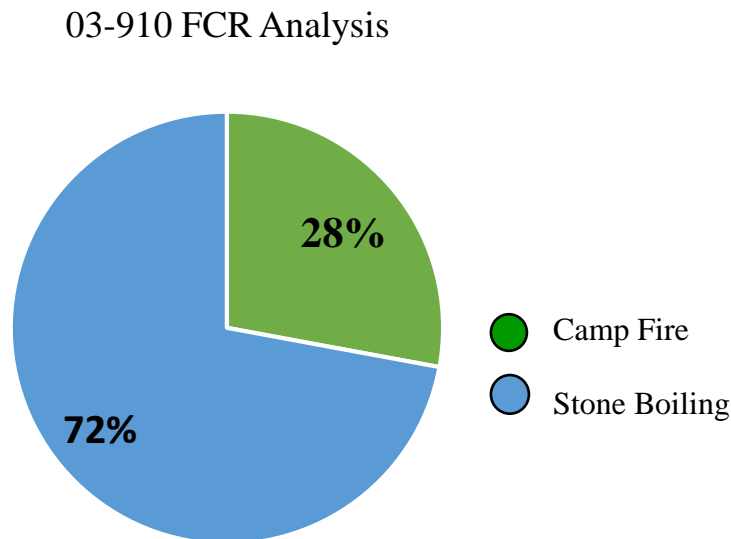


Figure 33: Percentage of thermal alteration type evident on the fire-cracked rock assemblage at the Muskrat Point site.

All but one FCR from these feature excavations came from outside of the pits themselves, all coming from below the buried A horizon. It is reasonable to assume that the

Woodland period pit features at the Muskrat Point site were dug through a Late Archaic site, and these FCR are remains from the preexisting site.

Discussion of Assemblage

The botanical remains at the Muskrat Point site were made up primarily of wood. There were no nuts, berries, seeds, or any other edible plant remains recover from the pits. Additionally, the FCR and single flake found during excavations were extraneous artifacts, unconnected to the features themselves. Pit features commonly lack material objects that give definitive indications as to their function. The pit features excavated at the Muskrat Point site fit this pattern. The one exception was the secondary use of Pit Feature 21 in which there is evidence of the burning of white cedar that may have been part of a smudging ceremony.

A lack of artifacts and botanical samples, however, is information that can be used, along with other contextual clues, to infer pit function. There was no burning at the base of the pits (excluding the secondary use of Pit Feature 21), indicating these were not roasting pits used for cooking food. There were no faunal remains, ceramics, tools, or any other evidence of residential activity, demonstrating that the Muskrat Point site was not a habitation or village area. The fact that no material objects were found in the pit features tells us that they once held something of value, something that was successfully stored in the ground and then retrieved. We also know that Pit Feature 21 was reused when white cedar was burned in the remains of a preexisting pit that had sat open for a period. White cedar, as was discussed earlier, is often associated with ceremonial smudging, which could indicate the secondary use of Pit Feature 21 was related to this type of cleansing ceremony.

The next step in understanding the functions of the features at the Muskrat Point site is to look at contextual environmental data, historical and archaeological data pertaining to land use and related pit feature activity in order to create a set of performance matrices. Such matrices can be an effective tool for exploring the performance characteristics of these pit feature.

Contextual Data Associated with the Muskrat Point Site

Available Resources

A variety of contextual clues are also play a role in understanding pit performance. In the 19th century, the General Land Office (GLO) surveyed throughout the state of Michigan and mapped the locations of Native American sugar bushes and sugaring camps. Grand Island was noted on this survey as a sugarbush location (Silbernagel 2000). Beginning with Schoolcraft's (1851) report from at least the mid-1700s to the mid-1800s the Ojibwe Indians on Grand Island were producing 3,500 pounds of maple sugar in 600 metal kettles. Maple sugaring was a consistent enterprise on the island from this point throughout the Williams era and into the 1950's when the island was under the direction of William Mather, the Cleveland Cliffs Iron Company (CCI) president (Thomas and Silbernagel 2003).

Figure 33 shows a map of presettlement forest types on Grand Island showing the location of the Ojibwe sugarbush documented in the 19th century GLO Michigan survey. The size of the pit features excavated at 03-910 are comparable to the size of the maple sugaring vats analyzed by Dunham (2000) holding 155 gallons of liquid. The Muskrat Point site, however, is located in a low conifer swamp forest, quite some distance away from sugar maples. These data

suggest that 03-910 was not a maple sugaring camp, therefore the pit features in this area were not used as sap storage vats.

This presettlement forest type map also indicates that the Muskrat Point area was not home to acorn producing oak trees, strongly suggesting these pits were not used to store or process acorns. The GLO survey refers to the area around the Muskrat Point site as a conifer swamp. This is a forested wetland dominated by lowland conifers such as the northern white cedar (*Thuja occidentalis*) (Kost 2002). The classification of “swamp” in this forest typology is a bit misleading when it comes to the specific soil drainage classes of Muskrat Point. Figure 34 is a more detailed map showing the diverse drainage classes of Muskrat Point soils and surrounding area. As seen by this map, 03-910 is located in an area of excessively well drained sandy soils, making this specific location well suited for the preservation of stored goods. Such soils are also very conducive to the excavation of pits with hand tools. The southern edge of the site is along an elevated beach ridge. As you walk north, past the area of pit feature excavations, the area becomes more low and swampy and this is where conifers become more prevalent. There were however, no white cedars in direct proximity of the pit feature excavations.

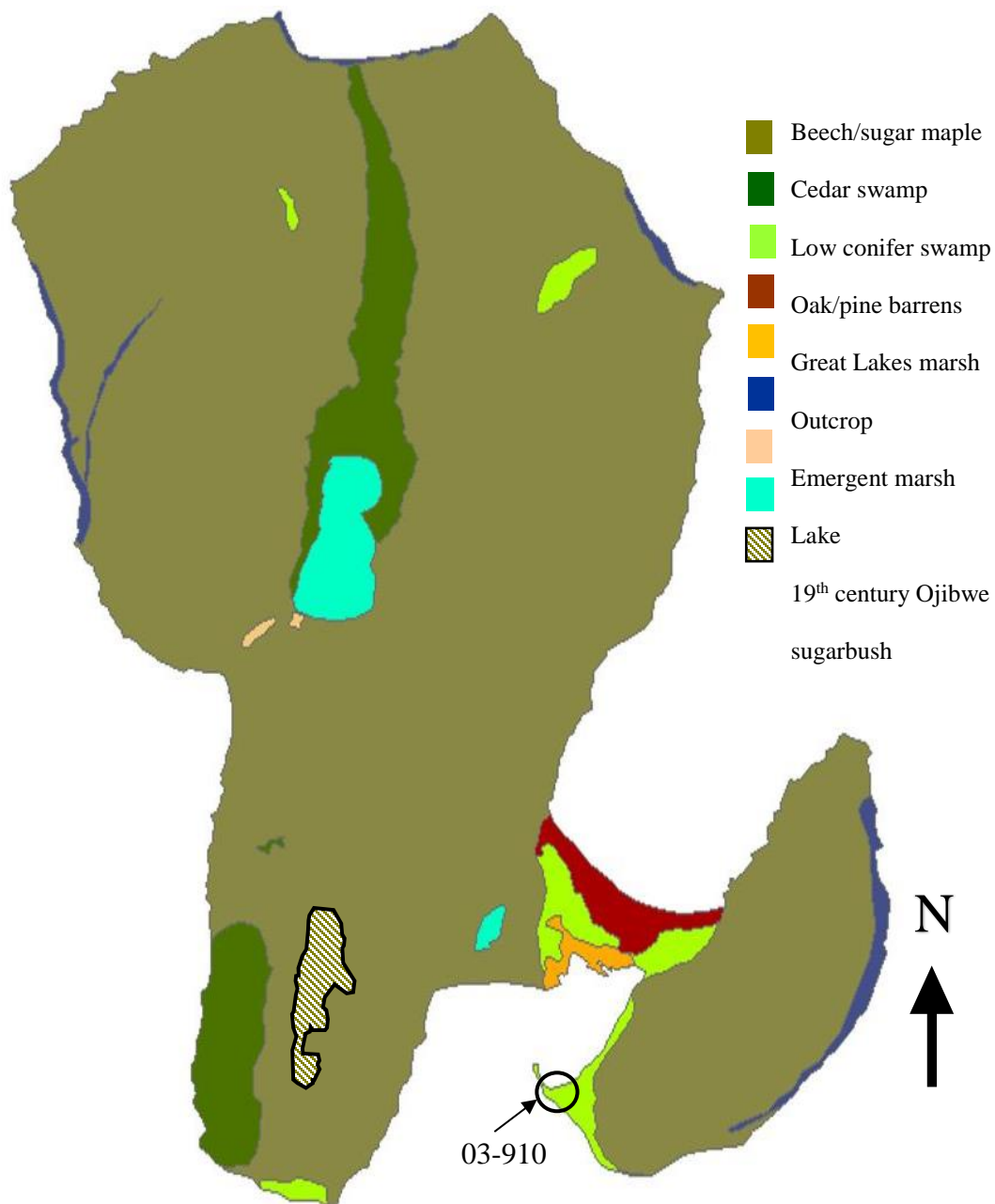


Figure 34: Presettlement forest type circa 1800 (Michigan.gov/dnrdata) with approximate sugar bush local as documented in GLO survey (Comer et al. 1955).



Map unit symbol	Map unit name	Rating
18	Kinross muck	Poorly drained
58	Dawson, Greenwood, and Loxley soils	Very poorly drained
65D	Jeske-Gongeau-Deerton complex, bedrock terrace, 1 to 20 percent slopes	Somewhat poorly drained
65F	Jeske-Gongeau-Deerton complex, 1 to 45 percent slopes	Somewhat poorly drained
72F	Deerton-Tokiahok-Trout Bay complex, 15 to 70 percent slopes, dissected	Excessively drained
275B	Munising, calcareous substratum-Cookson fine sandy loams, 1 to 16 percent slopes	Moderately well drained
309B	Rubicon sand, 0 to 6 percent slopes, deep water table	Excessively drained

Figure 35: Drainage class map for Muskrat Point and surrounding area (USDA).

Performance Matrices for Historical and Archaeological Documented Pit Feature in the Upper Great Lakes

Overview of Regional Pit Feature Performance Characteristics

As mentioned previously, performance characteristics are the characteristics of an artifact or feature necessary for it to perform its intended function. Performance characteristics and the associated technical choices can be understood by isolating and examining the elements of the artifact or feature. By isolating the technical choices along the feature's life history, investigators are able to find clues to understand performance characteristics. In the example of pit features, we can infer technical choices by the stratigraphy, contents, location, and other contextual information. Using this model permits me to answer the question, "why was this pit feature made this way?" The following is an overview of performance characteristics typically associated with pit feature of the Upper Great Lakes.

Preservation

Well-drained soils, pit lining, and storage of goods in ceramic vessels or birch-bark containers within the pit were common technical choices made in the design of a pit to insure preservation of its contents. Well-drained sandy soils would be important for preservation as moisture buildup leads to rotting. This would affect not only food, but also hunting and fishing gear made of plant-based materials (i.e. nettle-twine used by the Chippewa to make nets). Lining pits with tree-bark stabilized the pit walls to prevent collapse of the sandy soils. In addition, there are several tree species native to the region that have natural insecticidal and antifungal properties that discourage decay brought on by fungi and insect infestation. The storage of foods

inside ceramic vessels and birch-bark containers, or *makuks*, is a well-documented practice among contact period Upper Great Lakes tribes (Densmore 1929). The historic period Chippewa groups commonly sprinkled maple sugar on top of *makuks* holding dried berries and fish to help preserve the foods (Densmore 1929:389). Containers help isolate and organize different food types, but also add another layer of protection from pests and bacteria that a damp environment can encourage. A grass lining placed between containers is another practice mentioned in ethnohistoric literature. This layer of dried grass helped support the vessels and keep them in positions while also absorbing any moisture that penetrated the pit walls or surface.

Concealment

Historic accounts reviewed in chapter four suggests that Native American storage pits were often concealed and hidden, especially among mobile groups such as the Middle Woodland hunter-gatherers of the Upper Great Lakes. Pits used among mobile groups were dug and used by individual households and extended family (Dunham 2000). Only a small number of people would be aware of the storage location, which would have provided a level of security and social concealment. Unattended storage pits are more susceptible to human and animal disturbance, it is therefore crucial to take appropriate measures to cover up traces of hidden goods. Animals are another threat to stored goods. Ethnographic accounts note protection measures such as the use of sticks or logs laid across the top of the pit opening, which are then covered with soil and dead leaves (Atwater 1831; Charlevoix 1923; Densmore 1929; Eastman 1902). Supporting evidence for the threat of animal intrusion was seen during the experimental study of subterrestrial food storage done by Kathryn Frederick (2015). In this study, coyotes not only smelled, dug up and ate the stored smoked salmon, they also made a den out of two of the pits.

Capacity

There are many reasons to dig a hole in the ground, and the size and morphology of the hole can be a clue as to its intended function. The pit features from *Gete Odena* on Grand Island discussed in Chapter 2 (Skibo et al. 2007) are relatively small features interpreted to be smudge pits used to smoke animal hides. The shallow depth (about 41 cm) and narrow openings of these features make them ideal for the oxygen deficiency needed to support a smoldering fire to smoke hide. Larger pit features with an average depth of over one meter, are discussed by Dunham (2000) in his analysis of the *Ne-con-ne-pe-wah-se* food storage pits. Pit features used to process food vary in size depending on the type and amount of food being processed.

Ethnographically, reported cache pits used for food storage are relatively large. The cache pit documented at Red Lake Minnesota was six feet deep and about three feet wide. The pit was used to store potatoes, canned berries, and vegetables. However, there are cache pits from the same ethnographic reports that are much smaller, used to store only potatoes (Hilger 1951). The size of the food cache is variable depending on the what and how much is being stored. A variability in size was also seen historically in the use of earthen ovens. Among the Iroquois “pits of suitable size” (Waugh 1916:56) were constructed on an as needed basis, to a size that was seen appropriate for the food being cooked.

Ability to Find Again

The need to re-locate a pit completely depends on the function it served. For example, the ability to re-locate a pit used to cache food surpluses or valuable procurement equipment is crucial. However, it is not necessary to be able re-locate an earthen oven or smudge pit. For this reason, pits used for food storage are often located at or near interior primary habitation sites,

coastal fishing villages, task-specific locations (i.e. sugarbush), or along travel routes known and used by the group utilizing the pit(s).

Location

The location of a pit also depends on the function of the feature. Evident from historical accounts from the region, food storage pits were commonly located near a habitation or near the area of procurement (such as the maple sugar vats). Hide smudging pits are found near the habitation site, where animal skin processing took place. Food processing pits (i.e. acorn boiling, rice threshing, bread baking, etc.) were found near the habitation site or near the area where the food resource was procured.

The following table is the result of the performance matrices for common pit feature types from the Upper Great Lakes region, based on the historical and archaeological record discussed here and in previous chapters. Pit functions include: food storage, food processing, hide smoking, and gear storage. In each matrix, the importance of each performance characteristic (preservation, concealment, capacity, ability to find, and location) is rated “high,” “low” or “variable” for each of the possible pit function (Table 12).

Table 12: Performance matrices constructed for pit features found in the Upper Great Lakes region.

Performance Matrix for Seasonal Food Storage Pits	
<i>Performance Characteristics</i>	
Preservation	High
Concealment	High
Capacity	High
Ability to find again	High
Location	Variable
Performance Matrix for Food Processing Pits	
<i>Performance Characteristics</i>	
Preservation	Low
Concealment	Low
Capacity	Variable
Ability to find again	Low
Location	Near food procurement site or habitation
Performance Matrix for Smoking Pits (hides)	
<i>Performance Characteristics</i>	
Preservation	Low
Concealment	Low
Capacity	Low
Ability to find again	Low
Location	Near habitation
Performance Matrix for Gear Storage Pits	
<i>Performance Characteristics</i>	
Preservation	High
Concealment	High
Capacity	Variable
Ability to find again	High
Location	Away from habitation/Near food procurement

Discussion

In this chapter, the stratigraphic, morphometric, and macrobotanical results from the 2017 Muskrat Point pit feature excavations are presented. These results are followed by a consideration of additional contextual information about the Muskrat point locality that will aid

in the understanding and interpretation of pit function. This is followed by a review of the performance characteristics observed from the archaeological and historic data relating to pit features considered in chapters three and four. Performance characteristics and the associated technical choices are inferred from stratigraphic information, pit contents, and other contextual information for pit uses including food storage, food processing, hide smoking, and gear storage. These performance characteristics inferred from these data are: preservation, concealment, capacity, ability to find again, and location relative to water and/or habitation. In the following chapter these performance characteristics will be considered in regards to the Muskrat Point pit feature investigations.

CHAPTER VII

MUSKRAT POINT PIT FEATURE FUNCTIONAL INTERPRETATION

Performance Analysis of 03-910 Features

In this section I will explore the technical choices of the Muskrat Point pit features based on their performance characteristics.

Preservation

The location of the pit features identified in this study emphasize a selection for an area characterized by sandy, well-drained soils. All of the Muskrat Point pit features occurred on Rubicon sand (see Figure 34), and occur on a flat to moderately sloped surface that allows for some water drainage to the south (towards Lake Superior). "The Rubicon series consists of very deep, excessively drained soils formed in sandy deposits of disintegration moraines, ground moraines, end moraines, kame moraines, lake plains, outwash plains, stream terraces, beach ridges, and sand dunes" (USDA: National Cooperative Soil Survey 2012). Rubicon sands lessen the risk of water and/or moisture penetration into the pit and subsequent decay of stored materials. As a result, these pits occur in soils that would be very well-drained and ideal for preservation. Preservation would increase if the stored items would have been placed in containers or the pits lined.

Concealment

Storage of valuable goods need to be in a hidden location to deter theft by humans or scavengers. The heavily wooded conifer forest of Muskrat Point is a densely vegetated area that would provide ample concealment of pits. During this field season we were camped just over 100 meters from the pit area and we had to stomp down ferns and mark trees with colorful tape in order to get the excavations in a timely manner. Additionally, there is less evidence of human occupation on the eastern side of Murray Bay than on the western and northern sides of the bay. This less populated area would have been a more secluded location protecting the pits from unwanted encounters.

Capacity

The average total depth of the four pit features excavated at the Muskrat Point site is 114.25 cm, just over one meter deep. Excluding the secondary use pit of Pit Feature 21 and the estimated measurements from the single wall of Pit Feature 10, the average volume of these feature is $0.79 m^3$. These features are relatively large and have fairly uniform measurements. As detailed in the historic literature, the size of pit features depends on what was being stored. Based on the uniformity of the pit features at the Muskrat Point site it seems they were used for the same, or very similar storage needs.

Ability to Find Again

The Muskrat Point pit features are located near a sandspit, a distinctive sandy land feature that extends off the southwestern “Thumb” forming a thin, elongated hook-shaped projection into Murray Bay. This distinctive landmark is easily recognizable from the water and would

make relocating the general pit location relatively easy year after year if that knowledge was continuously passed down. Three of the excavated pit features were single use features, with one showing evidence of a re-use associated with a burning event (Pit Feature 21). This evidence of re-use coupled with the large number of possible pit features identified during the walking survey strongly suggests that the Muskrat Point site primarily served as a storage location for an extended period of time.

Location

The Muskrat Point site is some distance away from the well-established fishing villages of *Gete Odena*, Popper, and Trout Point I. This storage locale is uniquely located on a sandspit that provides deep water access on the south side, and shallow bay waters on the north side.



Figure 36: Photograph showing the southern ridge of the Muskrat Point site (photograph taken by author).

Muskrat Point itself may have been a productive fishing site, but no evidence of fish or fishing related equipment has been found yet. It is easy to get to by boat, yet secluded enough for safe, reliable storage. Muskrat Point is also a good overlook point, the southern shore bank of the site is a steep cliff ridge that overlooks mainland Munising (Figures 35 and 36). When standing at the shores of Muskrat Point, the line of sight is clear to the mainland and other areas Grand Island Murray Bay.



Figure 37: Photograph showing the view of mainland Munising standing at Pit Feature 12 (photograph taken by author).

Discussion: Performance Base-Analysis Interpretation

This performance characteristics analysis suggests a type of storage at the Muskrat Point site that was seen in historic accounts of seasonally mobile Canadian Arctic groups (Richard 1989). In comparison to historic literature pertaining to Upper Great Lakes native groups, the size and lack of burning of the Muskrat Point pit features would suggest that they were used for food storage. This was a location, however, that was only inhabited for short periods of time with no evidence of Woodland era residential activity. So, the question remains, why would there be storage pits on an island used exclusively for warm weather habitation when storage of food was not necessary?

Evidence from Grand Island, including net sinkers and high densities of fish remains in areas of exceptional preservation discussed in chapter three (Popper), support the interpretation that the island was inhabited seasonally during warm months to exploit spring and fall-spawning fish using nets. Mass-capture technology, such as a fishing net, would be overkill if the food resources were not stored. Surplus of fish would have been cured on the island by drying or smoking, then transported in the late fall back to the winter habitation site for cold season storage. However, even if the island was only inhabited for a few week to a month, the fish would still need to be stored in a safe place, out of reach and smell from animal predators. It is possible that these features were used as short term storage of food, used as a safe place for a short period.

Another possibility I suggest that these pits were used for storage of mass-capture fishing technologies. Reliable fishing gear, stored and used for predictable resources such as the spring and fall spawn, are appropriate for time-stressed exploitation of seasonal resources at higher latitudes (Zvelebil 1986). Mass-capture technology such as large nets, traps, weirs, etc. requires

construction and maintenance at the point of use, prior to the harvest (Rolwey-Conwy and Zvelebil 1989). During the off-season, supplies that did not need to be transported to interior winter camps could be stored at or near the area of resource procurement, and would be available upon return. The area these features are located suggests that there was an attempt to conceal their location. Each of the 15 pit features identified at the Muskrat Point site are situated in well-drained soils, making it a relatively dry place to store items underground. The Muskrat Point site is also some distances away from intensely used village spots, in a lower traffic area.

The botanical assemblage is almost completely made up of wood, which could suggest wood was used as pit lining or cover. Notably, white cedar oil, the most abundant taxa of the assemblage, has ethnohistorical accounts as being used for its natural insecticidal and antifungal properties (Adams 1987; Eller et al. 2014; Tuman et al. 2013). The presence of white cedar and other conifers in the assemblage may represent an important material used in the preservation of stores. Densmore (1929) notes that nets or seines were made from nettle-stalk twine, a strong natural fiber that would need to be kept dry to prevent rot. The well-drained soils and presence of white cedar remains are both indications that the pit features were designed to keep stores dry and protected from rot and decay. These pit features are relatively large, about 1x1 m., a suitable size for storing large fishing nets, net sinker and floats.

Fishing nets were quite large and extremely valuable. “An average size is 19 meshes wide and 60 arms spreads long. Pieces of light wood about 12 inches long are fastened to the edge of the net as ‘floaters,’ and opposite each is a stone ‘sinkers.’ The distance between these is twice a single ‘arm length’” (Densmore 1929:154). The labor requirements for making and maintaining nets (seines and gill nets) was considerable, and the loss of a net would probably have substantial effects on the group (Cleland 1982). The storage pits at the Muskrat Point site

offered a safe underground deposit of valued gear. Cleaned, maintained, and stashed away after the spring or fall spawn, these nets were kept on the island during periods of non-use, and retrieved when the Murray Bay was next visited for fish exploitation.

Conclusions

The primary research objective for this thesis was to analyze and interpret the function of the pit features at the Muskrat Point site on Grand Island and to consider what roles these features played in the seasonal mobility and subsistence pattern of the Native American groups utilizing them. Previous research is lacking in the examination of pit feature function in the Upper Peninsula of Michigan. This research aims to provide a stepping stone for future researchers to consider the diverse functions of these features, providing those interested in the past additional lines of evidence in the consideration and understanding of the Upper Great Lakes hunter-gatherers. In this conclusion I revisit the primary research questions and evaluate them considering the evidence presented in the previous chapters. I follow with a discussion of this thesis' methodological and theoretical approaches to pit feature function(s) in the Upper Great Lakes region.

Research Question One: When were pit features at the Muskrat Point site constructed?

Pit features have not been well documented in the eastern Upper Peninsula, and until now could not be conclusively linked to the Late Woodland or Terminal Woodland period (Dunham 2000, 2014; Dunham and Branstner 1998). Of the four carbon samples taken from Pit Feature 21, two were sent in for radiocarbon dating (P21, S2 and 3). Pit Feature 21, sample 2 (P21-S2) dated

to ca. AD 1301-1413 \pm 30, Pit Feature 21, sample 3 (P21-S3) dated to ca. AD 1193-1277 \pm 30, both dates linking this pit feature to the Terminal Woodland period (Table 9).

Research Question Two: What were the function(s) of the pit features at the Muskrat Point site?

The interpretation relies primarily on location, stratigraphy, morphology, historic accounts, and resource availability. Outlined here are the results of the performance-based analysis concerning the 03-910 pit features. Based on the criteria outlined for gear and food storage pits, it appears that the Woodland Period pit features at the Muskrat Point site were used for storage. In general, it is a lack of physical remains and use-alteration that suggests purpose of storage. It is the location and other contextual indicators that suggest possibilities of what was stored, fish or fishing gear.

Murray Bay, along Grand Islands southern shore, was and still is an extremely productive fishery for both shallow and deep-water fish spawning habitats. The island was repeatedly sought out for its warm season food resources. There have been no residential structure remains found at precontact archaeological sites on the island, indicating that island was used as logistical camp, visited during warm season resource height. Historical accounts written by early Euro-American fur traders and explorers visiting the island back this understanding stating that village along Murray Bay were deserted with only the remains of fish drying operations left behind (Gilman 1836; McKenny 1959).

Research Question Three: Can multi-use of pit features be determined through stratigraphy?

The sand soils that make up the majority of the island can pose issues with preservation of stratigraphic layers. Sandy particles do not adhere or stick to one another, which can lead to pedoturbation, the mixing of soils resulting in displacement, movement of stratigraphic layers and artifacts (Leigh 2001). The sandy soils of this site held the integrity of the pit features and a determination in the different stratigraphic levels were distinguishable. Three of the four pit features excavated during the 2017 field season at the Muskrat Point site are single use features. Pit Feature 21 shows definitive evidence of reuse of the feature after it had been left open for a period of time.

In all of the pit features, the pit's outline is beneath a level of sterile light brown to pale brown sandy loam that closely resembles the sandy loams exterior to the pits. This demonstrates that the pit features were left open and infilled naturally. If the pits were intentionally infilled you would expect to have a mixing of sand and duff.

Concluding Thoughts

Limited excavation, lack of material remains, and limited floral evidence are limiting to this study. For this reason, I acknowledge that my interpretations are necessarily based on this limited available data. A review of settlement and subsistence models for the Upper Peninsula during the Woodland period in chapter two demonstrates that there has been ongoing debate and discussion about the seasonal movements and subsistence practices in this understudied region. Ultimately, there is no one way to be a hunter-gatherer, and an understanding the lifeways of Native American groups of the extreme seasonal fluctuations of the Upper Great Lakes requires

considerable allowance for flexibility in modeling. With this functional analysis I intend to offer additional information from a Terminal Woodland period site, from the coastal setting of southern Lake Superior

Based on the historic accounts and the archaeological record, Grand Island acted as a logistical camp where groups of extended family members would gather during the spring and/or fall to exploit fish-spawns and other seasonally available food resources. Grand Island was home to numerable food resources used by precontact island residents such as wild game, maple sugar, acorns, hazelnut, and beechnuts (Ball 1993; Neubauer 2016; Skibo et al. 2009; Thomas and Silbernagel 2003). Fish were certainly not the only storable resource hunter-gatherers in Upper Great Lakes relied upon, they were however an incredibly important one.

...fish nets are not so easily manufactured as some other fishing gear, and the very fact that people spend time and effort in making nets can only mean that they are seriously engaged in fishing. A highly developed net fishery is a distinguishing mark of a specialized or professional fisherfolk [Rostlund 1952:81].

Evidence of mass-capture fishing technology on Grand Island suggests that the seasonally mobile groups that resided there were heavily engaged in bulk fish procurement. Fish or other food resources were collected on the island during spring through fall and those resources were transported back to the inland mainland during the winter to be stored in cache pits for food storage for the winter. These storage pits at the Muskrat Point site provide interesting insights into the regional and local traditions of the seasonal inhabitants of Grand Island.

Food storage is often understood as a mechanism for groups to manage abundant, but temporally or spatially dispersed resources. This interpretation has long been recognized as a critical component in understanding the behavior and agency of hunter-gatherers living in mid-to-high latitudes (Tushingham and Bettinger 2013:528). However, there is considerable

variability in hunter-gatherer storage practices. Morgan (2012) makes the distinction between caching (low intensity, dispersed storage) and central place foraging (more intensive, bulk storage tied to a central habituation base), an important distinction to make especially when studying groups whose settlement flexibility and mobility remained important strategies.

Many archaeologists have stressed the reliance on spring and fall-spawning fish as an integral part of life in the Upper Great Lakes. These fish can be harvested in great numbers, supply a substantial amount of protein, and arrive in predictable cycles. With the publication of Cleland's (1982) article "The Inland Shore Fishery of the Northern Great Lakes: Its Development and Importance in Prehistory," fish took the forefront in the settlement and subsistence discussion. The investment in the production of mass-capture fishing technology indicates Grand Island was in important location within a broader settlement system. That being said, Grand Island offers a broad range of food resources that would be necessary for supplementing a fish heavy diet.

Commonly, little significance is given to pit features of the Upper Great Lakes and their interpretation was restricted to "food cache" or "earthen oven." This assumed function, while an important consideration for pit feature research, can lead to a misinterpretation. Assuming a function based on lack of evidence ignores the possibility that pit features served a range of functions. Over the past twenty-five years, researchers such as Dunham 2000, Fredrick 2015, Hambacher and Homan 1995, Holman and Krist, 2011, Howey and Fredrick 2016, Howey and Parker 2008, Howey et al. 2016, and Skibo et al. 2007, have proven the importance of investigating pit feature function and have shown how these storage and processing pits can inform our understanding of Upper Great Lakes hunter-gatherer life. With this study I hope contribute to the ongoing discussion of pit feature use in the Upper Great Lakes and I have

sought to provide a functional interpretation of pit function using a performance based approach. In the absence of material remains, this performance-based analysis was well suited for “rendering the unknown knowable” (Walker et al. 1995:8), serving as a platform to link historical narratives, contextual information, and the archaeological data to the functional interpretation of these features.

The interpretations made here for the function of Muskrat Point pit features are presented with the primary goal of expanding the conversation of the use of storage among mobile hunter-gatherer groups. This research also pursued a series of performance matrices that could help in the determination of pit feature function (not limited to storage) throughout the Upper Great Lakes. I hope that this data and theoretical framework will prove useful for future researches interested in the function and roles of pit features in the area.

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