GROUP COMPOSITION AND THE ROLE OF UNIQUE RAW MATERIALS IN THE TERMINAL WOODLAND SUBSTAGE OF THE LAKE SUPERIOR BASIN.

By

Caven Peter Clark

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Anthropology

1991

ABSTRACT

GROUP COMPOSITION AND THE ROLE OF UNIQUE RAW MATERIALS IN THE TERMINAL WOODLAND SUBSTAGE OF THE LAKE SUPERIOR BASIN.

By

Caven Peter Clark

Descriptions of Terminal Woodland substage ceramic heterogeneity in the Upper Great Lakes region vary from chaotic to cosmopolitan. In this analysis the relationship between ethnographic and ethnohistoric groups is contrasted with archaeological cultures to provide a model of group composition which assumes that group membership is not restricted to a single archaeological culture. A range of potential interaction alternatives is defined on the basis of ethnographic and ethnohistoric accounts and is evaluated with respect to the anticipated archaeological cognates with which interaction must be inferred from the archaeological record. Using Isle Royale in Lake Superior as the focus of study, the distribution of geological copper is contrasted with that of archaeological copper within the parameters of the Terminal Woodland substage (A.D. 700 to A.D. 1650). The associations of waste copper, and copper tools and ornaments with ceramics related to specific archaeological cultures are used as an indication of differential access to or interest in native copper. Neutron activation analysis of trace elements in 100 geological and archaeological samples of clays derived from Terminal Woodland ceramics representing Blackduck, Juntunen, Huron, Sand Point, and Oneota archaeological cultures is used to assess the movement of pots and potters within the

Lake Superior basin. Zones of clay procurement are identified which, in part, correspond to the distribution of archaeological cultures. The combination of the copper distribution data and the trace element data suggest that in spite of widespread associations of diverse ceramics styles on archaeological sites, there may have been differential access to copper resources indicative of a type of cultural boundary not generally observed in a prehistoric setting.

ACKNOWLEDGMENTS

The production of this dissertation involved the assistance of a large number of individuals and institutions. The neutron activation analysis was supported by a grant from the National Science Foundation (BNS-8801707) to the University of Missouri Reactor Facility, Columbia, MO, and by the National Park Service, Midwest Archeological Center, Lincoln, NE. The following individuals and institutions made collections available for this analysis: Dave Arthurs (formerly Heritage Branch, Ministry of Culture and Communications, Thunder Bay, Ontario); Mark Lynott (NPS-MWAC); John O'Shea (Museum of Anthropology, University of Michigan); Betsy Garland (Department of Anthropology, Western Michigan University); Pat Martin (Department of Social Sciences, Michigan Technological University); and John Williams (Arcadia, Michigan). Technical services and advise were obtained from Michael Glascock, Hector Neff, and Gar Harbottle. Discussions of regional cultural historical problems with Claire McHale Milner and Dave Arthurs were most helpful and the input and support of my committee, Bill Lovis, Susan Martin, Larry Robbins, and Norm Sauer are greatfully acknowledged. My many families provided the impetus, momentum, and perseverance that brought this to completion: the Clarks, Thurbers, Keiths, and Petersons all made substantive material and spiritual contributions. The staff at Isle Royale National Park, especially, warrants many thanks for their friendship, accommodation, logistical support throughout my stay in the north. The BLACKDUCK let me down only when I mistreated her, otherwise seeing us through the fogs, shoals, and rough seas of Lake Superior. Stellar individuals who stood by during the long winters and all too short summers, Jo Thurber, Tim and Jean Cochrane, Edith Green, Stu and Ellen Croll, Uncle Bob, and of course, Sam, Spider, and Twister, are scattered throughout these pages to remind me of the years I spent in paradise. Buiadh na Bas.

TABLE OF CONTENTS

LIST OF TABLES

(List of Tables cont'd)

(List of Tables cont'd)

(List of Tables cont'd)

LIST OF FIGURES

(List of Figures cont'd)

CHAPTER 1

INTRODUCTION

Archaeology assumes a linkage between archaeological data and the living people who produced them. The linkage sought in this dissertation is between the material remains of late prehistoric archaeological cultures that occupied the Lake Superior basin and the information it encodes concerning the nature of interactions among these cultures over a period of about 700 years. Establishing this linkage entails an examination of differences among material representations of archaeological cultures through the vehicle of stylistic variation in ceramics and the evidence for the physical movement of ceramics across a cultural and physical landscape through trace element analysis of clays used by prehistoric potters. This dissertation explores the composition of sociocultural groups, the relationships between sociocultural groups as they are manifested in the archaeological record, and how a single resource, native copper, may have served as an incentive for and a medium of social interaction during the late prehistory of Isle Royale and the Lake Superior region of North America.

Isle Royale serves as the geographical focus of this analysis for a variety of reasons. As an island in one of the world's largest bodies of fresh water, in a climate which imposes definite limitations on access to it as well as the resources it is able to offer its human inhabitants, the archaeological record of its use in prehistory should reflect patterns of a less than casual nature. Effort and risks were required to get there and to live there. The presence of native copper sources there are believed to have constituted an additional rationale for visiting the island, and it is this resource that may have been one of the factors which contributed to the mixing of archaeological cultures on the island in the Terminal Woodland substage. From a practical perspective, the selection of Isle Royale was also determined by the opportunity of the author to oversee a four-year program of survey and testing of archaeological sites on the island with the questions addressed by this study in mind.

Trigger (1978) points out the importance of the dialectic between historically oriented ideographic goals and nomothetic goals:

> A better understanding of the past, as distinguished from formulating timeless laws about human behaviour, is itself of value and therefore a worthy goal for archaeologists. Equally important, however, is my conviction that such an understanding of prehistory is an integral aspect of the scientific investigation of human behaviour. [1978:xii]

There is one major nomothetic goal in this dissertation: to elucidate the effects of a unique, localized, and stable nonsubsistence resource on interaction among archaeological cultures that operated at equivalent levels of sociopolitical organization, and that lacked distinct geographical boundaries.

Nomothetic goals are borne on a pyramid of contextually specific, or historical, ideographic goals which attempt to reconstruct with as much precision as possible the relations among late prehistoric archaeological cultures as they revolve around the use of unique localized resources. Prehistoric settlement and subsistence are considered secondary to the central theme of interaction, and while they are appropriate areas of investigation in their own right, they are used here as points of departure for the larger issues being considered. In this analytical hierarchy ideographic goals are the prerequisites for the formulation of nomothetic statements.

As one focus of this study, the role of copper as a stable, durable resource will be addressed as a vehicle by which interactive/integrative alternatives can be evaluated. The information derived from stylistic and source analysis of material culture will make possible statements regarding differential access, value, and mode of acquisition of copper. The use of trade and exchange as explanatory factors in the movement of goods may not fully address the implications of interaction between groups as a manifestation of culture contact. Resorting to trade and exchange as the explanations for the presence of exotic goods establishes that locally unobtainable material objects move between different cultural settings. However, this explanation does little to assess the context of interaction between parties, the substance of interaction, or the part interaction plays in the larger arena of regional cultural development and change.

The sociocultural and ethnohistoric anthropology of culture contact situations is often embedded in a colonial setting, which emphasizes the interactions between technologically advanced states and their neighboring bands and/or tribal societies. This approach is one of contrasting extremes in not only the realm of technological superiority of one side over another, but of the political organization which wields that superiority.

The dichotomy between directed and nondirected contacts, drawn early in the anthropology of culture contact situations (Linton 1940, Spicer 1961), reduces interactive types to two basic forms. Directed contact assumes a superordinate/subordinate relationship between interacting parties where sanctions of the former are brought to bear on the latter, and where the process is an intentional effort on the part of the superordinate group. Non-directed contact, on the other hand, is defined on the basis of the absence of these criteria for directed contact: that is, in situations where there is no hierarchical relationship, and where there is no overt anticipation of imposed change on the part of either party.

Such a dichotomy directed toward investigation of colonial situations, is inappropriate for the study of the subtle and complex interactions between groups with a less clear agenda for assimilating or manipulating their neighbors beyond the personal level. It is also directed to the study of the interactions between whole corporate bodies (e.g., tribes or states), and lacks the sensitivity to examine the range of variation which occurs between smaller units within societies. Similar shortcomings can be found in the area of frontier theory where definitions tend to assume the existence of a state organization and its interaction with various types of subordinate societies (Casagrande, Thompson, and Young 1964, Prescott 1965). Directed contact is really the only type of interaction considered in frontier theory.

Boundary theory comes much closer to the types of interaction considered in this thesis. Barth's (1969) edited volume on ethnic groups and boundaries presents the relational structures of ethnicity relative to other groups among which interaction is contrasted with the ongoing definition and redefinition of the corporate identity. All definitions emphasize the highly relativistic nature of boundaries which are contingent upon the context and constituents involved (Despres 1975, Justeson and Hampson 1985, Leach 1954).

There is, in addition, the coincidence of literacy vs. nonliteracy in this arena of culture contact which provides written documentation, albeit often biased, of the context and nature of interaction. We know what the French thought of the Huron, for example, but have a less clear idea of how the Huron perceived the French (e.g., Trigger 1976). What is clear even from this type of early, observationally biased, documentation is that there is not just one form of interaction repeated between different groups, but that in spite of an official policy which attempts to condition appropriate social responses to other groups, interaction varies with its context. The numbers of individuals involved, the composition of groups, the influence of ties to parties not present, the primary activities being undertaken at the time of contact, all influence both the predisposition and outcome of a given episode of interaction. The study of interaction between native groups prior to the influence of non-native economic and colonial influences should be similarly structured if more subtle (Richards, Bruhy, and Goldstein 1987).

How, then, does non-directed contact differ from the interactive design offered in this dissertation? In a hierarchically structured model of interactive types which has as its primary variables social structure, subsistence, seasonal demographics, and geography, different levels of interaction will manifest, in varying amounts, elements of both directed and non-directed contact. It is not simply a matter of examining the interaction between whole societies, but one which contrasts and establishes systematic relationships between the different segments of each society in their particular forms with those of other societies. This places emphasis on the distinction between the sentiment and content of culture contact situations, and seeks to define the criteria for each in a given context.

This is not to imply that the study of relations between groups has been limited to those falling strictly into the directed contact category, although these have certainly been emphasized. It is possible to treat specific dimensions of such interactions, such as trade and exchange, diffusion, or warfare. Such approaches cannot, however, be expected to explain independently the diversity of interactive types which occur between group segments because in any given situation there may be several potentially viable alternative choices of interactive forms.

Within the study of subsistence and settlement there has been a tendency to concentrate on food resources, appropriately enough, because they are important factors influencing cultural behavior, and because they leave material remains which are recovered from archaeological sites. In the present study material (nonsubsistence) resources are also considered, for they are no less important as elements around which interactive patterns may revolve. Resources such as chert and copper are given equal weight in this analysis. Unlike most food resources, these two material resources are stable and predictable on the natural landscape, but may not be available to every group in equal amounts. The articulation of the combined strategies for acquisition of subsistence and material resources is important if our goal is to make generalizations about culture contact, for it is in this arena that virtually all episodes of contact must be framed.

The role of information exchange between groups may have a significant influence on decisions regarding group movement or site location selection (Moore

1981). Often there is an explicit relationship between mobility and subsistence interests, such as information regarding localized resource depletion or abundance. There can also be an economic or prestige-based stimulus for trading opportunities both within and among various groups, coordinated by this exchange of information. While not entirely unconnected from material and subsistence interests, social and religious concerns will also influence the decision making process, such as the desire to visit relatives living with other groups and the use of divination as a directive for planning, respectively.

Visiting and the sharing of resources and information is a characteristic of small related groups (Sahlins 1972). The exchange of information is a critical aspect of interaction because the amount and kind of information, transmitted, received, or symboled, is a function of perceived distance between groups. Information permits decisions to be made concerning future movements and allocation of energy and subsistence activities (e.g., Leacock 1954, Moore 1981). Misinformation, or lack of information, plays an equally important role as a manipulative agency.

It is necessary to have a working definition of the "group" as a meaningful analytical unit. The term must remain a fluid one with the ability to be redefined contextually, rather like Sahlins' (1961) concept of structural relativity as a means of creating a telescoping structure of social organization relative to a specific set of circumstances. This is not to advocate a loose definition, but one which is redefined on a contextual basis, depending on the variables outlined above. Many of the smaller group segments anticipated in this analysis fall short of current definitions of ethnicity (e.g., Aronson 1976, Barth 1969, Despres 1975).

Ethnic interactions as a subject of study may suffer from the same problems as have been previously discussed with respect to directed contact. Total societies become the minimal units of analysis at the expense of the many smaller permutations of the social structure. In addition, the assumption that such things as so-called pure ethnic groups exist, now or in the past, is contradicted by the evidence for multiethnic associations of families and individuals in a variety of contexts (e.g., Sharrock 1974). This analysis will consider the archaeological implications of such multiethnic associations as they relate to traditional explanations of trade and exchange, and the ability to account for assemblage heterogeneity.

Since this application is archaeological in nature, the maximal interactive units of this analysis are defined as archaeological cultures as they are manifested by their material remains. This definition is accomplished by a delineation of stylistically oriented bodies of material representations in ceramic artifacts with boundaries in space and time. Once defined, these archaeological cultures will be examined with respect to their smaller socioeconomic/political segments which correspond to our understanding of seasonal demographics and their social cognates.

It is assumed here that style encodes some level of corporate membership, and that the commingling or discreteness of style in a given assemblage will reflect a level of interaction or integration (Longacre 1968, Michlovic 1981, Weissner 1985, Whallon 1968). This is, admittedly, a problematic area. Stylistic heterogeneity in ceramics, for example, has invoked explanations of a group's marriage and residence rules (e.g., McPherron 1967, Whallon 1968), raiding and warfare (e.g., Trigger 1984, Ramsden 1977), stylistic mimicry (e.g., Mason 1976), and trade and exchange (e.g., Fitting

1975), all of which are potentially viable causal factors which are considered in this analysis.

RESEARCH DESIGN

The sequence of analysis begins with the definition of key analytical units. In Chapter Two the concept of ethnicity and its relation to archaeological cultures with an emphasis on the use of style is discussed. Using ethnographic and ethnohistoric sources examples of alternative interactive options are presented. With these examples it is possible to identify grades or stages in interactive possibilities from animosity to amicability. It is asserted that no single type of interaction is the exclusive domain of any particular group since, as noted earlier, unique situational factors may condition the nature of any episode of interaction. This notwithstanding, there is an important dimension of interactive classification that is contingent upon group size, composition, and level of sociopolitical complexity that circumscribes the possible choices in interactive types on the part of the participants. As will be shown, four general types of interaction encompass most of the variability seen in contact situations.

However varied are the alternatives seen in interaction possibilities of ethnographic and ethnohistoric groups, the translation of these into archaeological interpretation poses severe limitations. In Chapter Three the translation of ethnographic/ethnohistoric interaction into a form which lends itself to archaeological interpretation is made. Of importance to this study is the extent to which style is used to symbol group identity, and the extent to which style is utilized by archaeologists in the creation of archaeological cultures. The implications of style for an archaeologically based definition of group range and territory are also discussed. Finally, the archaeological cognates of group interaction are specified, addressing the thorny issue of assemblage variability and its explanation via archeological data at the levels of artifacts, sites, and the region.

In Chapter Four, archaeological cultures are defined at a theoretical level and for the Lake Superior region specifically. A cultural-historical overview gives the context for the definition of Terminal Woodland substage cultures based on stylistic variation expressed in material culture. This, in turn, provides the basis for examining patterns of interaction in the Lake Superior basin. The precontact archaeological cultures of the Upper Great Lakes region are identified by their ceramics, some of which, in turn, have been linked to corresponding postcontact linguistic groups. These hypothesized equivalencies approximate ethnic groups and/or archaeological cultures, and serve as the maximal units of analysis. While they form discrete analytical entities, the artifacts which are used to identify and define these cultures are often found in mixed assemblages. In some cases assemblages contain materials which appear to reflect a combination of stylistic elements derived from two distinct traditions. The extent of this mixing and/or hybridization is assumed to reflect actual or potential contact situations.

In Chapter Five, the Terminal Woodland substage on Isle Royale is examined with respect to 1) the archaeological cultures represented, 2) the degree of homogeneity/heterogeneity in the ceramic assemblage, 3) the subsistence base, seasonal indicators, 4) the inferred demographic content, and 5) evidence for technological activities involving discrete raw materials. The aggregate of these sites constitutes the basis for suggesting patterns of cultural interaction/integration in the Terminal Woodland substage. This provides the initial phase of identifying archaeological examples of potential contact situations.

The Terminal Woodland substage on Isle Royale in the Lake Superior Basin has been selected as the temporal and areal universe of this analysis. This framework offers several advantages to this type of study in the form of reasonably discrete archaeological cultures whose regime of subsistence and settlement is fairly well documented on the mainland. The Terminal Woodland was chosen primarily due to the presence and abundance of ceramics which, in this analytic context, is essential to a meaningful analysis of interaction/integration among groups. The Terminal Woodland substage has the advantage of being better documented than any other period of prehistory in the Great Lakes area (as well as the concomitant disadvantage of being very complex) in the Upper Great Lakes area.

Chapter Six considers unique resources within a variety of cultural settings, examining the systems for acquisition, processing, redistribution, and disposal of the resource. This involves sociocultural, technological, and logistical dimensions and serves as the point of departure for the discussion of Lake Superior copper. The role of Lake Superior copper, the techniques used in its extraction and fabrication, and its regional distribution on archaeological sites are discussed as a necessary prerequisite to the consideration of interaction revolving around copper resources.

In Chapter Seven, neutron activation analysis is used to test a series of hypotheses concerning relationships among a sample of Terminal Woodland ceramics from across the Upper Great Lakes region. These sample groups, selected from Isle Royale, northern Minnesota, northwestern Ontario, the Straits of Mackinac, and the Keweenaw Peninsula, reflect mobility of either the pots as objects of trade or exchange, or the movement of the potters. These data are then discussed in light of the evidence of cultural interaction on Isle Royale and across the Lake Superior basin. The availability of ethnohistoric literature from the Upper Great Lakes enhances the potential for the construction of models which reflect regional ecology and geography. Within the time frame embraced by the Terminal Woodland period (ca. A.D. 800-1450), the Lake Superior basin acts concurrently as a barrier and facility to mobility (Little 1987). Although canoe trips out of sight of land are reported, voyages across the lake involve risks so great so as to preclude them as a viable option on a regular basis. Travel along the lake shore, on the other hand, increases mobility and makes possible the transportation of quantities of goods that would be otherwise impossible. It is suggested that goods and persons made frequent use of the east-west routes throughout prehistory, both on the north shore and on the south, resulting in the interaction between groups of Algonkian, Iroquoian, and Siouan speaking peoples.

There may be a gulf between an interactive study based on ethnographic and ethnohistorical data, and one based solely on archaeological evidence. The patterns documented by the former must be reduced greatly in order to render them meaningful to the archaeological context. The interpretation of stylistic diversity on sites has shifted, historically, from theories of migration and diffusion to explanations of group exogamy and direct trade or exchange involving ceramics. This shift is largely due to the increasing emphasis on models which employ a relatively narrow scope, either of single sites or of catchment areas, and which insist on viewing archaeological cultures or sites as isolated phenomena. The limitations of single site analysis are such that equally important issues of information exchange, mobility beyond catchment areas, and intergroup interaction/integration are effectively precluded. The extent to which this analysis is successful will be measured in its capacity to demonstrate that (1) the examination of nonsubsistence variables is a both desirable and fruitful undertaking for prehistoric archaeology, and (2) archaeological cultures are fluid associations which are highly variable in composition, and capable of a wide range of interactive possibilities with other groups.

CHAPTER 2

ETHNICITY AND INTERACTION

INTRODUCTION

In this chapter the concept of ethnicity is discussed with respect to its relevance to an operative definition of archaeological cultures and to the potential forms of interaction open to ethnographic and ethnohistorical groups. Examples of interaction drawn from ethnographic and ethnohistorical groups are used to demonstrate the complexity of the content of group interaction, and the contextually specific variation that may occur in interaction between two groups. The classification of interactive types offered is not a model of interaction, per se, but a means of organizing the continuum of interaction alternatives in anticipation of a study of archaeological cultures in which a major transformation of the expectations from an ethnographic/ethnohistoric reality to an archaeological approximation is required.

ETHNICITY

The use of the classification of sociocultural organization which originated in the neoevolutionary school of anthropology (Service 1962, 1971) is not a requisite of this analysis. The catholic use of the definitions of bands, tribes, and chiefdoms has repeatedly demonstrated the inherent weaknesses of that system of classification (Fried 1966), although as broad parameters by which levels of sociocultural complexity may be contrasted, the nomenclature continues to have heuristic value. In the Upper Great Lakes region there is a concern with group dynamics which not only include the concepts of bands and tribes, but many smaller internal partitions such as hunting units or trapping partnerships. The notion of an ethnically pure band or tribe cannot be outright discounted insofar as this idea is the essential foundation for the archaeological interpretation of style. However, it serves only as a model, and as a point of departure for an examination of the ragged margins of these concepts where groups blend and boundaries become indistinct.

Barth (1969) is an oft cited source for definitions of ethnicity in the archaeological literature. His four dimensions of ethnicity include the requirements that; 1) the ethnic group must be biologically self-perpetuating, 2) the group shares fundamental cultural values, 3) the ethnic group makes up a field of communication and interaction, and 4) the group has a membership which identifies itself, and is identified by others, as constituting a category distinguishable from other categories of the same order (1969:10ff). Barth acknowledges the flow of contact and communication across ethnic boundaries, stating that the nature of the interaction is structured to preserve the categories of ascription and cultural differences which constitute the basis for self-identification.

In an elaboration of Barth's contribution Despres (1975) investigates the genesis and persistence of ethnic boundaries, the political incorporation of ethnic populations, and the organization of interethnic relations. In his critique of Barth, Despres finds the former's conception of ethnicity highly subjective. However, Despres himself underscores the subjective nature of ethnicity by pointing out that cultural categories are relativistic. Much of the argument which follows his definition and critique is directed towards ethnicity in the context of modern multiethnic communities or states. Despres also finds important the role of competition for resources in explaining ethnicity: "ethnic boundaries give issue to social strategies which are designed to monopolize particular resources, or in some instances, entire resource domains" (1975:200).

A more appealing approach to ethnicity proposes a cognitive/ideational definition. Aronson (1976:14) states that ethnicity is, "an ideology of and for value dissensus and disengagement from an inclusive sociopolitical arena, that is, for pursuing major values deemed not shared by others in the arena." Following Geertz, Aronson further explains that the "function of [ethnic] ideology is to make an autonomous politic possible by providing the authoritative concepts that render it meaningful, the suasive images by means of which it can be sensibly grasped." Aronson goes on to point out that the ethnic group is not the only type of group in the sociopolitical sphere. For example, class is not necessarily synonymous with ethnicity, and that the use of cultural differences by competing groups for political ends is the basis for ethnicity. Like Despres, Aronson's concern is primarily in the realm of modern social pluralism and multiethnic nation-states.

Using a case study of the interaction between ethnic groups Foster and White (1982) operationalize a definition of ethnicity which emphasizes the cognitive process in perceived distance between ethnic categories. Utilizing data from Thailand they contrast relations between Thai-Muslim (Tai educated), and Thai-Muslim (Islamic educated), and in another study they examine perceived distance between Chinese, Malay, Indian, European, and other foreigners in Singapore. Their third and final case study evaluates the relations between local and immigrant Filipinos in Hawaii.

Among their conclusions they find that ethnic categories become integrated into symbolic systems which are given affective dimensions, and that these categories become associated with rights and obligations of ethnic groups. Of particular importance is the finding of differences between behavioral and perceived distance between groups (I have chosen to express this as the difference between content and sentiment of relations, respectively), and further, that identity at any given point is a "dynamic cognitive process involving the social-situational manipulation of ethnic identity" (Foster and White 1982:121).

The underlying principle shared by these definitions of ethnicity is one of structural relativity, a term employed by Sahlins (1961) to describe the changing nature of lineage segmentation but one which has much broader applicability without compromising its intended meaning. Structural relativity allows for transformations between categories of identity, dependent on contextual variables. In the following section, ethnographic and ethnohistoric examples provide us with these contextual variables and permit a classification of modes of interaction which reflect the vacillating structure of intergroup/interethnic relations.

INTERACTION ALTERNATIVES: ETHNOHISTORICAL AND ETHNOGRAPHIC BASIS

Ethnohistoric and ethnographic sources provide the basis for the generation of a range of interactive types utilized in this analysis. The sources are not intended to have any historical connection to the archaeological case study. Rather, four essential interactive options described below are found to operate within a wide variety of sociocultural situations and in a wide range of settings. The first examples are drawn from historically documented contacts between Caribou Inuit and Caribou-Eater Chipewyan which form the basis of the interaction classification. This is briefly applied to a consideration of patterns of warfare among East African pastoralists. Finally, some examples of interaction are drawn from the Upper Great Lakes region's ethnohistoric sources. These examples are only a few of many possible choices which would be equally appropriate to demonstrate the interaction options open to groups.

In some respects the Chipewyan-Inuit example contains more extremes in oppositional categories than will be the case for the archaeological study. Historically, the two groups had a relatively brief period of contact which may have curtailed a developing long term relationship in contrast to the prehistoric Algonkians, Iroquoians, and Siouan groups which had been neighbors for centuries. The environmental constraints and subsistence options are also more pronounced than was the case in the prehistoric Lake Superior basin and likely contributed to the types of interaction documented for the region.

In considering relationships between two ethnic groups and their relations to their environment, the boreal forest and barrenland ecology provides the requisite background. A caribou-hunting subsistence economy characterizes both the Inuit and Chipewyan with antecedents in the prehistory of the region; a pattern which among the Chipewyan persists in a modified form to the present.

The prehistoric record of human-caribou interrelationships is an appropriate point of introduction to the diachronic trends in adaptive strategies and human interaction examined below. Gordon (1975) has developed the "discrete band/discrete herd" hypothesis based on archaeological investigations in the barrenlands. Arctic Small Tool and Dorset sites dating between 1500 and 700 B.C. produced a configuration of internally homogeneous stylistic complexes which appear to correspond to the distributions of the Kaminuriak, Beverly, and Bathurst herds. The discrete band/discrete herd hypothesis is suggested for a Paleo Eskimo archaeological culture, yet the model is derived in part form the historic Chipewyan, indicating a highly successful adaptation transcending chronological or cultural differences. The Chipewyan pattern may be projected back as early as 200 B.C. with the Hennessey complex of the Taltheilei Shale Tradition (Gordon 1975). The adaptive strategies of both the Chipewyan and Inuit are remarkably similar. Over time, that is, with the cultural evolution of the Caribou Inuit, the Chipewyan and Inuit grow to resemble each other more closely. For both groups social organization encodes the strategy and tactics for optimizing the target resource: caribou.

Helm's (1968) model of Athabaskan social organization defines the regional band, the local band, and the hunting unit. The Chipewyan bands which exploit the Kaminuriak herd and those which exploit the Beverly herd assume their group identity from some geographical feature within their range (Smith 1978:76). Band membership is fluid with recruitment by residence and joint cooperation in hunting. This corresponds closely to the definition of the band range which is defined by the regular use of a discrete area by a particular band. The regional band rarely if ever coalesces into a single cooperative unit.

The local band functions as a "microcosm of the regional band" (Smith 1978:76). Identity is derived from a smaller geographical feature within the band's range. Winter sites of the local band are located within the transitional zone near frozen lakes where yarding caribou are anticipated (Irimoto 1981, Smith 1978).

Hunting (and later in the eighteenth century, trapping) groups are the smallest unit of organization among the Chipewyan and are typically comprised of three to eight nuclear families (Smith 1978:77). Irimoto (1981) recognizes the nuclear family as the minimal unit of production. Both are accurate interpretations when applied to specific activities, emphasizing corporate or individual strategies. Units smaller that hunting groups are usually formed within the context of the hunting group. By contrast, caribou hunting almost always involves the entire hunting or local band, depending on season and strategy.

Major harvests of caribou are possible twice a year, during the spring and fall migrations. Since a herd's migration corridor may vary from year to year Chipewyan hunting units are distributed with respect to the <u>anticipated</u> distribution of caribou (Smith 1978:82). This is a linear arrangement of kin-based communications networks which crosscut the paths of the Beverly and Kaminuriak herds along the southern margins of the tree line (Gordon 1975, Smith 1978). Herd movement is monitored in all season by small hunting units, families, or by the occasional all male hunting parties that venture well into the barrens (Smith 1978:82). This monitoring and subsequent reporting of herd locations and movement provides the basis for anticipating which locations will intersect the migration corridors. Water crossings figure importantly in this respect, since spearing from kayaks or canoes provides large returns. A second period of caribou hunting occurs between migrations and is conducted by individuals or small hunting units. Summertime hunts followed the caribou along their migration corridor but this technique was not used to generate a large surplus. Winter hunting was conducted within the relatively restricted winter range with camps typically located near a yarding area.

In contrast to the longevity of the Chipewyan pattern, the Caribou Inuit arrived in the barrenlands early in the seventeenth century. Their origin has been variously hypothesized: Birket-Smith (1929) viewed them as a "proto-Eskimo" relic of the earliest form of Eskimo culture prior to the development of a coastal adaptation. Mathiassen (1930) suggested an opposing idea, that the Caribou Inuit split off from a Thule group and gradually adopted an interior subsistence pattern. Burch (1972, 1979) utilizes climatic data to support Mattiason's hypothesis, suggesting that an interior caribou centered adaptation evolved out of an episode of climatic deterioration in the "Little Ice Age."

The Chipewyan sentiment for the Inuit is perhaps best expressed by their taxonomy of other groups. Groups with which the Chipewyan have frequent contact (i.e., other Athabaskans) are called dene according to the cardinal directions (e.g., saaisa dene or eastern people, yodai dene or western people). The Inuit are referred to as hot'elna (barrenland enemy), the Cree as enna or enemy (Irimoto 1981:25). Viewed as the object and subject of contempt by the Chipewyan, the Inuit provided the model for the hot'elna det'oi, a supernatural people who resemble Eskimos but have massive body hair resembling a bear. Food is eaten raw, and in times of need, so are their own children. They are found only in the range of the Inuit (Irimoto 1981:24). Clearly, the use of the mythical image served to reinforce the distance between Chipewyan and Inuit by promoting inimical attitudes.

The Caribou Inuit are divided into five maximal bands consisting of 50 to 300 persons each (Arima 1984). These are autonomous and lack formal internal political organization. There is consciousness of group identity among the maximal bands with particular affectations of dress, name, and tool styles. Maintenance of maximal band identity is seen in the tendency for endogamy within Caribou Inuit society, in contrast to marriages with coastal Inuit groups.

Spearing at water crossings and bow and arrow killing at drive lanes meet the caribou in May. Hunting units intercept the herds to prepare a store of dried meat for summer use (Arima 1984:448). If necessary the summer stores are augmented by fishing. Maximal band aggregates coalesce in late summer and remain together throughout the winter. There is a major investment of corporate energy directed to the fall harvest of caribou since it must serve the requirements for food and shelter until the following spring. Small groups of caribou often wintered in the wooded river valleys of the barrens. These were hunted by stalking but this technique was met with low returns until the introduction of the rifle made long range shooting possible (Arima 1984:451). Winter camps were concentrated in the interior with dispersed coastal camps in the summer.

The settlement and subsistence strategies of the Caribou Inuit and the Caribou Eater Chipewyan are very similar. The tenure of the Caribou Inuit is barely 300 years long, but within this brief time one witnesses the rapid development of a subsistence system highly reminiscent of its Athabaskan neighbors to the south, while in other domains of culture it remained uniquely Inuit. Sharp (1977) examines Chipewyan social organization throughout the historic period, finding that despite the adoption of the Algonkian style canoe, use of dog teams, and firearms, it remains essentially unchanged. Modifications were made in seasonal scheduling to meet the added responsibilities of provisioning fur trading posts with caribou meat. Fur trapping was undertaken unenthusiastically (Sharp 1977:37).

Secondary sources based on historical documents and direct observations allow examination of the patterns of interaction between these two groups. Chipewyan-Inuit interaction is considered below with respect to four questions:

1) Is the content of the interaction representative of the sentiment expressed by one group for another?
2) What motivational factors can be identified to explain the various types of interaction?
3) To what extent can the types of interaction between these groups be attributed to general principles of interaction between groups with similar adaptive strategies and technological capabilities?
4) How do interactions document themselves materially?

Using examples of interaction cited by Arima (1984), Janes (1973), and Smith and Burch (1979) largely taken from Hudson's Bay Company records and those of the Thule Expedition, four categories or types of interactive options have been abstracted: ambivalent, amicable/cooperative/integrative, antagonistic/ noncooperative, aggressive.

Smith and Burch (1979) have divided the history of Inuit-Chipewyan interaction into four periods: Early Historic (1613-1715), Period of Intervention

(1715-1782), Period of Peaceful Coexistence (1782-1950), and the Period of Nucleated Settlement (1950-1977).

The early historic period finds the Chipewyan hunting caribou well north in the barrens. Inuit groups were restricted to the coast where they were actively engaged in sealing. This early period is inadequately documented for our purposes although according to Smith and Burch (1979) there are vague references to hostile sentiments between the two groups.

Documented interaction begins to gain momentum with the presence of French and British traders and officials. The establishment of posts at York Factory and Churchill marks the beginning of the Period of Intervention at which time the Chipewyan were encouraged to pursue furbearers for the trade. Hudson's Bay Company (HBC) records note that in 1717 a party of Inuit ambushed and killed six of a party of nine Chipewyan. No motivation is mentioned. Documents for the period between 1717 and 1721 give indications of alternating trade and hostile relations as Inuit groups began to impinge on the Chipewyan summer hunting range (Smith and Burch 1979:78). Until the Inuit received firearms in 1770 they were kept well to the north of Churchill by the flintlock-armed Chipewyan seeking to restrict access to the posts (Arima 1984:459).

A document from 1725 records a Chipewyan impingement some 150 km into the Inuit range (Smith and Burch 1979:78). Apparently there were no consequences of this action. What is interesting about this account is the recognition on the part of the HBC recorder of an Inuit range or territory with a characterization of the Chipewyan hunting unit as intrusive. By the middle of this period a pattern of variable interaction seems well established. HBC records from 1748 note that there are hostile sentiments among the Chipewyan who tend to blame the Inuit for their own misfortunes. However, it is the same year in which the first recorded example of coresidence occurs.

The regular trading visits to Eskimo Point by the HBC beginning in 1750 stimulated feelings of jealousy among the Chipewyan who were losing their monopoly over access to trade centers. Accusations of preferential treatment towards the Inuit may have given rise to the planned killing of an Inuit trading party camped at Eskimo Point in 1755. The HBC trading sloop had only just sailed out of sight when the Inuit were set upon by a party of Chipewyan. The reasons for this episode are twofold. The sloop had apparently failed or chosen not to respond to the smoke signals of the Chipewyan who desired to trade. Insulted, they prepared to retaliate against the Inuit who had just completed their trade (Smith and Burch 1979:51). Hearne (1958:217) suggests the killings were revenge, albeit in the context of opportunistic circumstance, for the magical slaying of two Chipewyan in the previous season. The explanations are not mutually exclusive and presuppose an atmosphere of hostility, real or imagined.

A peace agreement between the Caribou Inuit and the Chipewyan was negotiated by the HBC in 1764. Over the winter of 1767-68 a second case of coresidence was noted. In 1771, while peaceful trading was underway among the coastal Inuit and Chipewyan on Hudson's Bay, Yellowknife and Chipewyan massacred the Inuit of the Coppermine River at Bloody Falls (Hearne 1958). Hearne's account makes no mistake about the organization and intended outcome of this episode. His own compassion for some of the unfortunate Inuit was viewed as pathological by his Chipewyan hosts.

The period of Peaceful Coexistence is subdivided into two subunits by Burch and Smith (1979:81ff): Inuit Expansion (1782-1890) and Territorial Stabilization (1890-1950). At the outset of this period several factors crippled the Chipewyan position in the region. The winter of 1781-82 brought smallpox to many local band camps. In 1782 the French burned the HBC post at Churchill, which only served to encourage a shift to the post on Lake Athabaska established in 1778. The population decline and reduction in trading opportunities resulted in diminished opportunities for contact with the Inuit (Smith and Burch 1979:82-83).

By contrast, the Caribou Inuit appear to have undergone a population increase during the latter part of the eighteenth century. Continued encroachment into the Chipewyan summer range by the Inuit took place in a mixed atmosphere of amicable trading relations and small scale depredations between 1807 and 1818. HBC records continue to note the jealousy of the Chipewyan over signs of favoritism toward the Inuit. Inuit incursion westward and southward into the barrens took place as many Chipewyan bands were moving into the full boreal forest recently vacated by the Cree, themselves decimated by smallpox and measles (Yerbury 1976). Coresidential fall groups including both Inuit and Chipewyan were an annual occurrence on Yath-kyed Lake (Smith and Burch 1979:85). Cooperative efforts took on a new form in 1840 when the HBC uncovered a Chipewyan-Inuit conspiracy to defraud the Company in the sale of furs. Permanent occupation of the interior barrens by the Inuit was established by 1860. Friendly relations persisted without the exclusion of the Chipewyan from their summer hunting range in southern Keewatin, and by 1870 discrete ranges ceased to exist in an area of 24,000 km square.

Observations in 1868 by a Catholic missionary among the Chipewyan underscore the friendly content of Chipewyan-Inuit relations. There were expectations of regular contact with the Inuit on the part of Chipewyan hosts. Some of the Chipewyan were bilingual to a limited extent, although there is no indication that the reverse was true. A greeting ritual was developed and there was enough knowledge of Chipewyan food preferences so that an Inuit host knew to offer his guest dried instead of raw meat (Smith and Burch 1979:85). These observations, assuming they reflect the general content of relations for this period, indicate a tendency toward cooperation in trading and amicability in other forms of interaction.

The end of Inuit expansion is marked by the establishment of multiethnic communities around the trading posts. HBC census show that in 1881 the Churchill post community consisted of 515 coastal Inuit and 157 Chipewyan. The Brochet post in the same year included 386 Chipewyan, 217 Inuit, and 29 Cree. The transition into the following period also sees the crystallization of ethnic stereotypes which were to influence employment opportunities up to the present. Inuit workers were hired into the whaling industry in the 1830's where they gained a reputation for industriousness as opposed to the indolent Chipewyan, as they were perceived by whites. It was also this association with American whalers that introduced repeating rifles to the Caribou Inuit (Arima 1984).

The subperiod of Territorial Stabilization (1890-1950) sees the emergence of Inuit dominance in the local trade. However, the benefits of this advantage were shortlived. The year 1917 brought a severe decrease in the caribou population, resulting in starvation among the Inuit. This catastrophe became a trend, persisting with dramatic declines among both Inuit and Chipewyan populations. A famine more devastating than the 1917 disaster occurred in 1950. The reasons for this particular famine are unknown, although Arima (1984) suggests that a combination of overhunting and erratic caribou population decline are likely factors.

Interaction characteristic of earlier periods continued in the context of seasonal hunts in the interior. The establishment of a post on the northern end of Nueltin Lake in 1917 for the Kazan River Inuit brought them into sporadic but friendly contact with the Hatchet Lake Chipewyan. In 1930 a single Chipewyan household camped across a river from an Inuit settlement of four or five families where visiting, gaming, and dancing took place, "yet the establishment of regular interethnic social relations failed, leaving mutual suspicion and contempt" (Irimoto 1981:21-22). For all intents and purposes, opportunities for even this type of limited interaction ceased in 1961 when, in the face of a famine which threatened the remnants of the Caribou Inuit, they were removed to government camps on Hudson's Bay.

The only documented case of intermarriage occurred in 1938. Unfortunately, both parents died shortly after the birth of their first child, underscoring the Chipewyan belief that it is impossible to breed successfully with the Eskimo (Irimoto 1981, Smith and Burch 1979).

Post-1950 culture change increases in momentum and in complexity. Chipewyan and Inuit contact, which was becoming less frequent, was limited to the trade center at Churchill. Caribou Inuit and other Inuit groups who had no history of interaction with the Chipewyan began to emigrate to this port, creating a pronounced discontinuity in Inuit-Chipewyan relations up to this point (Smith and Burch 1979:90). Ethnically segregated neighborhoods and a ranked ethnic hierarchy virtually isolated the two groups in spite of their close physical proximity.

Smith offers an optimistic view of recent changes in Chipewyan social structure. Rather than assuming negatively that a process of "deculturalization" is underway, the shift towards increased sedentism is described in terms of the "the emergence of new cultural adaptations based in part on upon traditional patterns" (1978:38). In time, kin-based institutions tended to become more difficult to maintain: the larger postcentered villages may have strained interpersonal relations previously avoided by greater mobility and a diffuse settlement pattern. However, traditional values continue to be preserved, including an emphasis on egalitarianism, decision-making by consensus, and principles of reciprocity (Mattiason 1975).

Smith and Burch (1979) conclude that despite a sentiment of hostile relationships, few instances of violence can be documented for the Chipewyan and Caribou Inuit. Their use of HBC records suggests that the sentiment of relations became less overtly hostile through time. Janes (1973) also finds the content of historical relations essentially peaceful, but colored by a sentiment of mutual animosity.

Organized, premeditated violence occurred in the 1755 incident at Eskimo Point and possibly earlier in the 1717 ambush. The extent to which these events can be considered organized is debatable. In all likelihood the incidents were spontaneous in origin and acephalous in leadership, despite the necessity in the case of the 1755 killings of some level of premeditation and predisposition on the part of the Chipewyan. The Bloody Falls massacre of 1771 did not involve the Caribou Inuit but represents an extreme case of organized violence.

Antagonistic and noncooperative interaction includes the numerous accounts of small scale depredations. The 1717 incident may belong in this category. Spontaneous conflicts may have arisen out of chance meetings, although the stimulus for violence is impossible to characterize in a general way. This form of essentially hostile relations persisted until about 1820.

Both amicable/cooperative/assertive and ambivalent interaction functioned simultaneously with antagonistic examples, although the general tendency was toward more amicable relations. The extent to which these relations are conditioned by sanctions of the HBC and the desire to preserve economic relations with whites (or more importantly, access to trade goods) has not been developed here. Cooperation in hunting may have evolved later as shifting ranges brought Chipewyan and Inuit into contact at strategic hunting localities. Although avoidance through scheduling was suggested for the earliest Chipewyan-Inuit relations, it will be a difficult proposition to support empirically since, by definition, it leaves no tangible evidence.

While it is obvious that both the Chipewyan and Inuit were in competition for caribou, this competition was spatially and temporally isolated, usually without confrontation at the time the actual hunts were in progress. Contrary to expectations that competition over resources leads to violent or antagonistic behavior, caribou hunting appears to have been the context for coresidence and cooperation. Only control of access to trade centers and the jealousy related to the trade promoted antagonistic relations. In this setting it is likely that a synergism between the negative sentiments of the corporate body of Chipewyan and threats to an individual's avenue for prestige (i.e., trading) reinforced the possibility of violent interaction. Ironically, it is the same desire to control access to trade goods (and prestige) that at other junctures promoted amicable, or at least cooperative, exchanges between the Chipewyan and Inuit. Technological advantage in the form of firearms was briefly held by the Chipewyan until 1750 when regular trade between Inuit and the HBC bypassed the Chipewyan middlemen, effectively destroying their monopoly on access to Churchill. Otherwise, the two groups operated in a state of parity. As the number of sled dogs increased as a concomitant to an increased involvement in the fur trade, hunting pressure on the caribou increased. This, combined with the effectiveness of the repeating rifle and a predisposition for over-harvesting, placed both human groups in a precarious disadvantage with respect to their resource base. While there is no documentation for it, one might predict that under this type of stress and given what is known about caribou behavior and the hunting practices of both the Chipewyan and Inuit, each group may have sought to blame the other for resource scarcity and the ensuing collapse of the traditional hunting system.

The range of interactive options available to the Chipewyan and Inuit are not artifacts of their sociocultural organization or of any historical phenomenon. Looking at interaction among East African pastoralist groups one finds the same range of options available. As with the former example adaptive strategies and technology are viewed as constants. The critical natural resources are the distribution and availability of water and grazing lands.

In contrast to the Chipewyan and Inuit, the frequency of violent interaction is quite high. The need to maintain herds instead of hunt them places obvious constraints on the pastoralists. Typically, they operate in a range with a finite number of water sources, many of which are seasonal. Similarly, there is a nonuniform distribution of grazing lands which is also seasonal. As a consequence, pastoralists view territory rather differently than do hunters. There are finite limits to options in coping with drought, one of which is impingement on a neighboring group's waterholes. There is a cognition of territory among pastoralists that sets spatial limits relative to herd and camp location and needs. These may not encompass the same physical territory all year but fluctuate seasonally.

Violent interaction among pastoralists is largely reciprocal. Among them is found a similar juxtaposition between the sentiment and content of interaction (Jacobs 1977). That there is a predisposition towards violent interaction is, however, indicated by the social institutions which operate to satisfy certain needs such as economic and spiritual motivations. Cattle raids may or may not involve violence between groups but raiding often provides the impetus for retribution and escalation of hostilities. Cattle raiding is conducted to acquire bridewealth (Evans-Pritchard 1940), status (Baxter 1977, Fukui 1977, Tornay 1977), and/or revenge or recover stolen property (Larry Robbins, personal communication 1991). Economic opportunism may stimulate violent interaction as in the case of the Maasai's regional dominance in the ivory and slave trade (Jacobs 1977).

Among the Bodi intertribal homicide is generated by the death of a morare or "favorite ox" (Fukui 1977). Each adult has a morare, the color patterns of which are a source of personal spiritual identity. If the morare sickens or dies, the death of a member of a neighboring non Bodi group is sought as recompense. There is no reward other than spiritual implied in this form of violence, although individual prestige is a factor.

There is no central decision making process and usually no long term strategic objectives in mind when raiding is undertaken by pastoralists (although there are tactics). To this extent there is some similarity with the Chipewyan and Inuit. However, the role of age-grades indicates an institutionalized aspect of raiding in East African pastoralist societies (Baxter 1977, Evans-Pritchard 1940, Jacobs 1977). With respect to its functioning as a defensive network, Baxter (1977) notes some similarities with bilateral kin structure. Bilaterality exists in the context of contrasting pairs of age sets. The younger unmarried males constitute the active and aggressive role complemented by the older males who typically advocate passive resolutions to intergroup hostility.

There is proportionately more violence in intergroup interaction among East African pastoralists than between the Chipewyan and Inuit. Dramatically different perceptions and realities of territory and resources prevail with greater limitations on the pastoralist's mobility and interactive options. Among horticulturalists there is an even more emphatic definition of territory (Fukui and Turton 1977).

Before turning to the archaeological cultures and interaction in the next chapter some ethnohistoric examples from the study area require mention. Although this analysis downplays the immediate relations between a late prehistoric archaeological culture and the ethnohistorically documented groups of contact and the early historic period, the circumstances of interaction during this time are important as the closest geographical and cultural-historical analogs germane to the question of interaction.

The ethnohistorian may be as guilty of oversimplification of ethnic composition as the archaeologist by making blanket identification of a group without considering the origins of each individual of the group: a Huron village may contain a number of individuals or families from neighboring Algonkian or other Iroquois groups. Sharrock's (1974) analysis of ethnohistoric documents relating to the Cree and Assiniboine are highly instructive in this regard. Apart from the motives which may be directly attributable to the fur trade in the region, she documents the multiethnic association of the two groups in coresidence units ("any unified cooperative aggregate of any size whose members, for social, political, and/or economic purposes, form a single local group for any length of time," 1974:98).

Ethnohistoric accounts describe avoidance behavior (Innis 1970:24) and the presence of no-man's-land or buffer zones between villages as a means of ameliorating the potential for violent interaction. An atmosphere of reciprocal blood feuds acted as a backdrop for relations between the Huron and their neighbors to the south and east (Trigger 1976:319), and between the eastern Sioux and Ojibwa (Hickerson 1970). But beneath the very real potential for violence there existed a variety of mitigating techniques which belie the less antagonistic relations between interactive parties. In spite of officially antagonistic relations with the Mohawk many

Huron maintained amicable relations with them (Trigger 1976:349). The use of real and fictive kinship terminology coupled with the widespread adoption of captives also formed tangible links between groups. Finally, cooperative ritual was used to establish and reinforce relations: the Feast of the Dead included representatives of the Huron, Nipissing, and Algonkian and physically merged the bones of the dead as a strong symbolic merger of common interests (Cleland 1971, Hickerson 1960, Trigger 1976).

The distinction between the corporate feelings of animosity and the actual sentiment of interacting individuals is well expressed in an observation made by Joseph Nicollet, August 6, 1863, on a trip up the Mississippi River:

> The Chippewa from Sandy Lake and the Sioux from the lakes around St. Anthony Falls [modern St. Paul] often live on good terms and part only in case of general belligerency between the two nations to which they belong. So it was with the two parties I met successively on my way here. In the course of their hunting expedition, now interrupted, they had fraternized every evening in those abandoned camps...I found out that they had danced every evening, but I arrived too late to see the dances. They separated following the news of crimes committed at large in the land, and, not knowing what consequences these events might bring. [Bray 1970:45]

Thus, in spite of overall good relations, the Ojibwa and Sioux were compelled by the anticipated need to align with their respective corporate interests when events suggested an outbreak of hostility.

Based on the foregoing ethnohistoric and ethnographic examples, four major modes of interactive options are seen operating in varying degrees among human groups which perceive themselves as discrete and nonrelated to those with whom they are interacting:

AMBIVALENT: A pattern of small group interaction, ambivalent relations may involve some of the characteristics of cooperative relations but is tempered with mutual distrust and suspicion. Scheduled interaction is less likely to occur although it is not precluded (e.g., Ford 1972). The development of interpersonal relations may remain unaffected by this larger atmosphere of unfriendly relations (Trigger 1976). Ethnic distance as it is perceived by respective group members conditions ambivalent interaction, potentially transforming it in either less or more amicable relations.

Ambivalent interaction may take the form of avoidance. Scheduling of movements may, in part, be designed to minimize contact with other nonrelated groups or to avoid a concentration of people where subsistence resources may be limited. Avoidance is used to explain the mutually exclusive use of the northern barrens by Chipewyan in the summer and Inuit in the winter (Smith and Burch 1979:78). If such a balance use of the hunting range did occur in prehistory it was soon overshadowed by other forms of interaction. Avoidance may be underrepresented in historical records since it may have gone unnoticed.

AMICABLE/COOPERATIVE/INTEGRATIVE: This type of contact is peaceful and mutually beneficial to involved parties, typically found in the context of bands, smaller kin-based groups, and individuals. Shared language is not a requisite but is a conditioning factor. Mutually beneficial activities may include interpersonal trading arrangements, exchange of group members on a limited and temporary basis, cooperative resource procurement, and formalized scheduled contact. In addition, multiethnic associations may form to become integrative functioning units for any length of time.

In varying degrees, sharing, exchange, and formal trade characterize relations of mutual benefit which in turn reflect perceived degrees of relatedness. Sharing of food is a significant measure of relation, according to Sahlins (1972), representing close ties of mutual consideration modeled after relations between kin. The movement of goods and persons between interactive groups is reciprocal, based on mutually determined equivalencies in exchange value. Parity in values is a function of perceived distance: close relations exhibit little or no concern for parity in exchange value and the reciprocity can be delayed indefinitely. With increased distance a more rigid reckoning of value is imposed and the returns are expected to obtain within a shorter span of time.

Forming trade arrangements will often involve a ritual dimension. Ritual greetings and games may anticipate the exchange, indicating the formal quality of interaction. Ritual shared on a larger corporate level is an even stronger statement of perceived distance, such as Algonkian participation in a uron-sponsored Feast of the Dead where the commingling of remains symbolically expressed the closeness between the two groups while at the same time underscoring the economic obligations held by each party.

<u>ANTAGONISTIC/NONCOOPERATIVE</u>: This pattern of interaction is characteristic of competing, ethnically distinct groups. Size is not an absolute factor but the tendency is toward larger and more sociopolitically complex groups

which, unlike small groups or individuals, embody corporate sentiments that may amplify the negative aspects of ambivalent relations. Relations may be characterized by avoidance or periodic spontaneous aggression. Conflicts arise as a response to overt displays of animosity at confrontations over resource competition, often perceived as territorial transgressions or threats of usurpation of economic prerogatives. The juxtaposition of competing groups will stimulate a corporate response defined in terms of corporate sentiment and perceived distance between the opposing groups.

AGGRESSIVE: Violent interaction occurs at all levels of sociopolitical complexity, although the capacity to orchestrate planned aggression is facilitated by the presence of more formally structured ideas of corporateness defined in oppositional terms, and in the existence of integrative structures within a society which bring together and operationalize planned acts against other groups. The use of violence or, to invoke a Hobbesian sense of "warre" (a state of anticipation of being a victim of another's violence), may involve specialized social institutions such as warrior sodalities. These may become institutionalized to the extent that violence assumes a ritual form and seasonal context. Violence involving killing assumes a spiritually charged nature at all levels. The consequences of violent relations may result in a conscious restructuring of spatial relations with contested areas and/or a no-man's-land phenomenon. Ethnic relations may be played out in the treatment of captives, for example, adoption and incorporation will most often occur within linguistically related groups while more distant groups will be given a nonhuman status.

The extent to which the above consideration is applicable to archaeological examples is contingent upon the quality of the archaeological data. The level of specificity regarding group size, composition, and other operating factors seen in the ethnographic and ethnohistoric examples is almost unknown in archaeology. We may know from isolated examples that violent interaction took place in prehistory, but knowledge of the conditioning factors or other forms of interaction that may have occurred simultaneously remain obscure in the archaeological record. The transformation of the above examples into a form recognizable in an archaeological setting is one of scale. The fine scale of the ethnographic and ethnohistoric record requires generalization to a broader scale in which the operating units, loosely referred to as the "group," embrace larger aggregates of members in which patterns of interaction are manifest. These larger aggregates are defined as archaeological cultures.

CHAPTER 3

ARCHAEOLOGICAL CULTURES AND ARCHAEOLOGICAL DATA

INTRODUCTION

We have explored the complexity of interaction as it is played out among living groups, both distant and recent in time. It is now necessary to make the transformation that forms a bridge between the living and the dead in order to further examine the form and variability in interaction among archaeological cultures. This transformation becomes evident in the definition of archaeological cultures as entities based upon but vastly different from ethnographic and ethnohistorical ones. In this chapter we will see how groups are defined and how interaction is viewed through the archaeological record before moving into the more tangible realm of the late prehistoric archaeological cultures of the Lake Superior region.

ARCHAEOLOGICAL CULTURES

In the discussion that follows, which adheres to Trigger's usage of the concept of archaeological cultures, it will become clear that, for the archaeologist, the conceptualization of an archaeological culture is almost exclusively dependent on the configuration of traits (largely normative, nominally behavioral) associated with a geographic distribution on the physical landscape.

> An archaeological culture may be defined as a geographically contiguous set of artefact types that may occur in differing combinations in different functional contexts and that together form the surviving material expression of a distinctive way of life sufficiently comprehensive to permit its bearers to perpetuate themselves and their behavioral patterns over successive generations. [Trigger 1978:76]

Archaeological cultures are large in areal scope, long in temporal duration, and exclusive in terms of membership and are, therefore, not synonymous with component or community (Trigger 1978:116). Components and communities are often multiethnic, reflecting the dialectic among archaeological cultures (Syms 1977). Trigger (1978:117) cautions that, "a uniform material culture does not constitute proof that the people associated with it had a strong sense of common identity, any more than differences in material culture prove that lack of such a sense of identity." Thus, it is accurate to state that a given site has a Terminal Woodland substage component that includes elements of the Huron, Blackduck, and Juntunen archaeological cultures. Conversely, sites cannot, by the criteria set forth here, be described as having Huron, Blackduck, and Juntunen components, unless chronological or stratigraphic distinctions are discernable.

Certainly there are examples of sites where stylistically homogeneous ceramics suggest that only one archaeological culture was present. In this scheme such a site is considered an example of the absence of mixing of potters from discrete groups, but not necessarily one of the absence of interaction. Examples of stylistically pure components tend to occur in small collections where representativeness is in question and/or at small sites where the implication of a small number of people diminishes the probability that potters representing discrete stylistic backgrounds will be present at the same time. Interaction must be measured on a scale larger than a single site.

One attempt to measure complex interactions is Syms' (1977) Co-Influence Sphere model. This model is a response to the traditionally simplistic chronological model in which a one-to-one correlation of archaeological cultures and surviving ethnohistoric groups is assumed. The chronological model is unilineal, that is, cultures are largely viewed as having evolved in place over long periods of time (e.g., from the Shield Archaic to Laurel to Blackduck to historic Cree). It is also an assumption that there is no geographical or temporal overlap between archaeological cultures, with little movement within their territories. Under this model, change in material culture is explainable by invention or diffusion, all transitional forms attributable to in situ evolution.

Syms reaction to this takes the form of a complex model which attempts to explain the diversity of ceramic styles so often found on archaeological sites in a region. His model was stimulated by evidence of contemporaneous use of sites/regions by a variety of ethnographic groups exhibiting both positive forms of interaction as well as avoidance behavior and "emphasizes the importance of a constant consideration of more than one ethnic group at any season of year in a region" (1977:5). Syms' model assumes that groups utilized large areas of diverse ecological composition by a strategy of high mobility and technological adaptation.

Ceramics in Syms' model provide the source of boundary information reflecting a societal level of concern as more sensitive indicators of cultural partitions (1977:12). Within these partitions are three levels of intensity of range/resource utilization: core, secondary, and tertiary. The use of ceramics as the defining elements of cultural boundaries is based on assumptions taken from ethnographic analysis: i.e., that ceramics are sensitive indications of cultural boundaries produced in a familial setting which reflects a societal level of concern for the use of style and symbols (1977:12). Important to Syms' model is the use of microstyle in which, for example, Blackduck cultural materials represent the remains of a number of "related but autonomous" groups (1977:106). For Syms (1977:73) "ceramic variability...reflects numerous co-existing groups during specific time periods as a result of evolutionary change in stylistic impressions and movements of people."

For Syms, then, a ceramic tradition as it is perceived by archaeologists, represents the maximum aggregate of an archaeological culture. However, on the level of the site or subregion in which his core, secondary, and tertiary areas are in operation, the archaeological record of diverse ceramics reflects the mobility of various groups whose composition may include potters from more than one tradition or who may be influenced by stylistic practices from more than one tradition (accidental association in the archaeological record, notwithstanding).

Syms' model is realistic and precise, but as a practical matter very difficult to operationalize. It is necessary to assume, as Syms does, some level of correlation between the uniformity of the material culture and a corresponding archaeological culture as a first step in identifying the situations that deviate from it. Cautionary notes often include warnings that archaeological cultures cannot be automatically or mechanically linked with any ethnohistorical group (Trigger 1978:116, 117). This is true, but it does not mean that there will be no correlation; obviously, there must be some, or the use of style in archaeology is so inept that it invalidates all prior work. This cautionary finger shaking has, according to Sampson (1988), resulted in a poor environment in which to address questions of style and territory. Half of the issue is addressed by the question: are there patterns which suggest the existence of boundaries? The other half of the issue is framed by the question: what does the absence of boundaries tell us about intergroup interaction?

STYLE

The issue of style is central to the study of archaeological cultures. Style, in all its manifestations and definitions, permits the archaeologist to examine groups as they identify and distinguish themselves from nonmembers. The blending of style or the association of artifacts of different styles on the same site indicates rates and kinds of interaction/integration among groups. Subtle messages encoded in the stylistic elements of design may indicate the nature of social or personal relationships within and between groups, as well as to serve as a measure of the balance of personal and social identity through time (Michlovic 1981, Wiessner 1985).

Much of this has been learned from the study of living groups and, as such, has been found applicable to archaeological examples, albeit with certain limitations (Hodder 1979, Wiessner 1985). Formal definitions of what we call style in a broad sense have been offered to partition more explicitly the concept into meaningful units for analysis. Sackett (1982) considers the standard, isochrestic, and iconographic levels of stylistic variation with respect to style. The standard approach is a normative one focused on the "diagnostic" attributes of the artifact, where morphological similarities are taken to indicate cultural-historical relationships. His isochrestic approach defines style as a set of alternative ways of accomplishing the same ends, or as Wiessner has chosen to characterize it, "choosing specific lines of procedure from the nearly infinite arc of possibility and sticking to them" (1985:160).

Iconographic variation is defined as "specific elements of nonutilitarian formal variation which function symbolically as a kind of social iconology to identify human groups" (Sackett 1982:80). In other words, symbols contain information which structures formalized relations.

Wiessner commented critically on Sackett's classification of stylistic variability (1984, 1985). She acknowledges that there is such a thing as isochrestic style, particularly in the realm of technology. For example, ceramics may be constructed from either the coil, paddle and anvil, or some other technique. The choice of one technique should represent a conscious decision to replicate the previous choice of other potters in the community, but either way one ends up with a pot. Sackett clearly sees isochrestic variation as something larger than does Wiessner. The difference is made up in Wiessner's definition of stylistic variability where there is truly a "nearly infinite arc" of potential variation:

> Style, as I see it, has a behavioral basis in the fundamental human cognitive process of personal and social identification through stylistic and social comparison. In this process, people compare their ways of making and decorating artifacts with those of others and then imitate, differentiate, ignore, or in some way comment on how aspects of the maker or bearer relate to their own social and personal identities. Style is thus not acquired and developed through routine duplication of certain standard types but through dynamic comparison of artifacts and corresponding social attributes of their makers. Stylistic outcomes project positive images of identity to others to obtain social recognition. While isochrestic behavior functions to make life predictable and orderly, stylistic behavior presents information about similarities and differences that can help reproduce, alter, disrupt, or create social relations. [1985:161]

Isocrestic variation, then, tends towards conservatism in technological aspects of artifact fabrication while stylistic variation reflects dimensions of the social atmosphere at the time of manufacture. Wiessner's informants were not able, or anxious to discuss specifically isochrestic variation but were eager to comment on questions of style (1985:161).

Style is used to express corporate membership in some form of group, theoretically at levels ranging from the immediate family to the maximal unit of corporate membership. Messages are recognized by group members and outsiders. Hodder (1979:446) suggests that the use of style as a means of asserting simultaneously the inclusive and exclusive aspects of a society will intensify during periods of stress. Although Sampson (1988) notes that the reverse relation has yet to be demonstrated, sharply defined boundaries which separate stylistically homogeneous populations of artifacts reflect more emphatic distinctions between groups while heterogeneity and the absence of clear boundaries suggests a high degree of permeability. Hodder also questions the applicability of a simple fall-off model to explain the distributions of certain styles, citing the need to consider "values" (e.g., social, cultural) in addition to distance and probability of interaction (1979:447).

Wiessner's definition of style and stylistic variability, which is based on her study of metal projectile points of the !Kung, directs this analysis of Terminal Woodland interaction in the Lake Superior basin. In Wiessner's work, style is seen as a direct consequence of immediate social conditions which obtain from ongoing relations with other human groups. The implications of this line of reasoning for the

Lake Superior basin, characterized by the widespread distribution of a variety of ceramic styles, is the permeability of social boundaries. In this instance the relevant categories of material culture are limited to stone, copper, ceramics, and rarely bone and shell. Of these, ceramics, by virtue of plasticity and widespread appearance on archaeological sites, are by far the most significant source of information on group interaction.

Isochrestic variation would be an appropriate avenue if the temporal scope of the analysis was extended to include such things as the shift from coil construction of ceramics by the Laurel culture to the paddle and anvil technique by Terminal Woodland groups in the same area, or to detect differences in copperworking techniques among groups in different areas or at different periods. However, within the time frame of the Terminal Woodland substage, there is no relevant application of this dimension; isochrestic variation will be held as a constant in this analysis.

What could be construed as a major impediment to this analysis is the use of archaeological cultures based almost exclusively on a cultural-historical definition of style, and the use of these to examine relationships among them using Wiessner's definition of style. Fortunately, the two approaches are not exclusive. Wiessner (1985:162) states that style is influenced by social contact, and that "exactly how it [contact] will affect style depends on history, cultural context, and the nature of relations." Unfortunately, the history of an archaeological culture, that is to say, when and by whom the archaeological culture was first identified and its subsequent ontogeny through excavation, analysis, synthesis, etc., presents a unique and possibly enormous source of bias (cf., Syms 1977). When, for example, does one archaeological culture represent something approximating ethnic "purity," and when does it represent a cultural hybrid?

In the archaeological case study of Isle Royale and the Lake Superior basin, it is the maximal group or tradition that is reflected in the nomenclature of the ceramic analysis. Therefore, it is the archaeological cultures that are the primary focus. Ceramic subtypes will not be used, in spite of the fact that they are a better representation of the subgroups within major archaeological cultures, and area a better approximation of the groups discussed in the ethnographic and ethnohistoric examples. This is due to the nature of the data base of the region which is extensive in its distribution and diffuse in terms of its content. Therefore, this study is satisfied to identify an item as belonging to the Huron, or Selkirk style group; an identification that carries intended information on cultural-historical context.

RANGE AND TERRITORY

A consideration of boundaries as defined by the distribution of style groups requires a like consideration of group range or territory. The two terms as they are employed in this analysis reflect two dimensions of one phenomenon. Range (sometimes referred to as "home range"; e.g., Jochim 1981) is defined by the area exploited on a regular basis in a group's subsistence and settlement system. This definition is based on the presumed correlation between the structure of sociocultural groups as they are conditioned by the natural environment (i.e., distribution and types of resources). In concert with an ecological definition of range, territory is seen as an inclusive concept in which different levels of corporate membership are structured on the social landscape. Range and territory are not coterminous; any given territory includes a number of ranges reflecting in a parallel fashion the distribution of small groups (i.e., families, hunting partnerships) that constitute the larger social entity which, in turn, defines the territory to which a group feels affinity or from which it derives part of its identity. Archaeological definitions which grapple with the territory/ range issue are generally confined what is called here "range," as a set of physical relations among other sites with or without similar artifacts (Sampson 1988). Developing a cognitive application of territory with archaeological data is more complex. Range is a significant concept as it relates to the relations of resource distribution and the cultural means by which they are harvested, and while it would not be a first choice in the study of a living group, it must be seriously considered in the analysis of sociocultural boundaries and intergroup interaction. The range concept is used to model territory when using archaeological data. An aggregate of ranges which share stylistic affinities may approximate the territory archaeologically. But even this is incomplete insofar as more than one group may claim a sacred or special resource area as part of its cognitive territory.

The scope of a range or territory is delineated in terms of its corresponding unit of sociocultural organization. Families, hunting units, macrobands, etc., will all have some notion of territory, the definition of which is contingent upon actual or anticipated needs of the immediate or anticipated corporate group. In this sense, the definition of territory is analogous to that of group identity (Jochim 1981). Therefore, the level of specificity in the analysis of artifacts will, in turn, determine the corresponding level of corporateness reflected archaeologically. Within a single tradition individual stylistic varieties, or subtypes, may represent internal social partitions of the larger group. If, archaeologically, one is only able to assign artifacts to a tradition and not the smaller subtypes, it follows that one cannot test propositions regarding relations among the subtypes and how they relate to the tradition as a whole, or to their counterparts outside the tradition. My argument applies to this thesis in the decision to follow whole archaeological cultures, synonymous with ceramic traditions, rather than the smaller subdivisions of ceramic classification which, while more specific in detail, are less reliable indications of group interaction by virtue of the problems inherent in ceramic classification at the ware level.

In a highly successful look at band territories in South Africa, Sampson (1988) is able to distinguish among several distinctive decorative techniques and designs on pottery. For Sampson, a definition of range/territory is a prerequisite to the delineation of seasonal settlement and subsistence. The more typical approach which begins with a boundary imposed by a model (e.g., a hexagonal lattice), "opens up the awkward possibility that the archaeologist has built two or more fragments of seasonal rounds of neighboring bands into a spurious model of a single, but nonexistent group" (1988:13). It is clear that, in some areas, the "spurious models" are a necessary prelude to a more realistic view of sociocultural groups if anything is to be said of intercultural dynamics. Sampson, with the benefit of a relatively complete data base and tight spatial and chronological controls, has great control over his data and is able to discern very fine distinctions of stylistic variation within

wh
sy
AR

sm
und
Us
at
sy
sub
sug
cu
typ
res
wh
Ma
con
W,
con
to s
aud

what would appear under less controlled conditions as internal noise within a larger stylistic community.

ARCHAEOLOGICAL EVIDENCE OF INTERACTION

What is true of the relative scope of regional stylistic traditions and their smaller internal partitions is equally true of the scope of analysis permitted by individual archaeological sites versus a number of sites distributed over a large area. Usually, it is impossible to characterize the content of the interaction that occurred at a given site which resulted in the commingling of artifacts of two or more stylistically discrete archaeological cultures. However, at the next level of focus, the subregional or regional distribution of these comminglings may produce evidence suggestive of patterned relationships among groups. Only in the happy event of clear cut superimposition or stratigraphic distinction may it be possible to state that certain types of interaction did not take place, and that the presence of both styles is the result of two events unrelated in time. In areas of pronounced social stratification where artifacts take on affectations of class membership (e.g., Hopewellian and Mississippian cultures), it may be possible to determine social access within a single community. The potters from the various archaeological cultures of the Terminal Woodland may have symbolized various types of corporate statements, made comments on others within the group, or to those outside, but it is limited in content to statements which are essentially egalitarian in nature and directed to a likeminded audience.

It now remains to show the linkage between the questions asked of the data and the archaeological record. How is interaction represented in an archaeological site, and is it possible to determine the nature of the interaction? This question may be hierarchically addressed from the perspective of artifacts, individual sites, and populations of sites within the region as a whole.

An objective of most archaeological studies is interpretation of the behavior of prehistoric human populations which occupied a given area. For example, lithic debitage represents an important and durable record of prehistoric behavior. Analysis of lithic waste is designed to collect data which can be used to make inferences about the activities of subsistence, tool manufacture and use, and interaction with other areas and groups in the form of long distance acquisition of discrete lithic raw materials (Luedtke 1976). Ceramic artifacts encode complex elements of style which are used to interpret the use of symboling as a means of distinguishing among archaeological cultures (Syms 1977). The association of certain ceramic types and certain lithic raw materials provide a measure of a prehistoric group, indicating its territory/range, sphere of potential interaction with other groups, and something of how it perceives itself relative to other groups.

The analysis of the prehistoric artifact assemblage is accomplished through several lines of inquiry, one of which is the delineation of stylistically oriented bodies of material representations in ceramic and lithic artifacts with boundaries in space and time. As a model these archaeological cultures can be further broken down into smaller social segments (e.g., bands, families, task groups) which correspond to our understanding of seasonal demographics and their social cognates. Interpretation of the nature of interaction is based on the aggregate evidence of stylistic attributes and discrete raw materials from the region as a whole as well as the more specific approach of interassemblage/intersite variability. Domestic activities are represented by ceramics, by evidence of tool maintenance and production, by the presence of discarded tools and tool fragments, and by the presence of features and food remains indicative of subsistence activities and season of occupation. More specialized activities are indicated by a narrow range of artifact types, suggesting only a few specific activities at a given site. For example, copper mining is recognized by the association of hammerstones, flakes from hammerstones, and mine pits. Copper fabrication, on the other hand, is represented by copper waste and discarded or lost copper objects in various stages of production. It is the configuration of the artifact assemblage that permits the analyst to address 1) the activities undertaken at the site, 2) the composition of the group, and 3) their subsistence practices. It also allows the generation of general propositions concerning the relationship between Isle Royale and coeval cultural groups elsewhere in the Lake Superior basin.

Regarding the relationship between copper and subsistence activities, a stance of parity between them will be assumed. It is unlikely that anything can be gained by trying to determine if people mined copper and did a little fishing on the side or if people fished and mined a little copper. The relation is a dynamic one, the important aspect being the systematics of the relationship. In the case of Isle Royale copper, some estimation of the intensity of copper mining in the Terminal Woodland is necessary to assess the allocation of labor and group composition (demographic, not ethnic) in an intensive vs. nonintensive strategy for copper acquisition.

Evidence of interaction comes from assemblage variability which involves the stylistic attributes of artifacts and raw materials believed to originate outside of a perceived range or territory. Style is used to identify geographically and temporally bounded populations of artifacts believed to be collectively understood bodies of symbols of group membership-- whether internally or externally directed. The extent to which the symbolic representations of style are internally coherent and exclusive is one measure of a group's membership (of potters, minimally). Style (and technique) may, however, be introduced from outside the group by means of several agencies including band exogamy and outright copying, or the items displaying the stylistic attributes may be obtained from a producer outside the group. One example is the hypothesis that what is stylistically Huron in design in the Lake Superior basin is actually copied from the Huron by Ottawa and Ojibwa (Mason 1976, Ramsden 1989, Wright 1968). The introduction of pots and potters from outside the group or area by a variety of vehicles is an important facet of assemblage variability and is assessed in light of the many competing hypotheses regarding this phenomenon.

Ceramic heterogeneity has invoked explanations of 1) group marriage and residence rules (e.g., McPherron 1967, Whallon 1968, J.V. Wright 1972), 2) raiding and warfare (e.g., Ramsden 1977, Trigger 1984), 3) stylistic mimicry (e.g., Fitting 1975, Mason 1976, Ramsden 1988), and 4) trade and exchange (e.g., Fitting 1975, J.V. Wright 1972a), all of which are potentially viable causal factors. All presuppose some level of mobility. Mobility of group segments is required for adjustments to perturbations in the subsistence base, or as a response to changes in the sociopolitical environment. Mobility can be juxtaposed with residential stability in order to establish an internal dialectic between questions of range or territoriality and culture contact which can occur within, at the edges of, and outside of any sociogeographical construct.

ARCHAEOLOGICAL IMPLICATIONS OF INTERACTION

Given the wide range of interaction alternatives, what are the implications for the material evidence of interaction as preserved on an archaeological site?

Ambivalent relations should not leave any archaeological evidence because physical interaction is generally lacking. Archaeological deposits resulting from parties exercising ambivalent relations should reflect only the membership of their respective groups. However, the relation implies indifference manifest in avoidance without the necessity of range or territorial closure. No marked cultural boundaries will be expressed. It is likely that small ambivalent groups will exhibit a pattern of site use that is, at least in part, inclusive, resulting in the mixing of occupations in a single site. This effect mimics relations more friendly and more interactive than may have actually been the case. Trade and/or exchange are not precluded in ambivalent relations, particularly when the items involved serve to buffer the local scarcity of essential resources (Luedtke 1976).

In amicable/cooperative/integrative interaction artifacts from more than one archaeological culture are associated on a site as a consequence of mixed group composition (i.e., a co-residence unit), or as evidence of trade/exchange between groups. Mixed assemblages are, under these conditions, widespread indicating permeability of whatever boundaries may be present. Diffusion is likely to occur under these circumstances with potential hybridization or mimicry of style elements and techniques. Raw materials may also be quite diverse, reflecting the resources of more than one territory. Trade and exchange are predicted under conditions of amicability, as are patterns of marriage between groups and transmittal of stylistic elements or techniques. Extreme diversity in material remains would be predicted, assuming that the interacting groups are distinctive in their material expressions. A lack of distinctiveness in style or material between groups may cloak the actual nature of the interaction.

Although trade is known to exist between hostile parties (e.g., Ford 1972), it is expected that, on a regional scale, evidence for antagonistic/noncooperative interaction is limited in scope. Physical evidence occurs at the territorial margins as an indication of exclusivity. The actual evidence of violence, well documented historically, will be virtually invisible archaeologically, except in the case of sites which contain the physical remains of humans with forensic evidence. At the level of individual sites this type of interaction will be reflected in a suite of artifacts that is derived solely from the group membership, and at the regional level, from the inference of pronounced boundaries. This does not imply that such assemblages are necessarily expected to be homogeneous in stylistic or raw material content: group membership may be simultaneously multiethnic in one dimension and exclusive in another. It is expected that assemblages will tend towards homogeneity as a function of a heightened sense of corporate exclusivity. Skeletal remains notwithstanding, the archaeological evidence for antagonistic/noncooperative interaction will not be apparent on individual sites, but must be inferred at a regional level since the essential characteristics manifest in the material remains will mimic certain aspects of ambivalent and amicable relations.

Regionally, aggressive interaction is readily recognized in a distribution of fortified villages and in human physical remains in which direct evidence of the cause of violent death is preserved. Territories and ranges should be firmly drawn with possible use of buffer zones (e.g., Hickerson 1970). Sites in a buffer or contested zone are limited to camps of short duration which would likely be interpreted as small hunting camps by most archaeologists. On the surface of it, one might expect absolute exclusivity of assemblage raw materials and stylistic components, formally indistinguishable from the conditions predicted for ambivalent or amicable relations. However, if the aggressive interaction involves the taking of captives, especially female potters, and their subsequent adoption into a group, one's expectations shift to accommodate an influx of stylistic variation. Raw materials, on the other hand, should continue to remain exclusive.

Except in the rare cases where the archaeological record leaves no doubt, each interaction alternative has the potential for creating an archaeological assemblage with mixed stylistic elements. Raw materials could be an indication of territorial boundedness, were it not for the confounding influences of trade/exchange across boundaries. A more parsimonious explanation of discrete distribution of raw materials is that of a core area (after Syms 1977) in which certain raw materials are not part of an exchange or trade system with neighboring groups.

A fundamental difficulty with this application of interactive alternatives, and with all models which attempt to deal with the interpretation of the archaeological record of a region which has several archaeological cultures, is the dimension of time and site formation processes. Collapsed stratigraphy, as it has been called by Canadian archaeologists (Hamilton 1988, Reid 1988, Syms 1977), is caused by the repeated occupation of a site over a long period of time, resulting in the apparent association of items which, in their systemic context had no immediate relationship to each other. Excavation strategies which are designed to accommodate this phenomenon by utilizing 2 cm vertical control, or by piece-plotting each item as it is excavated, only partially succeed in clarifying the site formation processes. In this analysis, the associations of artifacts on a site are interpreted as evidence of actual or potential interaction, irrespective of possible variations in the systemic processes responsible for their entry into the archaeological record.

The lack of a more fine-tuned chronological partitioning of a data base creates the possibility of a serious misreading of the archaeological record. For example, in the 700-800 year time span involved in this analysis, the presence of more than one style of ceramics on a site or in a region can be explained by a wide variety of factors not necessarily contingent on the types of interaction being considered here. Environmental determinants which condition the movement of groups are not invoked, for example. The lack of more precise chronological controls could be compensated for by the use of ceramic varieties which reflect smaller groups, smaller areas, and smaller increments of time. However, the ability to make accurate determinations at this level are suspect. Further, the assessment of potential interaction among Terminal Woodland substage groups requires a larger data base than is permitted by a more particularistic approach; we are studying the forest, not the trees.

ARTIFACT ANALYSIS

For the archaeologist it is the configuration of suites of associated artifacts that suggest relationships among archaeological cultures. The raw materials from which artifacts are made have sources that are almost always restricted in space. The physical treatment of these materials through a variety of technological operations transforms it from a raw substance into something useful such as a tool or ornament. The handling and use of the finished item and its movement within a single group, or its movement between individuals or groups as an item of exchange or trade implies, on the one hand, an estimation of value of the item in its systemic context, and the nature of relationship between interacting parties on the other.

The following section specifies the types of raw materials, and some of their technological transformations which permit the definition of the material assemblage specific to an area and, by extension, an archaeological culture.

LITHIC ARTIFACTS: The raw material of lithic artifacts reflects the movement of people and/or goods in the Lake Superior basin. Identification of lithic raw materials is observed for all lithic artifacts with the understanding that the resulting data are based on macroscopic observations. We are fortunate that in the western Lake Superior basin major sources of lithic raw materials (Figure 1) are relatively few and these tend to have discrete qualitative characteristics which minimize the potential for confusion between source identification made macroscopically. The lithic raw materials, including trace-cherts, encountered on Isle Royale and the Lake Superior basin are described below.

Bois Blanc chert (BBL): Primary sources for BBL are found on Bois Blanc Island (Mackinac Co., Michigan), Bruce County, and Haldimand County (Ontario). The geological association is the Lower Devonian Bois Blanc Formation where it is found as nodules and lenses in primary contexts. It is also known from secondary deposits in the form of pebbles. Luedtke (1976:210) describes BBL from the Juntunen site as having "large mottles and areas of limestone within the chert." Colors range from pale gray to cream N8/ to 2.5Y7/2 to 2.5Y8/2 to N7/; occasionally medium to darker gray N6/ to 5Y6/1 (Munsell 1975). The texture is fine to coarse, luster is dull, material is opaque; drusy crystals may occur in cavities and along planes. Luedtke also notes the "striking similarity between Bois Blanc, Onondaga, and Amherstberg cherts," (1976:211). There may also be some visual confusion with the Fossil Hill/Collingwood cherts from northern Lake Huron.

Gunflint Silica (GFS): GFS is found in primary outcrops from the Ontario-Minnesota border to the east of Lake Nipigon. Kakabeka Falls on the Kaministikwia River near Thunder Bay is the source of a banded variety. The geological association of GFS is the Gunflint Formation of the Animikie group where it occurs in tabular form (Pye 1969). It is also known from secondary deposits as till. McLeod (1978:168) describes it as having a variety of colors: clear to white, light gray, dark gray, blue, and black. Mottled or granular inclusions and thin dark bands are known. Dave Arthurs (personal communication 1987) describes it as "a milk white or virtually transparent at its best, but can also be a near opaque grey or blue. The

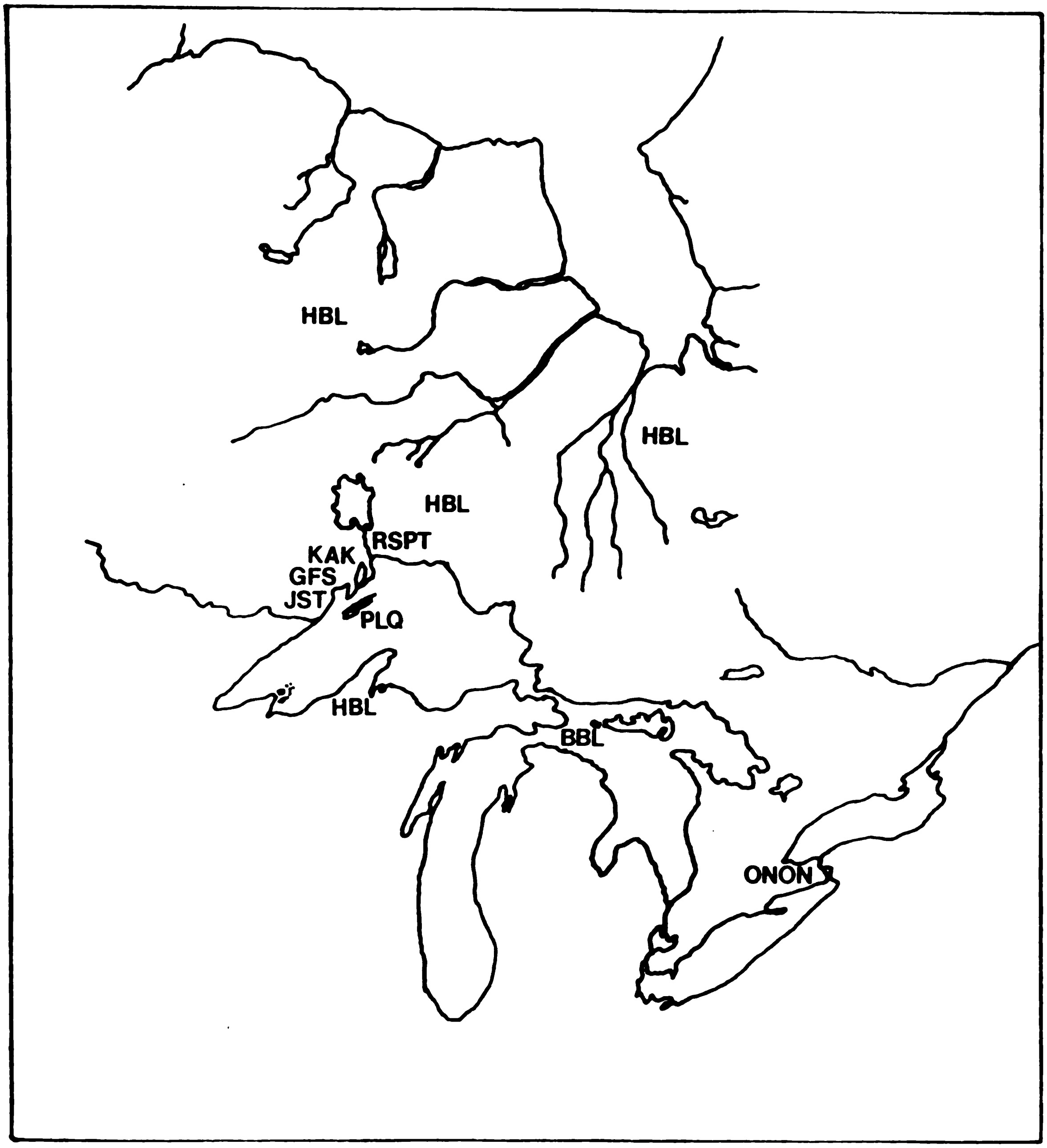

Figure 1. Lithic raw material sources.

identifying characteristics are the waxy lustre and the presence of black spherical inclusions that give it a peppery appearance." It is an excellent quality material, common and widespread on archaeological sites on the north shore of Lake Superior, Isle Royale, Lake of the Woods, and Rainy River. McLeod (1978:168) suggests that GFS was used primarily in Woodland substage sites. On Isle Royale GFS is known from most Woodland substage sites as debitage and unifacial tools. Rossport chert (RSPT), a typically homogeneous black raw material, can physically intergrade with GFS.

Hudson Bay Lowlands chert (HBL): HBL is found in a wide variety of secondary deposits as beach and river cobbles and pebbles. The primary source(s) is far to the north in the Hudson Bay lowlands whence this material was glacially transported. In the Lake Superior area HBL is strictly a secondary source, exhibiting highly variable characteristics in quality and color. A tan or yellow cortical rind is common but not diagnostic. Internal flaws are common but many pieces are homogenous and of excellent quality, albeit small in size. The bipolar reduction technique is often applied to HBL which satisfies most requirements for small tools such as scrapers. Few pieces of HBL are of sufficient size for larger tools, however. Occasional pieces of agate may be included in this category. A brown translucent chert often identified as Knife River flint (KRF) is believed to originate in northern Ontario, north of Lake Superior (Griffin and Quimby 1961:98). Steinbring (1974:68-70), in his discussion of Pickerel Lake site artifacts from Quetico Provincial Park, suggests that the "pre-Cambrian algal domes in the vicinity of Schreiber, Ontario, northeast of Thunder Bay, might well yield comparable variations." Indeed, chemical characterization of some of the KRF mimics by Julig, Pavlish, and Hancock (1988) indicates that much of what has been identified as KRF clusters more closely with the HBL samples than with the KRF. To assess this visual similarity chert samples from Isle Royale were analyzed at the University of Toronto SLOWPOKE reactor facility. Findings indicate that the KRF look-alikes from Isle Royale are also chemically similar to other HBL samples (Julig, Pavlish, and Hancock, personal communication 1989). On Isle Royale this variety of HBL frequently co-occurs with JST and GFS, suggesting that its point of entry to the island is from the Thunder Bay area to the north. This KRF-like chert has been found at several Terminal Woodland sites on Isle Royale. While in proportion it falls behind the other Thunder Bay area sources, it is often found in association with them.

Jasper Taconite (JST): Jasper taconite has a distribution similar to that of GFS; from St. Louis County, Minnesota east to Rossport, Ontario (Steinbring 1974:67-68). It is also found in the Animikie group of the Gunflint Formation where it occurs in tabular deposits (Pye 1969). JST is also available from secondary sources in the western Lake Superior basin where it occurs as beach cobbles. McLeod (1978:167) describes it as a "reddish granular chert, which, depending on the iron content (up to 28%) and the degree of oxidation of the iron present, may vary in colour from bright red to almost black. When held to the light the granules are visible." Dawson (1983:8) reserves the term "jasper taconite" for the red specimens only, distinguishing between them and green, gray, and black taconite. Gradations between colors may occur on single specimens, and it is not uncommon on Isle Royale to find specimens of JST that grade into GFS. Confusion between JST and cherts from other sources is highly unlikely. JST is a common raw material on Isle Royale sites and has been found at most sites dating to the Woodland stage.

Kakabeka Chert (KAK): Another material of the Animikie group in the Kakabeka formation of the Thunder Bay/Port Arthur area, KAK occurs in river cut gorges of the Kaministikwia River. Pye (1969:15) describes it as closely spaced chert layers with banded carbonate rocks, forming chert-carbonates. With equal access to GFS and JST, KAK may have been a less desirable raw material, owing in part to its cleavage plane fracture properties and relative lack of homogeneity.

Onondaga Chert (ONON): Onondaga chert has its source in the Onondaga formation of the Niagara escarpment of New York and southern Ontario where it occurs in both primary and secondary contexts. Luedtke (1976:273) describes it as "mottled and streaked and ranges from very dark grey, N3/ to N4/, to lighter greys, N5/, N6/ and 10YR5/1 to 10YR8/1. Texture is fine to medium, the luster is shiny, and the material is opaque. Fossils, bits of limestone, and crystal filled veins and cavities occur as inclusions." There is only one incidence of Onondaga chert on Isle Royale at the Finn Point site (20IR5) where a notched projectile point was found (Bastian 1963a:367-368).

Portage Lake Quartzite (PLQ): The only primary source of chippable stone known on Isle Royale comes from fine-grained arkosic quartzites interbedded with the Portage Lake volcanic series (Terry Keith, personal communication 1990). Primary and secondary sources are localized and of variable quality. Primary outcrops examined yield material with pronounced planar fracture properties. Secondary sources in the form of water-worn beach cobbles are more homogeneous with good conchoidal fracture. PLQ is a dense, micaceous quartzite with very fine particle size and some bedding. Color is dusky red 2.5YR3/2, homogeneous or with lighter bands. On Isle Royale PLQ has been found at both shoreline and interior sites, but exhibits a higher absolute and proportionate frequency at Archaic sites on interior locations. A similar and probably related lithic material called Sibley sandstone is found on the north shore of Lake Superior.

Quartz (QTZ): In one form or another, quartz is ubiquitous in the Superior basin, supplying some areas (e.g., the western Upper Peninsula of Michigan) with significant amounts of chippable stone. QTZ can be found in primary igneous, sedimentary, and metamorphic deposits, and secondarily in river, lake shore, and till contexts. On Isle Royale, however, QTZ is not typically found in a state of sufficient homogeneity rendering it suitable for tool production. No tools made of QTZ are known from Isle Royale and it is rare as debitage, in contrast to lithic assemblages from the south shore of Lake Superior and interior sites where it is common.

Rossport (RSPT): Rossport chert occurs in the Gunflint Formation where it intergrades with GFS and JST. Known exposures of RSPT are found near the town of Rossport, Ontario west to Whitefish Lake (Dawson 1980:59). Dawson (1974:69) describes RSPT as "a black chert with a slightly shiny surface, opaque diaphaneity and of massive structure." As noted by Dawson (1974:69), RSPT is "reminiscent of siliceous coal." J.V. Wright named this raw material type (1967:31) and has identified it in the assemblage from the Terminal Woodland levels at the Michipicoten site (1968). On Isle Royale RSPT is a common constituent on Woodland stage sites where other of the Thunder Bay area raw materials occur. It should be remembered that RSPT is an archaeological taxon for a raw material type which physically intergrades with GFS and JST, and it is not uncommon to find artifacts which demonstrate this feature.

COPPER ANALYSIS: There has been little interest in the analysis of copper waste categories, attention being directed towards the formal artifact categories. Bastian (1963a, 1963b) distinguishes between worked and unworked scrap, and identifies as intermediate categories bent strips and bars. Hoxie (1980) makes a distinction between flat hammered chips and nuggets, but found no items which he recognized as intermediate forms. Most of the literature dealing with copper artifacts is concerned with finished products, usually in contexts removed from the sites of their original production (e.g., Penman 1977, Wittry 1957).

A notable exception is Vernon's (1985) paper on the archaeometallurgy of the Old Copper industry. In it he studies the microstructure of a series of copper items including finished tools, ornaments, intermediate categories, and unworked pieces. A substantial contribution of his work is the identification of stages in fabrication represented morphologically and through the microstructural attributes. Cold hammering and annealing as conjoined techniques of copper working were employed in the manufacture of blanks which anticipate a range of final products, and in some of the formal tool categories. Vernon's findings indicate that cold-working of the metal results in a greater hardness, while annealing has a softening effect. The cold-hammering of previously annealed pieces obscures the structural evidence of annealing and returns the copper to a work-hardened state (1985:156). Although rarely mentioned in the context of aboriginal copper working, the technique of slaking hot metal probably followed the annealing. Slaking, or the immediate immersion of the metal into a cool liquid bath, renders the object available for immediate hammering.

In his sample of 15 blanks from an unspecified site in Houghton, Michigan, Vernon found that most were made "by flattening a piece of copper, folding it over and flattening it again, and repeating the process in a buildup fashion to the completion of the blank" (1985:156-157). Observations made on finished tools suggest that awls were finished in a cold-hammered state, whereas the knives, points, and adze were finished in a fully annealed state (1985:158-159). He goes on to consider the cultural implications of his findings, stating the possibility that items used for technical purposes, such as the awls, were cold-hammered to improve their functional qualities while the other artifacts, such as ornaments or large spear points, were employed in symbolic roles not requiring a final hardening.

Vernon's contribution to the understanding of the relationship between cold-hammering and annealing has important implications for copper working of later periods in prehistory. In the absence of specialized microstructural analysis we must employ a classification based on macromorphological observations.

In this analysis the extraction and fabrication of copper is modeled after reduction trajectories for lithic debris, and is derived in part from the replication of several tool and ornament types. Waste categories analogous to lithic debitage, intermediate stages of fabrication, and final products are identified in native copper assemblages. This classification permits the copper industry to be examined relative to other activities, such as flintknapping or subsistence related pursuits. Proportions of the various categories should indicate the intensity of initial copper working versus tool or ornament fabrication, and proximity to copper mines. Waste/initial fabrication categories (Clark 1989a:156-158) defined below are based on a combination of replication by the author and the examination of archaeological specimens:

1) RAW WITH MATRIX: These items show no evidence of hammering. Copper is present with basalt, calcite, epidote, or other nonmetallic matrix. This category represents an initial stage of processing or extraction. These pieces are of little value for further modification if proliferated with matrix due to the difficulty of bonding small pieces of copper and will likely be discarded at or near the site of origin. If larger amounts of copper are present, the piece will likely enter the flat, vesicular category.

2) RAW WITHOUT MATRIX: Evidence of hammering is absent but the piece is homogeneous, lacking nonmetallic matrix. The surfaces of items in this category may be smooth (e.g., a nugget) or rough. Homogeneity is a desirable quality and even a small homogeneous piece of copper can provide the basis for a variety of small tools or ornaments. Transport of homogeneous pieces to fabrication loci is considered likely.

3) NUGGET, HAMMERED: Items in this group are homogeneous with relatively smooth surfaces, and exhibit evidence of hammering without being conspicuously flattened. Folds or laminated features are absent. This category represents an initial stage of manufacture and is likely to be found at fabrication loci.

4) FLAT, VESICULAR: This category represents the hammering of the "raw with matrix" stage. The pieces are hammered flat causing the nonmetallic matrix to fall out, resulting in a "swiss cheese" effect. Depending on the initial size of the piece being worked and the degree of homogeneity the resultant product may be discarded due to the problems of bonding small pieces of copper. Items in this group may be found at both extractive sites where initial fabrication takes place, or at later stage fabrication loci to which raw pieces with matrix have been transported.

5) FLAT, HOMOGENEOUS: These are pieces which are hammered flat but which lack laminated structure. At this stage many will exhibit the beginnings of a rectangular profile with a bipolar and quadrilateral orientation to the hammered edges. This is a highly desirable stage which can anticipate any final product, size and internal structure being the only limiting factors. This category is more likely to be recovered at fabrication loci. This group is differentiated from bars (see below) on the basis of the more formal quality of the latter (cf., Vernon's "blanks"; 1985:155).

6) FLAT, LAMINATED: Items in this category can be either single sheets of thin hammered copper or layered sheets. Some are foil-like while others may be more dense: in either case they represent the limits of hammering single pieces and must be folded and/or annealed if they are to be used further. These items are used in the production of rolled tubular beads and small projectile points. It is also common to find awls and other larger items built up from a few flat sheets. Small flat laminated pieces represent copper debitage produced in the process of

hammering larger homogeneous pieces of copper and should be anticipated as a numerically abundant category on all sites
where fabrication is undertaken in addition to extractive sites involving the removal of copper from large masses.

7) ROLLED, LAMINATED: This category may represent the attempt to build up one or more flat pieces by sequential folding and hammering. A successful outcome utilizing flat sheets requires annealing since cold hammering of thin sheets will result in a brittle product. Discarded rolled tubular bead failures may also be included in this group, especially if crushed postdepositionally. This group is anticipated only at fabrication loci.

8) BARS: Bars are frequently encountered and represent a general preform or blank for the production of virtually all final products other than small rolled beads. They are typically rectangular and may be homogeneous or laminated in structure. Copper bars can be found at fabrication loci as well as at sites removed from the copper source areas since it is in this state that much of the copper could be stored or transported without committing it to a final form.

Formal tool and ornament categories follow the extant literature (e.g., Wittry 1957). Awls, beads, projectile points, crescentics, and "butterknives" form the bulk of the finished copper products in the region, although other categories including hooks and gaffs are known.

An important aspect of the analysis of copper artifacts is the consideration of temporal/cultural variability in formal types of finished items. For example, is there any significant difference between awls with round versus quadrilateral profiles, or between rolled tubular beads and heavier bent strip beads? Such questions may not be answerable based on data from Isle Royale alone and need to be addressed on a regional scale.

The role of copper as a unique resource with limited distribution may have been an important factor in the interaction between Superior basin groups. It is necessary to examine the value of copper in the broader context of the total material culture to determine the extent to which it was an item required for subsistence technology, a vehicle for attaining or demonstrating status, or a relatively unimportant luxury. Except for its use as ornaments, virtually all tools manufactured from copper could be duplicated in stone, bone, and wood. Yet copper is known from widespread Terminal Woodland sites. Some consideration of its geographic distribution around the Superior basin is necessary to determine the extent to which copper may have "drawn" residents of the north shore to Isle Royale. Lake Superior copper is treated in detail in Chapter 6.

CERAMIC ANALYSIS: The attributes utilized in the analysis of ceramic artifacts are selected to classify sherds and the vessels they represent into a larger taxonomic category or type. Materials utilized in manufacture, vessel shape, surface treatment including decoration are believed to encode the stylistic information resulting from the cultural context of a ceramic tradition and the temporal placement of the site from which the pottery was recovered. Further, neutron activation analysis (NAA) is used to determine the relationships between certain style groups and pots from archaeological sites around the Lake Superior basin. Specific hypotheses regarding the anticipated outcomes of the analysis are presented together with the results of the analysis in Chapter 7.

Since whole vessels are rarely recovered the analysis of prehistoric ceramics necessarily involves a classification of vessel fragments or sherds. In this analysis sherds are identified as to type, referring to the portion of the vessel from which they came. Rim, neck, shoulder, body, and basal sherds represent all possible types of vessel fragments. Where two areas are present on a single sherd, such as one from the rim and neck, or from the rim, neck, and shoulder of a vessel, the sherd is classified in the uppermost category, in this case as a rim sherd. Counts are recorded for each category. Thickness is measured in millimeters where both the interior and exterior surfaces are preserved intact. Tempering material is identified as to mafic or felsitic origin and a maximum measurement is recorded in millimeters. Temper density is estimated for each vessel. These descriptive data are recorded elsewhere (Clark n.d.) and are not presented in this thesis.

Vessel shape must be inferred from fragmentary evidence as well. The morphological characteristics are thus described for those items which exhibit morphological attributes, especially the relation between the shape of the lip, and the attitude of the rim relative to the neck and body. These observations are possible in a relatively small number of cases.

Surface treatment is recorded for both exteriors and interiors of sherds. In the Isle Royale assemblage interiors are uniformly smoothed; exteriors, on the other hand, exhibit more variability. These may be smoothed, polished, cord-marked, smoothed over cord-marked, or fabric impressed. Surface treatment is considered an aspect of pottery manufacture and is treated apart from decoration. Additional observations relating to surface conditions include the extent of erosion and the placement and extent of cooking residue.

Decorative attributes are variable and, taken in concert with the morphological variables, provide the basis for typological analogy to extant ceramic traditions in the Upper Great Lakes region. Type of decoration, its placement on the vessel, and its placement relative to other decorative motifs on the same vessel help to define individual vessels. The use of incising, impression by various means (e.g., cord-wrapped stick or push-pull), and punctations or bosses constitute most of the decorative technology seen on the Isle Royale ceramics. Characteristic ceramic attributes are described in Chapter 5 for each Terminal Woodland archaeological culture.

The functional definition of "vessel" used in this analysis is a sherd or group of sherds which can be confidently demonstrated to represent a single pot. Typically, vessels are defined on the basis of rim to shoulder sherds where decorative elements indicate unique attributes. Occasionally, undecorated or decorated body sherds can be assigned an individual vessel status on the basis of discrete traits such as temper or surface treatment.

SITE CLASSIFICATION

In order to understand the organization of demographics and labor in prehistoric cultures it is necessary to classify sites in terms of the activities undertaken there. The evidence for activities is inferred from both direct and indirect sources.

Artifacts, food remains, and features are a direct indication of the different activities undertaken at a given site. Site locations may offer some indications of potential activities by virtue of their proximity to specific resources or their relation to logistical features of the landscape.

There is not always a direct correspondence between the evidence and the actual activities conducted at the site. The multiple reoccupation of the same site by the same or different groups gives the impression of higher density of artifacts and, hence, of activities conducted there. In addition to this problem of site formation processes is the extreme variability in data recovery. Single artifacts found on the surface during a survey often reveal more complex deposits when subjected to a more intensive investigation involving subsurface testing. It has been the experience of many archaeologists to find their initial interpretations radically altered by subsequent investigation on the same site or region, even where a comprehensive sampling strategy was employed (e.g., Flannery 1976).

As a consequence, any site classification must be seen as a heuristic device by which broader generalizations regarding the issues mentioned above can be addressed. The classification is tentative in an absolute sense, but represents an organizational scheme that incorporates assumptions about land use that is drawn from ethnohistoric and ethnographic studies of how human groups allocate their energies and organize themselves on the physical landscape.

Nine site types and their criteria for classification are presented below. These terms are applied to both surface finds and subsurface deposits as descriptive devices.

0) Uncertain Status: This category is required to account for a site whose location or content is not adequately known. It applies to sites recorded in the past for which no adequate documentation exists.

1) Spot Find: The discovery of a single artifact or feature of any kind constitutes a spot find. The finding of a single artifact should be accompanied whenever possible by close examination of surrounding areas for additional materials, both surface and subsurface. Single artifacts represent the smallest of the "limited activity sites." This is often a tentative classification, since a revisit to a site is likely to encounter additional artifacts.

2) Lithic Scatter: The finding of an array of lithic artifacts relating to flintknapping activities without any associated domestic materials constitutes a lithic scatter. Artifacts may include any number of flakes, cores, and small (non-mining) hammerstones. Whole, broken, or exhausted tools may indicate an aceramic occupation site and are, therefore, not included in the lithic scatter category. This is a somewhat discretionary classification, requiring that a discrimination be made between an aceramic occupation and a lithic workshop.

3) Pot Break: As the name implies, this is a type of spot find, identified by the recovery of numerous sherds which represent the breaking of a single vessel. Single sherds fall under the category of spot find. Any additional associations of lithics, copper, features, or sherds from a second pot constitute an occupation site. Note that the term "pot break" can be used in the context of larger occupation sites to refer to a discrete ceramic feature.

4) Occupation: This broad category includes the association of lithics and/or copper and/or ceramics and/or features. Unless the evidence indicates a highly specialized activity, the assumption is that occupation sites are the focus of domestic and ancillary activities relating to habitation, subsistence procurement/processing, and related technologically oriented functions. Occupation sites are differentiated from mines, workshops which specialize in a limited range of technical activities, and mortuary sites. However, any and all potential activities may be associated with an occupation site.

5) Mine/Quarry: Copper mines and lithic quarries constitute a specialized site type. Although they usually are discrete in terms of activities represented by artifacts, they do occur in conjunction with occupation sites in some instances (see below). Artifacts consist of hammerstones and waste materials in association with relevant geological features, in the case of Isle Royale, copper deposits.

6) Burial: Unless associated with occupation sites, burial sites are seen as strictly the site of the deposition of human remains and associated grave furniture.

7) Occupation/Mine: This is a composite site type where evidence for domestic activity supporting mining operations is present.

We have, then, specific expectations of the archaeological record as it pertains to interaction among groups with distinctive material expressions and raw materials. These have been discussed in terms the classification and analysis of lithic, copper, and ceramic artifacts. Through this analysis archaeology defines its archaeological cultures which, while different from ethnographic cultures, permit the pursuit of interaction data at a general level which recognizes not the smallest but the largest aggregate of social membership.

In the following chapter, archaeological cultures as analytical entities are defined. A cultural-historical overview for the Upper Great Lakes and the archaeological cultures of the Terminal Woodland substage are presented as an introduction to the evaluation of interaction among groups, and the role of copper as a potentially mediating resource, on Isle Royale in Lake Superior.

CHAPTER 4

ARCHAEOLOGICAL CULTURES AND CULTURAL-HISTORICAL OVERVIEW

INTRODUCTION

The following discussion is concerned with archaeological cultures and their relationships in space and through time. As we have seen, archaeological cultures differ from historically documented cultures in several important ways. Smaller internal subdivisions including single or associated extended families are among the most important economic units in the historic ethnic populations of this area, but are generally below the level of archaeological visibility. As a consequence, archaeological cultures are typically much larger, more inclusive, and of longer temporal duration than their historic counterparts. As is evident in the discussion of the ceramic artifacts in particular, the attention paid to style, and its association with time and place, is the primary means by which the identification of archaeological cultures is pursued.

Apart from the obvious need to exercise control over the spatial and temporal parameters of the data, the definition of archaeological cultures is an organizational prelude to the study of interaction among prehistoric groups. In other words, it is necessary to have defined analytical units in order to assess the extent and nature of interactions among them. For Isle Royale, this study of interaction is restricted to the Terminal Woodland substage.

Although the documented prehistory of Isle Royale begins over 4000 years ago, sites dating as early as 8000 B.P. dot the Lake Superior basin. Following the retreat of the last glaciation prehistoric hunters found ample prey among the caribou, bison, elk, and moose in an environment then in transition from a periglacial tundra to the present southern boreal forest.

The archaeological remains are largely confined to stone tools and waste material left over from stone tool production. Large bifacial projectile points with distinctive flaking patterns are typical of these early cultures. The classic fluted points, often found associated with the remains of mastodon, mammoth, or bison are absent from this area. The first recognizable archaeological culture is the Plano Tradition, noted for the use of collateral flake scars on finished tools. The absence of Plano Tradition artifacts from Isle Royale is attributed to the high lake levels which prevailed at the time (ca. 8000-5000 B.P.). On the north shore of Lake Superior Plano artifacts have been found at a number of sites preserved, in part, by the effects of isostatic rebound of the shoreline which have elevated the already high beaches well above the current levels of Lake Superior. Notable are the Brohm and Cummins sites near Thunder Bay, Ontario (Dawson 1983). Both are quarry sites and have extensive areas of flintknapping debris of jasper-taconite, a material which figures prominently in the later periods of Isle Royale's prehistory.

The south shore of Lake Superior is less well known than the north, but finds in recent years have shown that the antiquity of this area extends at least as far back as 8000 B.P. The Flambeau (ca. 7000 B.C.) and Minocqua (ca. 6000-5000 B.C.) phases were initially defined for sites and artifacts from northern Wisconsin (Salzer 1974) which, like the Plano Tradition artifacts to the north, are characterized by distinctive flaking patterns and a persistent use of Hixton silicified sandstone as the preferred raw material. Hixton has its source in south-central Wisconsin and found its way at least as far east as Marquette County, Michigan where it occurs in some abundance on finished tools (Buckmaster and Paquette 1988, Clark 1989b). The best documented association of copper with this early period comes from the Itasca site in northern Minnesota which has been dated between 7600 and 5500 B.C. (Shay 1971).

The evidence for a human presence in the Superior basin during this early period is gradually becoming better known, but the interest of the Plano hunters in copper has yet to be demonstrated. Our knowledge of the Plano Tradition in this area is very rudimentary in contrast to subsequent periods where we have not only artifacts but the food remains and living sites to attest to the past life-ways of these people.

Two cultural traditions germane to the prehistory of Isle Royale are recognized for the Archaic stage: the Shield Archaic, and the "Old Copper Culture." Generalizations which distinguish these from the earlier Plano Tradition include a more diversified material culture, a broader subsistence base, and larger populations. Fitzhugh (1972:1) has characterized the Archaic stage in eastern North America as having "widely flung and locally variable expressions." Such is the case with the Superior basin cultures among which can be seen similarities in overall patterns of subsistence and organization, as well as contrasting stylistic expressions.

Some of the differences may be attributed to the local variability in environmental factors which affords scope to the parameters of archaeological cultures. Other differences may obtain from nonenvironmental factors which have more to do with the evolution of culture and society apart from the environmental constraints. Whatever the causes of dissimilarity, there is ample evidence for the interaction among prehistoric groups seen in the long distance movement of raw materials, including copper, across cultural boundaries. It is during the Late Archaic substage that we perceive an intensification of local subsistence strategies which give structure to the relationships between neighboring groups, thus facilitating the enhancement of exchange of both goods and information.

The Shield Archaic occupied an area on the Canadian shield from Keewatin District to Cape Breton, Nova Scotia (Wright 1972b). The distribution of their sites suggests extensive use of watercraft and primary exploitation of moose, caribou, fish, and beaver. Bone preservation on Shield sites is generally poor and the food resources are inferred from locational data. In the material culture of the Shield Archaic one finds no clear cut stylistic patterns, but rather an array of small utilitarian tools made of locally available resources.

Disagreement exists regarding the pedigree of the Shield Archaic. It is Wright's belief that cultural evolution in the Canadian Shield is an in situ transition from Plano to Shield Archaic to Laurel (1972b). According to Buchner (1979) the definition of the Shield Archaic is much too large and inclusive, and it is likely that it includes a number of smaller units which thusfar have fallen outside of our ability to identify them. Buchner also feels that the origins of Laurel lie not with an indigenous Archaic population, but came instead from south of the boreal forest. In either case, the archaeological identification of Shield Archaic, and the discrimination between it and aceramic Woodland assemblages has been difficult owing to the longevity in stone tool forms that clearly begin in the Archaic and continue into the Woodland stage.

For reasons of vagueness in its usage, the second Archaic archaeological culture is equally unpopular with respect to its title, and uncertain with respect to its meaning. The Old Copper Culture, Old Copper complex, or simply Old Copper begins as early as 3000 B.C. and continues until around 1200 B.C. (Stoltman 1986). The geographical distribution of Old Copper has its heart in northeastern Wisconsin, proximate to the copper district of the Keweenaw and Ontonagon on Lake Superior's south shore. Artifacts attributed to Old Copper are found well away from this core, however, and extend around the west end of Lake Superior, and into the Lake Michigan basin, into the northern reaches of the midwest riverine, west to the plains periphery, and east as far as the Ottawa River between Ontario and Quebec (Mason 1981).

The diagnostic artifact forms are fashioned of copper and represent the most varied assortment of copper items at any time in Upper Great Lakes prehistory. Only during the Middle Woodland in the Hopewell culture, and later in Mississippian culture does copperworking assume comparable proportions, although in much different expressions. Archaic artifacts include large (by Terminal Woodland standards) spearheads, knives, gaffs, adzes, as well as an array of forms more familiar later in time, the awls, tubular and discoidal beads, and hooks (Wittry 1957).

The boundary between the Archaic and Woodland stages is archaeologically defined by the introduction of ceramic technology. This analysis uses Initial and Terminal Woodland for consistency with nomenclature used by some archaeologists in Canada, northern Minnesota, and northern Michigan, as well as for substantive cultural-historical reasons which reflect the southern tier-northern tier construct of Mason (1981).

In eastern North America south of the boreal forest the first ceramic producing cultures are referred to as Early Woodland, bearing dates as early as 1000 B.C. Early Woodland pottery is characteristically coil constructed and thick with cordmarked interiors and exteriors. By the time we recognize a Middle Woodland cultural pattern, beginning about 300 B.C., ceramics have a wider variety of shapes, surface treatments, and types of decoration (Mason 1981). It is at this juncture that ceramics make their appearance in the material culture of the Shield Archaic (Wright 1972b), or are brought into the region around and north of Lake Superior by a different culture to the south (Buchner 1979). In either event, the result is the taxonomic transformation of the resident Archaic population into the Woodland stage, albeit with little or no effect on the subsistence practices of those dwelling in the boreal forest. Echoing an earlier sentiment of Wright (1968:47) that, "The evidence from the sites under consideration...strongly suggests that ceramics are not an indigenous part of Ojibwa material culture," Mason summarizes the ambivalence with which he believes pots were accepted in the north:

> There is a high probability that there were some people in the Laurel country who did not manufacture or use earthenware but who were fully contemporaneous with those who did and that the only empirical difference between their respective sites would be the presence or absence of sherds. [1981:286]

In practice, there is synonymy in the terms "Initial Woodland" and "Laurel" in the Lake Superior basin. Other Initial/Early Woodland archaeological cultures (e.g., Nutimik and Saugeen) are peripheral to this analysis, although they represent analogous cultural developments as marginal manifestations of more westerly or southerly Woodland stage cultural evolution (Mason 1981). The Laurel focus was defined by Wilford (1941) from his work in northern Minnesota. The definition was subsequently expanded into southern Manitoba by MacNeish (1958). Laurel sites are now known from a large area north of the Great Lakes and between Saskatchewan and central Quebec.

Other than the apparent deletion of large sized copper items from the inventory and a change in raw material preference, there were no fundamental changes in the lithic and copper technology and their products from previous Archaic material culture. Net sinkers appear to be new in the region at this time (Wright 1967), and trade items such as Saugeen pottery, shell from Manitoba, and Yellowstone obsidian occur on both sides of Lake Superior (Janzen 1968, Wright 1967). There is a proliferation of small endscrapers in the Laurel culture, which is attributed to the functional needs of an economy devoted to fishing (Janzen 1968). Copper tools and ornaments in Laurel assemblages include the typical range of small forms common throughout prehistory. There are no copper tools or ornaments which are considered distinctively Laurel in style. It is assumed that copper was one of the items used by the Laurel people in the context of gift exchange or trade in the acquisition of nonlocal commodities. The degree of interregional exchange appears not to be too great, however, since nonlocal items rarely occur in appreciable numbers.

It is Laurel pottery that identifies this culture. Vessel construction is by coiling and there is a modest use of temper. Vessels are hard and thin-walled, usually conoidal with straight rims and squared lips. Decoration is by dentate stamping, linear stamping, push-pull, incising, pseudo-scallop shell impression, and use of punctates and bosses confined to the upper 1/2 to 1/3 of the vessel which is otherwise smooth. Cordmarked exteriors and the use of cord-wrapped sticks (CWS) for decoration do not occur in Laurel (Mason 1981).

A provisional seriational sequence for Laurel ceramics begins with the Pike Bay phase in which most decoration is by linear stamp and push-pull. In the McKinstry phase most decoration is with pseudo-scallop shell (PSS) impressions which is the hallmark of Laurel pottery. Finally, in the Smith phase, there is a return to the decorative styles that were popular in the Pike Bay phase (Mason 1981:289ff). In addition to this chronological dimension there is a geographical distribution of design elements that underscores the internal variation within the Laurel culture: PSS has a higher frequency on northern sites while the linear stamped and push-pull decorations are more common at sites along the southern border of the Laurel range. Similarities among Laurel ceramics and contemporaneous North Bay (Mason 1967, 1969), Saugeen (Wright 1967), and Point Peninsula (Stoltman 1973, Wright 1967) styles have been noted.

Also along the southern periphery are the largest Laurel sites and the only Laurel sites with burial mounds, principally in the Rainy, Nipigon, and Pigeon rivers along the international border. At the Smith Mound in northern Minnesota the mode of interment was by bundle burial in small ossuaries. There was also evidence for preburial ritual treatment in the form of dismemberment and defleshing (Mason 1981).

There is no sudden change in artifact style to mark the beginning of the Terminal Woodland substage. Instead it is defined in terms of the trends which set it apart from its antecedent (Gibbon and Caine 1980). With the Terminal Woodland there is increased localized cultural differentiation measurable in increments of stylistic variability and raw material use. Subsistence practices become highly specialized in areas with unique resources, such as the wild rice district in northern Wisconsin, Minnesota and adjacent portions of Canada, or the fisheries at Sault Ste. Marie. There is evidence for an increase in population size in the Terminal Woodland in the form of a higher density of sites and larger site size (Fitting 1975, Mason 1981).

The archaeological recognition of the onset of the Terminal Woodland substage lies between A.D. 600 and A.D. 700. From this point to recorded history the Upper Great Lakes was the scene of a complex interplay of archaeological cultures representing three linguistic groups which were, in turn, partitioned into what are traditionally thought of by archaeologists as culturally discrete and autonomous units. It has reached proportions of a litany to state that one of the characteristic qualities of sites in this region is the consistently heterogeneous ceramic artifacts. At virtually any site it is possible to find a constellation of Terminal Woodland wares including Blackduck, Lakes phase, Huron, and Straits of Mackinac varieties. Brose

(1978:577) refers to the general condition as "chaotic" in a substantive sense, citing widespread population movements, wholesale abandonment of areas, and decimation by disease. There is increasing evidence of endemic warfare in the Lower Great Lakes (Trigger 1976) and midwest riverine (Milner, Anderson, and Smith 1988) areas, primarily among the horticultural societies.

On Isle Royale the Terminal Woodland was a time which saw the most intensive use of the island's resources. Here the array of ceramic styles are as diverse as anywhere on the mainland. As is made clear in the analysis which follows, a great deal of uncertainty remains regarding the composition, both demographic and ethnic, of the groups responsible for the archaeological sites of the Terminal Woodland.

Specific accounts of Native Americans or Europeans on Isle Royale are uncommon in the early documentation of the French missionaries, explorers, and traders. We know that the first French in Lake Superior, the traders Brule in 1622 and Nicolet in 1634, and the Jesuits Raymbault and Jogues in 1641 had little or no immediate consequences for native culture. However, the trends which began in the early and middle seventeenth century in the Lower Great Lakes became amplified as the incorporation of European material culture and participation in the fur trade spread to the Upper Country (Stone and Chaput 1978).

The acquisition of European material culture preceded the arrival of the first whites, filtering through a down-the-line exchange network extending from the St. Lawrence River across the Great Lakes to the Mississippi Valley. While there is no consensus regarding the extent and magnitude of sociocultural change brought on by contact and the fur trade, at a broader scale certain fundamental shifts in native culture can be traced, including an increase not only in the incidence of intergroup hostility, but in the motivation behind it. Low level endemic warfare existed to address the reciprocal animosity among groups and as a means to acquire prestige with lines often drawn along linguistic boundaries. Blood feuds required exchanges in which redress and compensation were the ultimate goal.

But by the mid 1600s the motivation for violent interactions, even if founded on traditional blood feud idioms, were directed towards the acquisition of furs, fur bearing territories, and/or an economically strategic position as middlemen between the French and those groups lacking direct access. By the mid seventeenth century Neutral and Five Nation Iroquois attacks on the Assisteranon (a generic term for nonIroquois speakers) in Michigan's Lower Peninsula caused the Sauk, Fox, Kickapoo, Mascouten, Miami, and Potowatomi to move west of Lake Michigan, leaving the land between lakes Huron and Michigan virtually uninhabited. It was also during this period, between the 1660s and 1690s that the French increased their presence in the Upper Great Lakes with the building of missions, forts, and trading centers. Changing social configurations found the development of multiethnic populations around the social and economic nucleus of these French establishments (Mason 1981, Quimby 1966, Ray 1974).

ARCHAEOLOGICAL CULTURES OF THE TERMINAL WOODLAND SUBSTAGE

Anticipating the need to differentiate among archaeological cultures in order to address questions of interaction, the archaeological cultures of the Terminal

Woodland substage are defined both in terms of normative and, where evidence exists for it, behavioral characteristics.

BLACKDUCK: The Blackduck culture was defined initially by Wilford (1941, 1955) with a number of subsequent augmentations (Evans 1961, Hlady 1970, MacNeish 1958, Wright 1965). The core area of Blackduck is in the Rainy River area between northern Minnesota, Ontario, and Manitoba, but may be found across the north shore of Lake Superior to the Straits of Mackinac and into the northern reaches of the Lake Michigan drainage (Figure 2).

Blackduck dates from A.D. 700-800 to around A.D. 1100 (Lugenbeal 1979) or A.D. 1750 (Lynott, Richner, and Thompson 1986; Syms 1977), by which time it is, by one account (Arthurs 1986), replaced by ceramics representing the Selkirk and Sandy Lake archaeological cultures. The replacement theory is not universally accepted, and there is evidence to suggest that Blackduck, Selkirk, and Sandy Lake are contemporaneous (Syms 1977).

Although there is little consensus regarding the origins and ultimate ethnic identification of Blackduck, or the dates which bracket it, Blackduck pottery is distinctive, although it shares similarities with Mackinac, Heins Creek, Madison, Kathio, and Clam River ceramic traditions (Afinson 1979). Typical Blackduck vessels are globular in shape with triangular or wedge shaped rims decorated with complex CWS impressions and exterior punctates. Bodies are cordmarked, often with brushing or combing on the neck (Figure 3).

Subsistence practices emphasize local resources without horticulture, wild rice being particularly important in the Blackduck core area. Gibbon and Caine (1980)

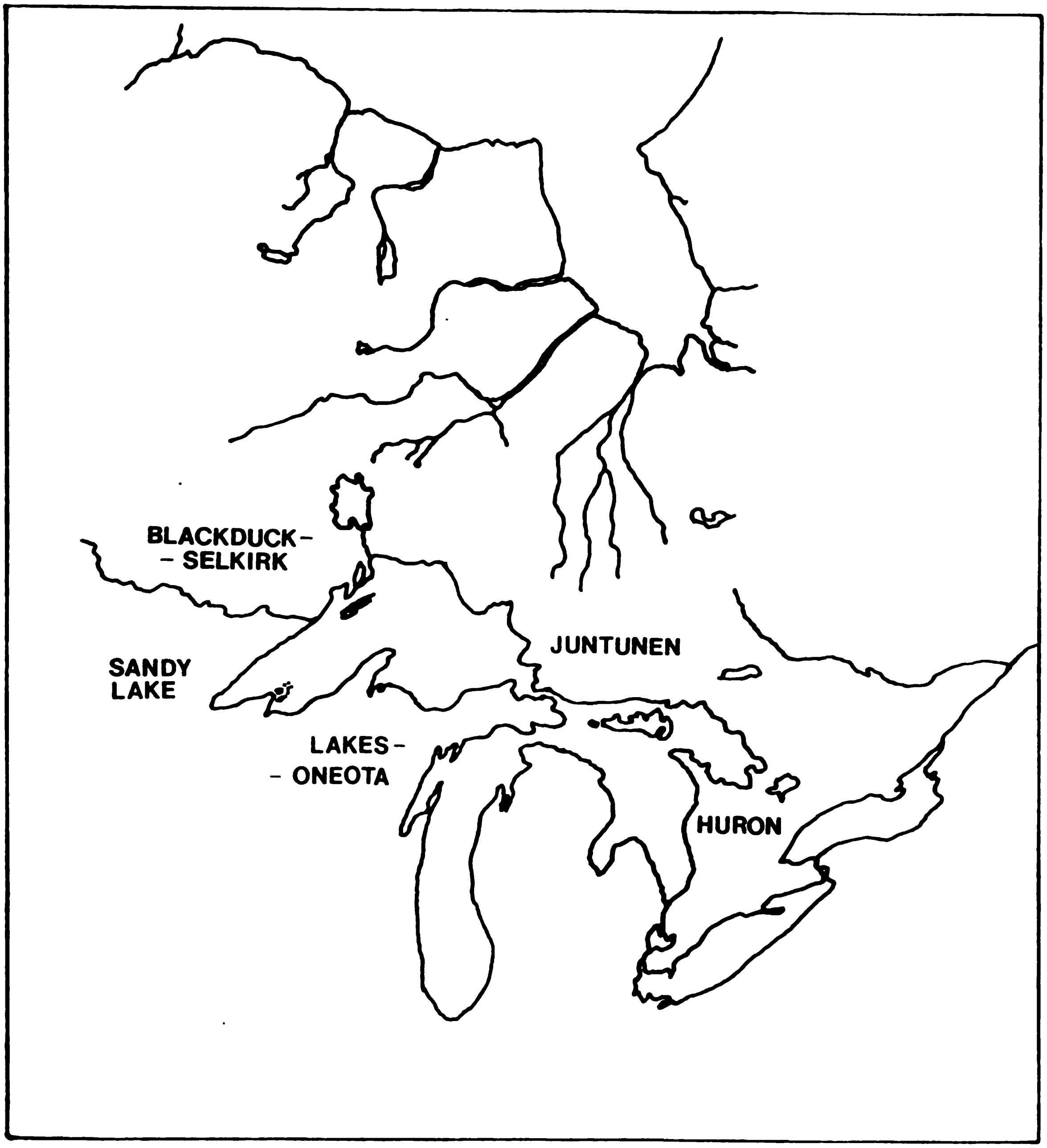

Figure 2. Distribution of Terminal Woodland archaeological cultures in the Upper Great Lakes.

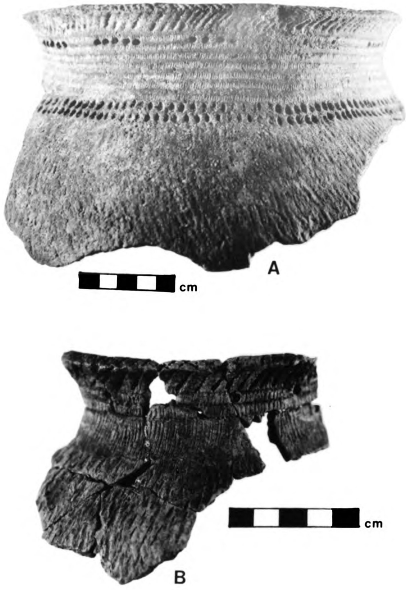

Figure 3. Blackduck Pottery (A, DeIp-3; B, 20IR72)

identify several related trends from Middle (Initial) to Late (Terminal) Woodland which are germane to the Blackduck culture, including an increase in rice processing features, in site numbers and size, and in small limited activity sites.

On Isle Royale, Blackduck ceramics are no more or less common than other Terminal Woodland types. Pure Blackduck components are fewer than anticipated, given the proximity to major areas of Blackduck activity. Copper artifacts attest to some level of interaction with the copper sources of the north shore and Isle Royale, probably by direct acquisition, although like the other Terminal Woodland copper industries, needs for the metal were largely nonessential small tools and ornaments.

SELKIRK: Selkirk is known from the area to the north and west of Lake Superior, dating between A.D. 700 and 1750 (Arthurs 1978, Rajnovich 1983, Wright 1981). Initially defined by MacNeish (1958), Selkirk was subsequently expanded to include a number of related ceramic style groups (Hlady 1970, 1971). The areal distribution of Selkirk is embrace by an area bounded by northern Saskatchewan, the Hudson Bay Lowlands, the northern shore of Lake Superior and northern Minnesota (Rajnovich 1983:52). In a reanalysis of Selkirk ceramics Syms (1977) has brought together a number of complexes which he believes are part of a larger "Selkirk Composite" (1977:71). The individual complexes exhibit sufficient integrity of style and regional distribution to suggest that they formed an internal partition within the composite. The composite represents the maximal aggregation of related style groups which constitute Selkirk as an archaeological culture.

According to Rajnovich (1983) subsistence and settlement of Selkirk is difficult to ascertain due to the archaeological mixing of ceramics from more than one style group. At Voyageurs National Park in northern Minnesota Lynott, Richner, and Thompson (1986:279) found it impossible to differentiate the subsistence and settlement practices of Selkirk from those of Blackduck with which it was consistently associated. It is likely that the perceived need for so-called pure components for the elucidation of cultural practices has systematically sidestepped the potential for examining the meaning of mixed assemblages.

The Selkirk occupation at the Spruce Point site in northwestern Ontario was found to have structural remains of two oval lodges measuring 6-7 m long by 4 m wide with outside activity areas (Rajnovich 1983:61). Proximity to water is used as a criterion for determining seasonality of occupations; using Rogers' (1967) ethnographic work among the Mistassini Rajnovich believes that sites occurring within 10 to 30 m from a shoreline reflect warm season encampments while sites 100 to 200 meters away from water are likely winter occupations (1983:63-64). At Voyageurs National Park small ephemeral occupations were identified, indicating short term camps aimed at the exploitation of beaver (Lynott, Richner, and Thompson 1986:279).

Selkirk is identified archaeologically by its fabric impressed ceramics with little or no decoration (Figure 4). According to Rajnovich (1983) the earliest Selkirk pottery is found in northern Manitoba where conical bases on vessels strongly imply a Laurel origin for Selkirk with a subsequent diffusion to the south and east. Closer to Lake Superior in southeastern Manitoba and the Lake of the Woods area of northwestern Ontario the earliest Selkirk material is "simple undecorated ceramics (Alexander Fabric Impressed)...followed later by decorated types influenced by

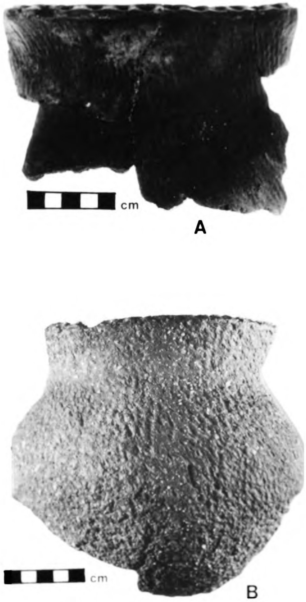

Figure 4. Selkirk Pottery: A, 20IR1; B, Mason Collection, Thunder Bay

Blackduck" (1983:58). It is thought that Blackduck is replaced by Selkirk and Sandy Lake in the mid eighteenth century (Arthurs 1986). Wright (1968) sees Selkirk as ancestral to the historic Cree in northwestern Ontario and adjacent Manitoba. On Isle Royale Selkirk has been identified at a number of the recently recorded sites, but prior collections have not been systematically examined for this type of pottery.

<u>SANDY LAKE/WANIKAN</u>: The Wanikan culture was defined by Birk (1977), although Sandy Lake pottery, the diagnostic artifact of the Wanikan culture, was identified earlier by Cooper and Johnson (1964) who suggested that the Wanikan culture evolved out of the Siouan speaking Clam River focus.

Like Selkirk, Wanikan is identified primarily by its pottery which is often difficult to distinguish from its late prehistoric cordmarked contemporaries. It is described as having, "thin-walled, globular pots with straight, thin rims, exterior surface treatment of vertical cording or smoothed exterior, and occasional interior or exterior punctates [Figure 5A]. Decoration is confined to interior lip notching, although some vessels show influence from other wares, such as Oneota, with trailing or stamping" (Lake Superior Basin Workshop 1988). Temper is predominantly shell in the southern part of the range of Sandy Lake pottery, changing to grit in the north (L. Peterson 1986).

Chronologically, the Wanikan culture falls between A.D. 1000 and A.D. 1700. The Norway Lake site in northern Minnesota contained a substantial Wanikan component associated with Blackduck ceramics. A burial mound with a single flexed primary inhumation contained Sandy Lake pottery exclusively, although Birk (1977) indicates that simple burials in shallow graves are more typical. Settlement and

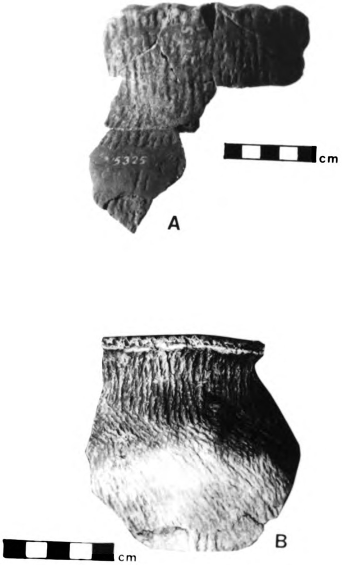

Figure 5. Sandy Lake and Mackinac Pottery (A, 20IR28; B, 20MK1)

subsistence is not well known but is believed to reflect a predictable focus on wild rice and other aquatic resources of the region. Sandy Lake pottery has a maximum distribution from the Mississippi headwaters area east to Lake Nipigon, north and west as far as eastern Manitoba, with its area of primary concentration in the Lake of the Woods and Rainy Lake area on the international border (Arthurs 1978).

STRAITS OF MACKINAC: The Terminal Woodland sequence determined from excavations at the Juntunen site (McPherron 1967) includes three cultural phases: Mackinac phase (ca. A.D. 800-1000), Bois Blanc phase (ca. A.D. 1000-1200), and the Juntunen phase (ca. A.D. 1200-1450). Subsequent reanalysis of the collection raises some doubt as to the validity of the middle Bois Blanc phase, and has broadened the temporal parameters somewhat (Clair McHale Milner, personal communication 1989). For the purposes of the Isle Royale analysis the Bois Blanc phase is divided arbitrarily between the Mackinac and Juntunen phases, ca. A.D. 800-1100 and ca. A.D. 1100-1450, respectively.

The Mackinac phase levels of the Juntunen site are interpreted as the remains of large warm season fisheries (McPherron 1967). There is little evidence of the use of native copper in this phase. Pottery styles favor cordmarked and fabric impressed exteriors on short squat vessels with round bases and square lips (Figure 5B). Decoration is by the use of punctations, and geometric designs on rims and necks executed with a CWS. Mackinac ware is broadly similar to most contemporaneous ceramics from surrounding areas, including Blackduck, Wayne, Princess Point, Heins Creek, and Canton wares. Bois Blanc ware as defined by McPherron (1967) has many close stylistic ties with Blackduck and possibly represents the easternmost manifestation of this culture.

Juntunen phase pottery, on the other hand, has close stylistic affinities with the Ontario Iroquois Middleport and Uren stage of the Lake Huron basin. Juntunen ware includes castellated collars, and extensive use of linear punctations and the push-pull technique for decoration (Figures 6 and 7). Nested chevrons and bands are common motifs. Subsistence emphasizes fishing with augmentation with maize. There is, according to McPherron (1967) a resurgence in the use of native copper for small types of ornaments and implements during the Juntunen phase, while lithic tools do not appear to have made any significant changes since the Archaic, with the exception of the adoption of the bow and arrow by ca. A.D. 900.

In McPherron's (1967) initial analysis of the cultural/ chronological sequence at the Juntunen site he described a shift in interaction sphere from west in the Mackinac phase to the east in the later Juntunen phase. At that time it was suggested that, on the basis of stylistic similarities between the Juntunen phase ceramics and the Middleport and Uren substages of the Ontario Iroquois Tradition, and the suggestion of a longhouse structure, that the Juntunen phase was best considered the product of an Iroquoian group.

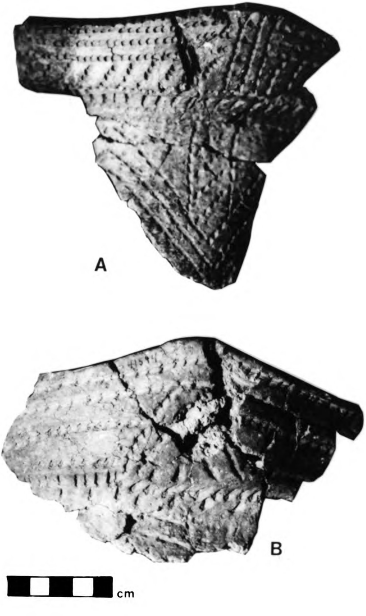

Figure 6. Juntunen Pottery (A and B, 20MK1)

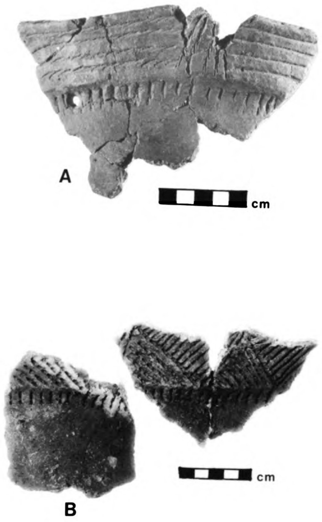

Figure 7. Juntunen Pottery (A, DeIK-1; B, 20IR1)

Wright (1968, 1972a) takes exception to this interpretation, stating that:

> Although a number of ceramic attribute equivalents exist between certain Late Woodland ceramics in Michigan and the ceramics of the Ontario Iroquois Tradition, it is my opinion that the parallels are of such a general nature that proposal of origin are placed in a very hazardous position. In short, I cannot see a direct relationship between the Ontario Iroquois Tradition ceramics of Southern Ontario and the push-pull ceramics of Michigan and Northern Ontario. [1968:49]

Wright was, at that time, looking from the perspective of the Michipicoten site in the eastern Lake Superior basin where his excavation revealed a discontinuous stratigraphic record, dating between A.D. 1100 and A.D. 1600. In nine strata Wright found a record of mixed ceramic styles, representing archaeological cultures from the south and southeast but not the west. Four groups of ceramics identified at Michipicoten include Huron, Peninsular Woodland, stamped, and push-pull. The latter two groups were to soon bear more formal appellations in the Juntunen site ceramic analysis (McPherron 1967). The missing pottery from the west, Blackduck, was found at the Pic River west of Michipicoten and the Montreal River to the south, filling in the regional picture of the complex array of ceramic style. Of all the published reports on Terminal Woodland material culture, the Michipicoten and Pic River sites most nearly replicate the Isle Royale assemblage.

Wright asserts that since pottery was not an indigenous part of Ojibwa culture north of Lake Superior, the heterogeneity in style observed in the prehistoric record is explainable through trade/exchange. A cognate of this argument is his interpretation of the lithic industry as highly conservative, showing little variation through time or space. Wright (1968:47-48) believes that this is an indication of local stability in prehistoric Ojibwa material culture. It could be argued that nowhere in the region was ceramic technology indigenous. The stance assumed in this thesis is that ceramic technology was at some point acquired by indigenous groups who used it, modified it, or rejected it to suit their needs. Further, as it will be argued in Chapter 7, the notion of ceramics being primarily introduced as trade items is rejected; virtually all ceramics in the region are locally produced on locally available clays.

Fitting (1975) favors the Chippewa (Ojibwa) as the probable identity of the Juntunen phase, based on the faunal remains which he interpreted as representing the "Chippewa adaptive pattern" (1975:185). Stylistic similarities in ceramics, according to Fitting, were the result of influence from interacting Iroquoian groups. Compelling evidence for an Algonkian identity for Juntunen was found at four Juntunen phase sites in northern Lower Michigan where shale disks bearing iconographic representations of Algonkian origin have been excavated (Cleland 1985).

HURON: The evolution of the prehistoric Iroquoian-speakers into their historic counterparts is much better known than for their Algonkian or Siouan speaking neighbors. This is due, in part, to the continuity in geographical setting of the Iroquois groups, and to their early interactions with the French. In particular, the documentation left by the Jesuits is an especially valuable source of information on those aspects of their traditional society usually unavailable in the form of archaeological data.

The historic Iroquois are divided into the Saint Lawrence, Five Nation, Erie, Neutral, Susquehannock, Petun, and Huron. It is primarily the latter two groups, archaeologically collapsed into one, that are relevant to the prehistory and early history of Isle Royale, although the effects brought about by the wars of the Iroquois and Huron diaspora in the mid seventeenth century are significant regionwide. These people were residentially stable with fortified villages, outside of which were extensive fields where corn, beans, and tobacco were grown. Hunting, fishing, and gathering were practiced but the primary subsistence was based on horticultural produce. Mortuary preference was for ossuary burials, often at intervals of seven to ten years at which time all the dead which had accumulated since the last interment were gathered for a large "Feast of the Dead." In addition to the obvious function of disposal of the dead, the accompanying rituals reinforced mutual ties of kinship or acknowledged friendship among both Huron and Algonkian groups. Goods were redistributed and trading partnerships for the following years negotiated, often assuming the idioms of kinship terminology (Hickerson 1960).

Prior to 1660 the Northern Division of the Huron Branch of the Ontario Iroquois Tradition (Wright 1966) was located in an area referred to as Huronia, between northern Lake Huron and Lake Simcoe. Village locations shifted in response to a variety of factors, but overall there was little movement outside of this area except by small task-specific groups undertaking long-distance trading expeditions. After 1660 when relations with the Five Nation Iroquois forced the Hurons into their historical diaspora across the Great Lakes and into the Mississippi Valley, the remnant segments of Huron society took on a modified identity as

Wyandotts and, with their Ottawa counterparts, continued to practice their trading across the upper lakes.

Huron pottery is characteristically well fired, thin-walled, burnished or smoothed, with distinctive decoration on the rims and necks of vessels (Figure 8). Lines made by incising or by tool impression are most common, although punctates and push-pull continue to be employed. Vessel shapes are round and globular, often with squared collars and/or castellated rims. While Huron pottery is "distinctive" it has been suggested (Fitting 1975, Mason 1976, Ramsden 1988) that what is Huron in style in the Lake Superior region is, in fact, Algonkian mimicry. Huron pottery is common on Isle Royale, but not in numbers indicating any more or less activity there than for other non Iroquoian groups.

The traditional view of the Huron as a relatively unitary cultural entity has been questioned. Ramsden (1977, 1988) suggests as an alternative that it is the French documentation that has erroneously resulted in this view, and that in late prehistory what later became a Huron confederacy as a response to the stressful conditions of trade and warfare, is better characterized as a number of sociopolitically and economically independent villages or village clusters which shared a similar cultural pattern. He reviews the ontogeny of the archaeological Huron, pointing out that its evolution has strongly colored its use and, concomitantly, our understanding of group interaction in this area. The origin of the historic Huron and their relations to their Iroquoian neighbors is irrelevant to the issue at hand, but of moment is Ramsden's (1988) investigation of the nature of Huron-Algonkian boundaries to the north of Huronia.

Figure 8. Huron Pottery (A, 20IR28; B, 20IR52)

LAKES PHASE: It is thought that the Lakes phase of the Late Woodland evolved directly from its Middle Woodland Nakomis phase ancestor, appearing archaeologically as a population explosion in an area of northern Wisconsin only sparsely inhabited previously (Salzer 1974, 1986). The Lakes phase is believed to date between A.D. 600 or 700 and A.D. 1400. Subsistence reflects local variation and constraints: a seasonally mobile strategy of small mammal hunting, ricing, and fowling was followed in this area of extensive marsh and lakes. Mortuary practices included burial of bundled secondary, flexed primary, and cremations in simple effigy, linear, or conical mounds.

Lakes phase pottery is cordmarked with decoration by cord wrapped stick, cord, and punctation (Figure 9). The problem of the lack of stylistic boundaries is evident with the Lakes phase which in its early stage is similar to Heins Creek and Madison of the Lake Michigan and Door Peninsula area while in its late stage it is similar to Point Sauble, Aztalan, and Mackinac ceramics (Salzer 1986). Mason (1981:312) summarizes the Lakes phase: "This country was then, as today, far more a cul-de-sac than a crossroads, and it seems likewise to have encouraged a conservative tendency which helped secure life even if at a pace behind those of some other areas."

Copper tools and ornaments are common among the Lakes phase sites. Immediate access to drift sources in northern Wisconsin and/or primary copper sources in the Upper Peninsula undoubtedly supplied the Lakes phase with all their needs.

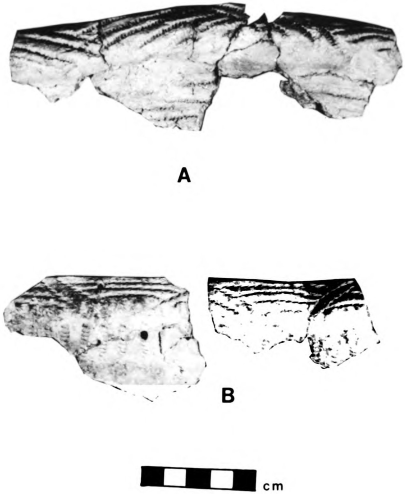

Figure 9. Sand Point (Lakes Phase) Pottery (A and B, 20BG14)

The Sand Point site at the southern end of Keweenaw Bay in Lake Superior is the only major site in this part of Michigan which has been extensively excavated. The site is a combination of occupation and burial mounds, dating between A.D. 1100-1400. Although Sand Point ware was defined as a discrete taxonomic entity (Dorothy 1980), the ceramics exhibit an expected amount of stylistic merging with the Lakes phase with which it is combined for the purposes of this report. Associated ceramics include Blackduck, Oneota, and Juntunen to form a typical mix of Terminal Woodland wares.

Lakes phase ceramics are not sufficiently distinctive to allow consistent identification in analysis, and disagreement or uncertainty regarding Lake phase and other Wisconsin ceramics (e.g., Madison, Heins Creek) is likely to be a problem.

<u>ONEOTA</u>: Oneota is a late prehistoric cultural development on the margins of the Lake Superior basin which only nominally affected human interaction on Isle Royale. The geographical core of Oneota cultural development is in the Upper Mississippi headwaters and east to Lake Michigan. It is believed that Oneota is ancestral to the historic eastern Siouan speaking groups (Iowa, Oto, Omaha, and probably Winnebago).

The Oneota cultural-historical chronology employed here is divided into Emergent (A.D. 900-1000), Developmental (A.D. 1000-1300), Classic (A.D. 1300-1634), and Historic Oneota (post A.D. 1634) (Mason 1981:362). Origins of Oneota include strong ties to Middle Mississippian cultures to the south, reflected in unmistakable similarities in stylistic qualities of ceramics. The northward diffusion of maize horticulture into the upper Mississippi valley was adopted by these northern

Mississippians. Depending on the configuration of the local resource base, Oneota adaptive strategies included a well balanced blend of horticulture, hunting, and collecting which emphasized the resources of the abundant lakes in the region, fish, mussels, and wild rice.

Villages were semipermanent with circular or rectangular bark covered wigwams. A defensive stockade, reflecting the increasing atmosphere of endemic warfare, encircled many settlements. Garden beds for maize and other crops were located outside the village. Burial of the dead was extended and primary in cemeteries or infrequently flexed and primary in mounds. Oneota pottery is distinctive in its shell temper, smoothed surfaces, use of trailing in simple but bold decorative motifs, and typical Mississippian vessel shapes of strongly outflaring rims and acute shoulders (Figure 10).

Within the Oneota archaeological culture, several localized variants are recognized. The one with immediate similarities to Oneota on the south shore of Lake Superior is the Mero Focus or Complex (Mason 1966) in the Green Bay and Door Peninsula areas of Wisconsin. In a review of sites along the Menominee River between Michigan and Wisconsin, Buckmaster (1979) identified a number of sites with Oneota ceramics, and at the Sand Point site on Keweenaw Bay Oneota sherds were found in association with an otherwise Algonkian Woodland assemblage (Dorothy 1980). These northern variants of Oneota did not confine themselves to the use of shell temper often using grit instead. However, Oneota potters tended to adhere to more normative uses of decoration and vessel shape.

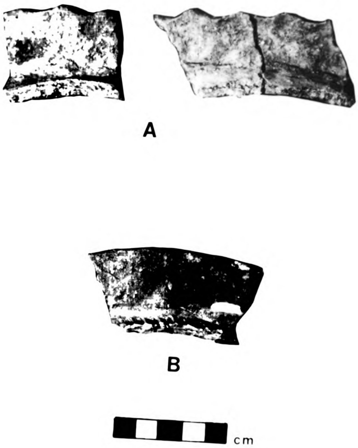

Figure 10. Oneota (Mero Phase) Pottery (A and B, 20KE15)

Copper is found on Oneota sites. It is likely that their requirements for raw copper were met by the Keweenaw and Ontonagon sources which were within their immediate reach. Although Bastian (1963a) identifies one sherd from Chippewa Harbor #1 as Mississippian, it is an inconclusive example of Oneota on Isle Royale. An explanation of the absence of Oneota in the late prehistory of Isle Royale may be found in the combination of cultural boundaries, differential access to copper sources and alternative sources, and Lake Superior as a natural barrier. It seems clear that the Oneota did not need Isle Royale's copper, nor does it seem that the people of Isle Royale needed any Oneota pottery.

Specific hypotheses derived from the above consideration of the archaeological manifestations of interaction and what is known of the late prehistoric archaeological cultures of the Lake Superior region are presented as the basis for the neutron activation analysis of ceramics in Chapter 7. In general, we can conclude from the overview of Terminal Woodland archaeological cultures that, in spite of differences in material culture, the essential behavioral characteristics relating to settlement and subsistence practices are so similar as to preclude differentiation at this level, Huron and Oneota horticulture notwithstanding. An examination of the distribution of the different material representations of these cultures, especially ceramics, is used to assess the possibility of differential access to copper and subsistence resources on Isle Royale.

CHAPTER 5

ISLE ROYALE ARCHAEOLOGY

INTRODUCTION

The core of this analysis is provided by archaeological data from Isle Royale National Park. Having provided a regionwide cultural-historical background, the environmental background and resource base of the island are now examined. In order to appreciate the evolution of the archaeological data base on the island the previous and recent research efforts are reviewed. Data representing 51 Terminal Woodland sites are used to determine the nature and extent of the use of the island's resources, and an assessment of the relative intensity of this use by the different archaeological cultures from the Lake Superior region is made.

ENVIRONMENTAL SETTING

Isle Royale is located in northwestern Lake Superior, 24 km southeast of the province of Ontario and 72 km northwest of Michigan's Keweenaw Peninsula (Figure 11). The main island is 72 km long and 14 km at its widest point. The total area of the island is 544 square km (210 square miles). Approximately 200 smaller islands occupy the periphery and the interior of the main island has 83 lakes. The island's topography is characterized by ridge and swale contours oriented southwest-northeast along the lines of uplifted geological features. The highest elevation is 425 m (1394 t) amsl or 241 m above the modern level of Lake Superior at 183 m (602 ft).

Keweenawan Volcanics dominate the geology of Isle Royale, with interbedded sediments exposed in the upwarping of the deposits which tilt towards the southeast

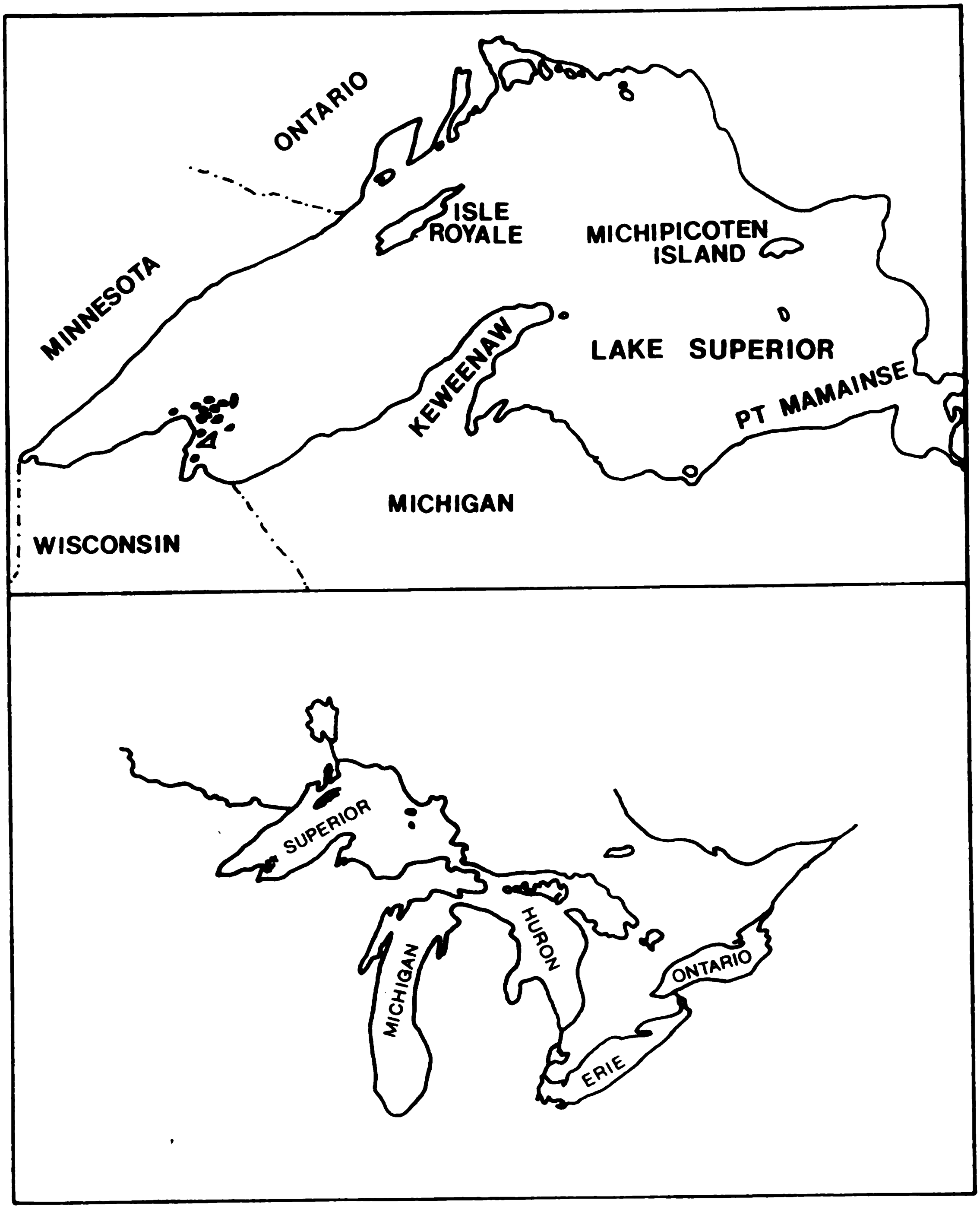

Figure 11. Location of Isle Royale and the Upper Great Lakes.

and mirror the formations in the Keweenaw Peninsula which tilt towards the northwest. The southwestern end of the island is comprised of sedementary deposits which also have corresponding features on the south shore of Lake Superior as sandstones and conglomerates. The availability of native copper, around which much of the economic history of Isle Royale revolves, is typically greater in the sedimentary deposits where it occurs as lodes. Fissure deposits are found in transverse faults which cut across the beds. Although the former are typically more productive, as on the south shore of Lake Superior, the fissures on Isle Royale provided the bulk of the mineral for both prehistoric and historic miners (Huber 1975:56-57). As a consequence, most of the evidence for copper exploitation is found in the northeastern part of the island. It is significant to note that while there are few sources of comparable quality on the north shore of Lake Superior, copper is distributed across the north shore from Duluth to north of Sault Ste. Marie. Some prehistoric mines are found near Point Mamainse at the eastern end of the basin (Griffin and Quimby 1961:77-82). Packard (1893:179), citing early geological surveys, states that some copper is available in the trap rock of Michipicoten and St. Ignace islands in northern Lake Superior (see Chapter 6).

The Pleistocene history of Isle Royale begins with the recession of the Valders ice mass ca. 11,000 B.P. The recession first exposed the southwestern end of the island and, punctuated by a series of minor fluctuations, continued to contract towards the northeast leaving in its wake many of the typical periglacial features such as drumlins and moraines. The postglacial stages of Lake Superior beginning with Lake Nipissing at ca. 5000 B.P., are relevent to this study since it is here that the cultural history of the island begins. The elevation of Lake Nipissing between 184 m (605 ft) and 198 m (650 ft) amsl in combination with the effects of isostatic rebound created shoreline features now well above the present level of Lake Superior (Farrand 1969, Stanley 1932).

The combination of volcanic and sedementary morphogenesis and subsequent glacial and lacustrine effects explains the very thin and poorly developed soils throughout the island. Soils are somewhat better developed on the southwestern end where the decomposition of sediments has facilitated the process. To a large extent these edaphic factors influence the forest communities on the island. Two major upland forest types have their interface on Isle Royale: the southern boreal forest, dominated by spruce, fir, and birch, and a temperate deciduous community of sugar maple, birch, and red oak. Lowlands are occupied by communities of cedar and spruce. Modern vegetational communities are greatly influenced by fire and moose browsing (Slavick and Janke 1987).

Plants relevent to aboriginal subsistence include blueberries, strawberries, and thimbleberries which are widely abundant, and cranberries which are found locally in their bog habitat. Aquatic lily tubers are available in many of the inland waters. Roses, high-bush cranberry, currants and a variety of herbaceous plants with edible greens are also locally abundant. Sugar maple was exploited for its sap in the early historic period. Other plants of economic value include birch for containers and canoes, and cedar and nettle for fibers.

Wild rice is not known to occur on Isle Royale, either from cultural sites or in natural stands. Its presence on a prehistoric site would not be surprising given the proximity to the rice district of northern Minnesota and its documented use by Blackduck and other Terminal Woodland cultures. Similarly, maize has not been recorded at any location on Isle Royale. While it is certain that maize horticulture was impossible on the island, its introduction via a cultural agency such as groups from the eastern Superior basin is considered highly likely.

Faunal resources are members of the southern boreal forest biome and included, prior to the extirpation of several species, woodland caribou, beaver, muskrat, otter, mink, matren, hare, coyote, fox, wolf, and lynx (Meech 1966).

Aquatic resources may have constituted the most reliable source of subsistence in prehistory. Major economic species include lake trout, whitefish, suckers, sturgeon, pike, walleye, yellow perch, and brook trout. Fisheries located on the many inlets and bays of Lake Superior would have been the most productive, although seasonal abundance of spawning suckers and sturgeon at strategic locations would have also been highly desirable. Warmer water species (pike, yellow perch) are found in the interior lakes and the few streams on the island contain brook trout and seasonal spawners from Lake Superior (Koelz 1929, Sharp and Nord 1960).

Avian resources are limited to birds with an aquatic orientation such as loons, grebes, mergansers, and a relatively small variety of ducks, although a wide variety are available during migration. Geese are abundant only for a brief period during migration and many choose to over-fly the island. The only specie of gallinaceous bird recorded on Isle Royale was the sharp-tailed grouse which apparently flew over from the north shore to colonize a burned over area in historic times (C. Martin 1988). The population has since become locally extirpated. The economic value of this and other terrestrial species was likely insignificant in prehistory. Historical sources document the presence of passenger pigeons which were harvested on the island at least as recently as the 1870s (C. Martin, personal communication 1988).

The detailed study of the modern populations of moose and wolf on Isle Royale indicate a delicate balance of predator-prey relationships. Moose, if not subjected to the culling and strengthening effects of predation, will quickly overpopulate the island and strip its resources with a resulting crash in population (Meech 1966, Peterson 1977). The peaks and valleys of wolf/moose demographics exhibited in recent times do not take into account the effects of human predation which tends not to exercise the same selective discrimination of the wolves. The implications of human predation for the reliability of major terrestrial faunal resources (i.e., caribou) in an insular context where recruitment was possibly random and anything but regular, produced a highly unpredictable and capricous subsistence base. Fish and smaller mammals (especially beaver) undoubtedly constituted an important buffer or occasionally were the primary subsistence base for the prehistoric occupants.

Nowhere in the survey area, or on the island as a whole, is one very far from either copper sources or a wide range of subsistence resources. The shoreline areas of Rock Harbor and Tobin Harbor are immediately proximate to copper and fishing resources, as is Chippewa Harbor. Riparian and terrestrial resources are available a short distance inland from virtually any shoreline site. In addition, the logistical features offered by the transverse faults and embayments, such as at Chippewa Harbor can be considered significant apart from purely economic or subsistence considerations. Interior lakes, while relatively poor in fishing, offer a combination of sheltered and warmer environments away from the Superior shoreline with the benefit of molluscs, beaver, and a few aquatic plant foods. The series of lakes covered in the 1987 survey offer, in addition, the most expedient means of crossing Isle Royale at any point along its entire length, and thus represents the potential for logistically placed sites along portage routes.

PREVIOUS RESEARCH

The advent of American mining on Isle Royale and the Keweenaw and Ontonagon districts to the south began a period in the awareness of and speculation about the identity and antiquity of the prehistoric copper miners. From 1846 to about 1910 attention was focussed on the identity of the miners and their relation to the mysterious Mound Builders to the south in whose elaborate burial mounds copper artifacts were often found. Much of this speculation was highly conjectural and imaginative. The involvement of the Smithsonian Institution brought the first serious consideration of the historical accounts pertaining to copper in the Great Lakes region and was a proponent in the identity of the Mound Builders and copper miners as the ancestors of surviving Native Americans (e.g., Packard 1893, Winchell 1881). The emphasis was on mining, however, and although excavations of mining pits were undertaken with descriptions of associated artifacts, there was virtually no interest in occupation sites in the copper districts.

The emphasis on copper mines continued to dominate the analysis of prehistoric remains on Isle Royale well into the twentieth century but, beginning with the McDonald-Massee Expedition to Isle Royale in 1928, was tempered with the recognition of occupation and burial sites on the island. The expedition reported by West (1929) describes the Massee Rockshelter (20IR14), Chippewa Harbor (20IR1), Birch Island (20IR27), and McCargoe Cove/Minong Ridge (20IR73/20IR24) prehistoric sites and alludes to others on Chickenbone, Livermore, and La Sage lakes in the interior. The artifacts were described by McKern of the Milwaukee Public Museum and compared to Effigy Mound Tradition materials from Wisconsin, thus creating the first tangible relationship between the island and prehistoric Indian cultures on the mainland.

In the 1920s and 30s Fred Dustin applied himself to the prehistory of Isle Royale, bringing with him a well-tuned eye for occupation sites developed in the Saginaw Valley of lower Michigan. In addition to traversing much of the island, Dustin tested the Chippewa Harbor #1 site and several mine locations, publishing and presenting his findings in the years between 1929 and 1957 (Dustin 1929, 1930, 1957). Among his contributions is a more realistic view of the cultural dynamics and systematics of the prehistoric miners than was held by his predecessors. Four of Dustin's general observations represented in Griffin (1961:30) continue to act as viable research hypotheses:

1. The probable route by the miners was from the Keweenaw Peninsula to the Island and back, rather than from the north shore.
2. The ancient miners were probably the ancestors of the Algonquian and perhaps Iroquois of the Upper Great Lakes.
3. Isle Royale did not offer much inducement for permanent settlement.

4. The major mining area was McCargoe Cove.

Carl Guthe of the University of Michigan made limited test excavations at Birch Island and Chippewa Harbor in 1930 (Guthe 1930). In the same summer tests at the Indian Point site were undertaken with the assistance of Fred Dustin, adding to the growing interest in the island's prehistory.

George Quimby was, perhaps, the first "modern" archaeologist to work on Isle Royale. In his 1939 publication on aboriginal camp sites on the island he presents data on several occupation sites with the identification of Iroquoian and Woodland ceramic types, and faunal and botanical remains. The interpretation was directed towards relations between cultures in the Soviet Far East and similar developments in the New World reflecting hypotheses of interest at that time.

Roy Drier of the Michigan College of Mining and Technology conducted test excavations at the Minong Mine, Indian Point, and Chippewa Harbor in 1953-54 (Drier 1961:1-7). Drier's contribution through this effort includes two radiocarbon dates from Pit 25 at the Minong Mine which very loosely date the feature between the first and third millenium B.C. A privately printed collection of earlier works on prehistoric copper mining was published in 1961, making available under one cover a number of obscure articles (Drier and Du Temple 1961).

Subsequent to Quimby's and Dustin's involvement, intermittant survey and excavation by the University of Michigan Museum of Anthropology continued, firmly placing Isle Royale in the broader context of Upper Great Lakes archaeology. Survey and testing by Spaulding in 1959 was followed by three years of work under the leadership of Tyler Bastian. Bastian's unpublished report of the survey (1963a) and masters thesis (1963b) give the first comprehensive descriptions of prehistoric and historic sites on the island and effectively provide the baseline for all subsequent archaeological reconnaissance. An additional hallmark of Isle Royale archaeology is Griffin's (1961) edited volume on prehistoric copper and the Indians of the Lake Superior basin, much of which is a compilation of older sources and informal discussions on the subject.

Since the University of Michigan survey in the early 1960s, archaeological research on Isle Royale has been limited to a small number of impact assessments of development associated with the National Park's visitor and staff facilities, largely undertaken by park personel or by archaeologists from Michigan Technological University in Houghton. In 1984 Maass produced the park's Cultural Sites Inventory, a major compilation of cultural resources on the island, largely taken from extant secondary sources.

Between 1981 and 1986 the National Park Service's Submerged Cultural Resources Unit conducted a submerged cultural site inventory on Isle Royale (Lenihan 1987). Shipwrecks and a number of selected historic sites with terrestrial associations were examined and documented. It was this survey which unintentionally discovered a nearly whole Terminal Woodland vessel off the Siskiwit Mine.

In the spring of 1986 Patrick Martin conducted an archaeological field school on Isle Royale in which the location and mapping of historic features at Todd Harbor, McCargoe Cove, and Daisy Farm was the basis of instruction in archaeological field techniques (P. Martin 1988). This effort resulted in the discovery of one of the first copper smelter in the Lake Superior basin, and generated a series of detailed maps for management purposes.

In the fall of 1986 the area around the Rock Harbor channel was examined in an attempt to establish a terrestrial context for the Juntunen phase pot found off the Siskiwit Mine by divers. The survey area extended from Daisy Farm on the southwest to Threemile on the northeast on the main island. On the Lake Superior side of the channel coverage was from the Bangsund Fishery to Mott Island, including the Rock Harbor Lighthouse, West Caribou, East Caribou, Cemetery, and Rabbit Islands. Among the results of the Rock Harbor survey included the discovery of an occupation site at the Siskiwit Mine, confirmed the presence of subsurface prehistoric deposits at the Rock Harbor Lighthouse and Cemetery Island, and identified new a site at West Caribou Island (Clark 1987).

The most recent study of Isle Royale National Park by the Midwest Archaeological Center of the National Park Service provides survey coverage of existing development areas within the park, along with survey coverage of selected sampling areas and limited testing of selected archaeological sites. The initial phase of the project, the field survey, assessed the effects of recent fluctuations in the level of Lake Superior on cultural resources and the impact of visitors and park facilities such as trails and campgrounds on cultural sites. Survey work is focussed on shorelines and campgrounds in order to locate new sites in critical areas as well as monitor the ongoing condition of previously known sites.

OVERVIEW OF THE TERMINAL WOODLAND SUBSTAGE ON ISLE ROYALE

These data are based on the results of the 1986 Rock Harbor survey and the 1987-90 surveys, as well as on published and unpublished accounts of prehistoric sites on Isle Royale. For those sites not visited or tested by the Midwest Archaeological Center (MWAC) survey Bastian's (1963a, 1963b) work is the primary source. (Table 1; Figures 12-14).

The Terminal Woodland substage has more complete documentation than the earlier prehistory of Isle Royale. If relative numbers of sites are an accurate reflection of activity, the Initial Woodland use of Isle Royale was only slightly greater than in the preceding Archaic stage, while in the subsequent Terminal Woodland substage there appears to have been a major increase in the use of the island's resources evinced by a dramatically increased number of sites. Within the Terminal Woodland ceramic evidence indicates that the increase in population on Isle Royale peaked ca. A.D. 1250-1450, and continued at equivalent or somewhat diminished levels as late as ca. A.D. 1550-1650.

A possible source of error in the determination of temporal placement involves those sites which lack ceramics and are believed to belong to the Woodland stage on the basis of their lithic raw materials. At this level, the determination is highly reliable. However, at the present we lack the ability to discriminate between Initial and Terminal Woodland raw material preferences. For this reason no aceramic sites are included in Table 1 or considered in any detail in the following discussion.

Table 1. Summary of Terminal Woodland Sites at Isle Royale National Park.

SITE#	NAME	COMPONENTS*	SITE TYPE
20IR1	Chippewa Hbr. #1	TW/H	occupation
20IR14	Massee Rockshelter	TW	burial
20IR17	Grace Island	TW/H	occupation
20IR18	Grace Point	TW/H	occupation
20IR27	Birch Is.	TW	occupation
20IR28	Indian Point	IW/TW/H	occupation
20IR29	Belle Isle #1	IW/TW/H	occupation
20IR30	Lookout	A/TW	mine
20IR31	Grass Point	TW/H	occupation
20IR41	Siskiwit Mine	TW/H	occ/mine
20IR42	Cemetery Is.	TW	occupation
20IR45	Daisy Farm	IW/TW/H	occupation
20IR46	Ransom	TW(?)	mine
20IR52	Baker Point	TW	occupation
20IR53	Chippewa Hbr. #2	TW	occupation
20IR56	Rock Harbor	TW	occupation
20IR65	Washington Is. #1	IW/TW	occupation
20IR78	Merritt Lane	IW/TW	occupation
20IR80	Singer	TW	mine
20IR81	Phelps	TW	mine/occ.
20IR82	Boys Island	TW	occupation
20IR107	West Caribou Is.	TW	occupation
20IR111	Rock Hbr. Light.	TW	occupation
20IR114	Lone Tree Cove	TW	occupation
20IR116	Threemile #1	TW	occupation
20IR118	2 1/2 Mile	TW	mine
20IR120	Chickenbone Lk.#1	TW	occupation
20IR124	Lake Ritchie #1	TW	occupation
20IR127	Chippewa Hbr. #3	TW	pot break
20IR128	Lane Cove	TW/H	occupation
20IR134	Mott Sauna Beach	TW	occupation
20IR140	Duncan Bay #1	TW	pot break
20IR142	Belle Isle #2	TW	occupation
20IR143	Belle Isle #3	TW	occupation
20IR144	Pickerel Cove #1	TW/H	occupation
20IR147	Brady Cove #2	TW	occupation
20IR148	Brady Cove #3	TW	pot break
20IR149	McCargoe Cove #2	TW	occupation
20IR150	McCargoe Cove #3	TW	occupation
20IR151	McCargoe Cove #4	Prehistoric	occupation
20IR152	Cove #2	TW	occupation

Table 1 (Cont'd)

20IR153	Cove #3	TW	occupation
20IR154	Cove #1	TW	occupation
20IR160	Washington Is. #2	TW	occupation
20IR174	Malone Bay Camp.	IW/TW	occupation
20IR175	Malone Island #2	TW	occupation
20IR179	Greenstone Beach	TW	occupation
20IR180	Little Greenstone	TW	occupation
20IR181	Wright's Island	TW/H	occupation
20IR183	Malone Bay #3	TW	occ./mine

*Components: A=Archaic, IW=Initial Woodland, TW=Terminal Woodland, H=Historic

With only a few exceptions, notably the Indian Point and Chippewa Harbor #1 sites, the data utilized in this discussion are derived from limited sources. The fact that we are looking through very small windows, surface collections or excavations consisting of less than seven, and in many cases one or two units, places obvious constraints on how far the data are to be trusted. Sample sizes are small and, perhaps not representative in a quantitative sense for individual sites.

The absolute chronology for the Terminal Woodland substage is weakly developed on Isle Royale: there are twelve dates germane to this period, representing six sites (Table 2). This is a major handicap as concerns the internal partitioning of the Terminal Woodland. It is expected that over 700-800 years significant differences in group locations, movement, and interaction potential occured which may address what is ostensibly an association of different ceramics. For example, the association of Huron and Blackduck ceramics on the Indian Point site could be attributable to chronological factors and be independent of cultural ones, the events responsible for the ultimate deposition of the ceramics taking place 200 or 300 years apart. This problem cannot be addressed in this analysis: future work should utilize the potential for radiocarbon dates taken from residues deposited on the vessels themselves in order to refine both the absolute chronology and the stylistic seriation of the various ceramics found in the Lake Superior region (cf. Hamilton 1988, Lovis 1990).

SUBSISTENCE AND SETTLEMENT

The amount of domestic refuse recovered at many occupation sites indicates small groups with ancillary subsistence activities conducted from an occupation site nearby. Typically, one to four pots were broken/discarded in the immediate vicininty of hearths, around which chipped stone tools were manufactured and repaired. The picture is one of a family or a few families engaged in brief episodes of mining supported by fishing, collection of berries, the hunting or trapping of beaver, with the occasional taking of caribou.

The larger sites at Chippewa Harbor (20IR1) and Indian Point (20IR28) do not necessarily contradict the above characterization of small groups as the primary feature of Terminal Woodland demography on Isle Royale. It is not certain if the impression of these sites as large obtains from repeated occupation of these strategic locations by the same small groups whose more discrete occupations are in evidence elsewhere on the island. An argument in favor of these sites as representing larger aggregations of groups drawn from other areas of the island can be made on the basis of their strategic positioning at either end of the major corridor across the island. In such a location it is expected that groups would anticipate contact with other groups for purposes of information exchange in the context of visitation. The

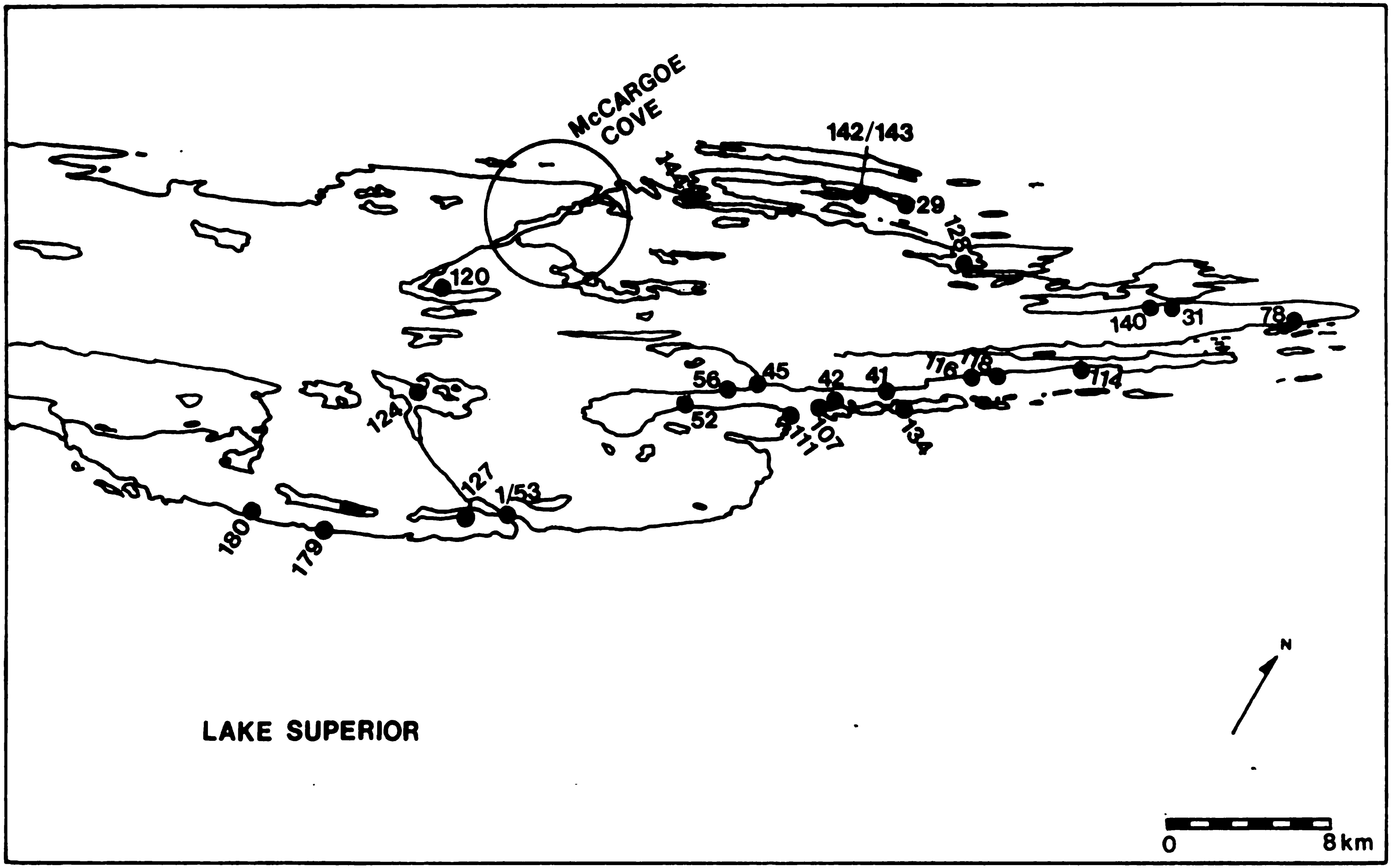

Figure 12. Terminal Woodland Sites on Isle Royale, East End.

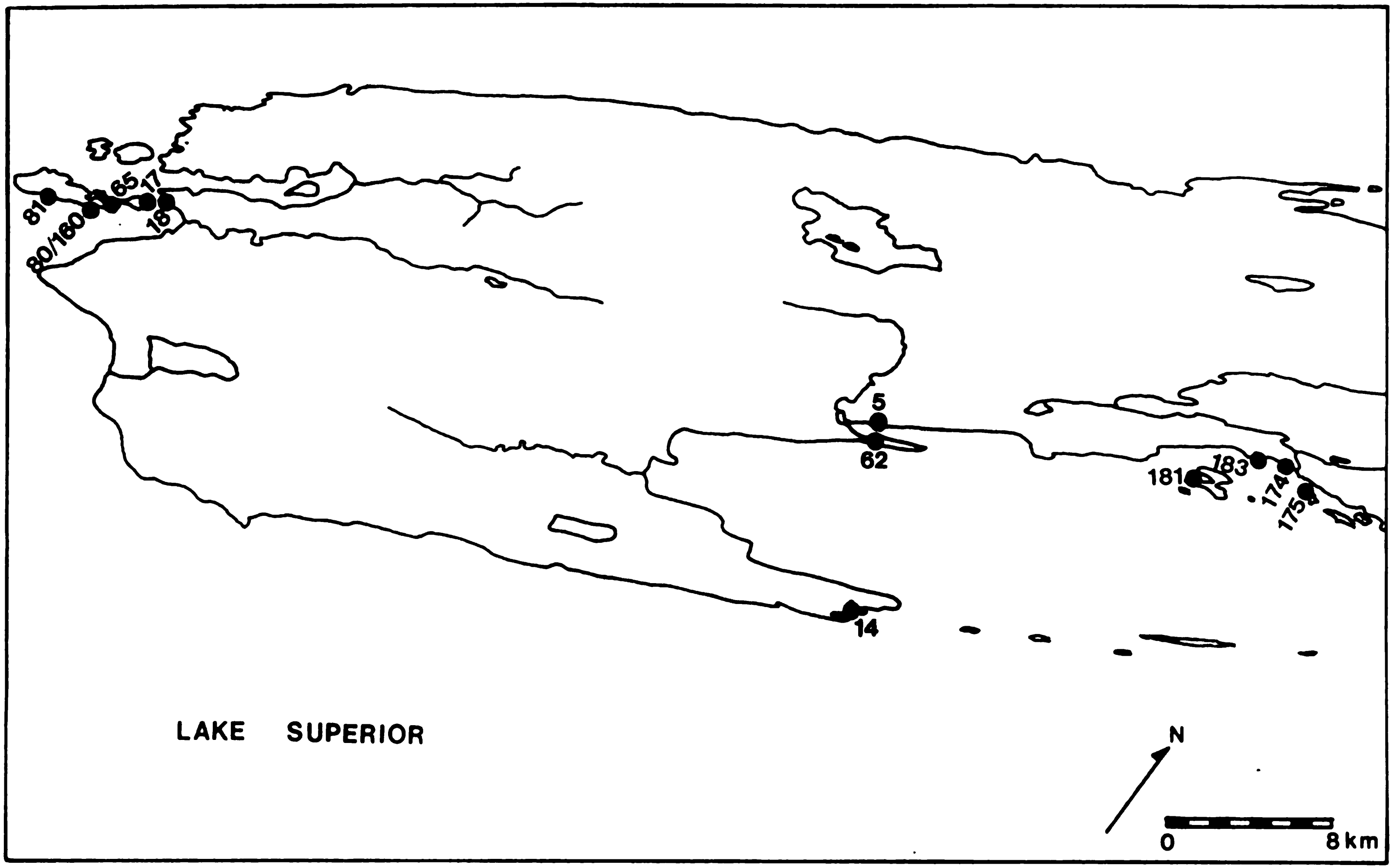

Figure 13. Terminal Woodland Sites on Isle Royale, West End.

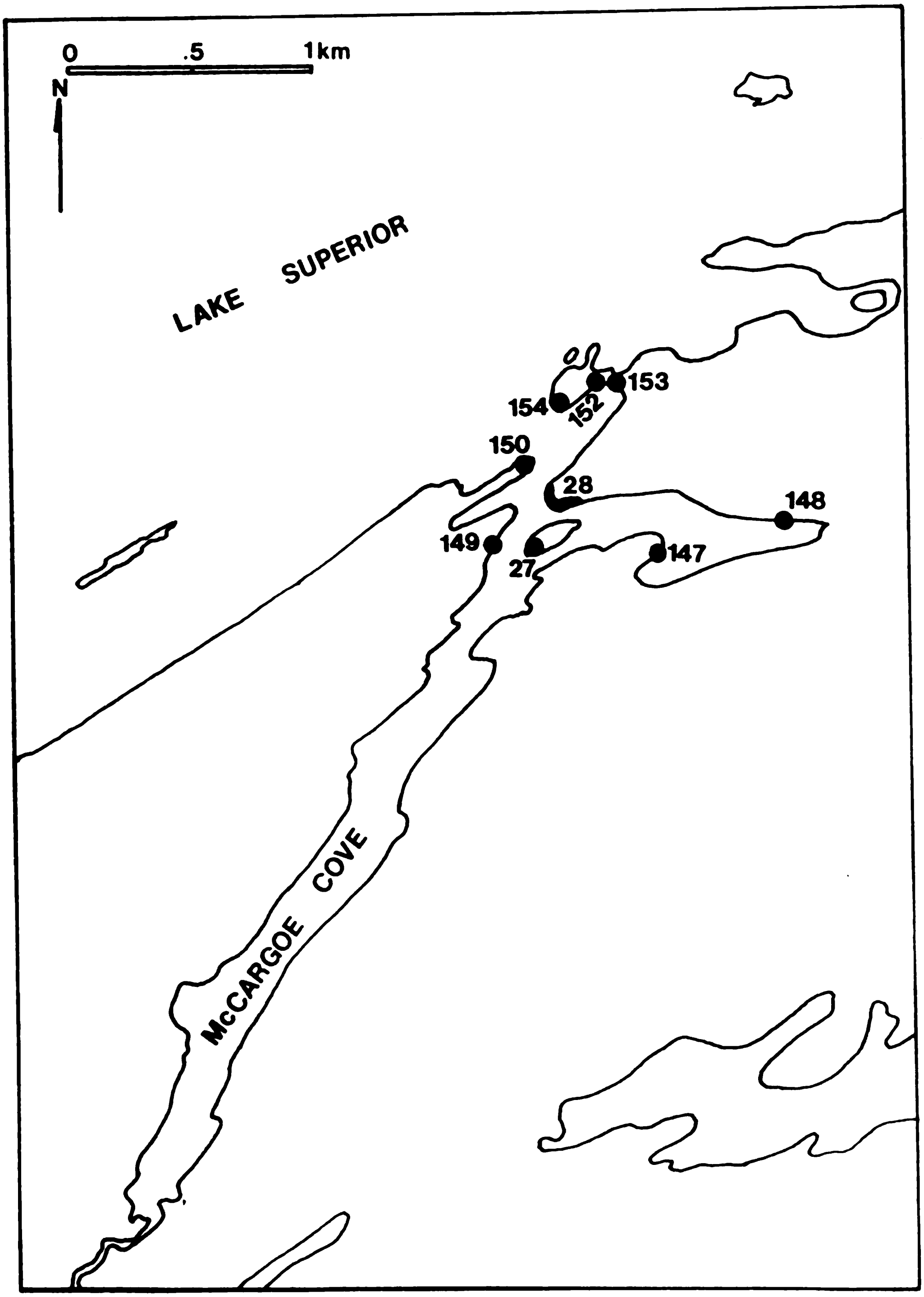

Figure 14. Terminal Woodland Sites on Isle Royale, McCargoe Cove area.

Table 2. Calibrated Terminal Woodland substage radiocarbon dates. (Calibrations are calculated according to Stuiver and Becker (1986) and determined using the CALIB Radiocarbon Calibration Program, Version 2, Quaternary Isotope Lab, University of Washington.)

20IR1, CHIPPEWA HARBOR #1	
Sample Age	Calibrated Ages (Intercept ± two sigma)
A.D. 890 (M-1272) 840 ± 100 B.P. Crane and Griffin 1965:127-128	A.D. 694 (985) 1206
A.D. 1130 (BETA-23115) 820 ± 80 B.P.	A.D. 1020 (1219) 1280
A.D. 1360 (BETA-23114) 590 ± 80 B.P.	A.D. 1264 (1328, 1350, 1391) 1440
A.D. 1410 (BETA-23113) 540 ± 60 B.P.	A.D. 1280 (1410) 1440
20IR18, GRACE POINT	
A.D. 1250 (BETA-35054) 700 ± 70 B.P.	A.D. 1210 (1280) 1406
20IR30, LOOKOUT MINE	
A.D. 1510 (M-1640) 440 ± 100 B.P. (Crane and Griffin 1966:26)	A.D. 1298 (1439) 1650
A.D. 1540 (M-1276b) 410 ± 100 B.P. (Crane and Griffin 1965:128)	A.D. 1320 (1446) 1660
A.D. 1625 (M-1276a) 325 ± 100 B.P. (Crane and Griffin 1965:128)	A.D. 1410 (1523, 1581,1625) 1955
20IR41, SISKIWIT MINE	
A.D. 1760 (UCR-2243a) 190 ± 60 B.P. (Clark 1987:11)	A.D. 1527 (1668, 1751, 1758, 1777, 1796, 1947, 1947, 1953) 1950
A.D. 830 (BETA-23116) 1120 ± 80 B.P.	A.D. 687 (898, 920, 942) 1147
20IR45, DAISY FARM	
A.D. 1670 (BETA-35055) 280 ± 50 B.P.	A.D. 1480 (1642) 1955

two interpretations are not mutually exclusive and, in fact, are supported by similar lines of evidence. The ceramic heterogeneity found at Chippewa Harbor and Indian Point would be expected in the case of multiple reoccupation by small groups or by the coalescence of these into larger, multiethnic groups.

The subsistence and settlement patterns of the region are characterized by adaptations which emphasize local resources. In some cases these resources are thinly dispersed across a southern boreal forest landscape while in others the local resources are concentrated and abundant seasonally (Heffley 1981). Major native fisheries at Sault Ste. Marie and the St. Louis river, or the wild rice district of northern Wisconsin, Minnesota, and adjacent portions of Ontario and Manitoba are resource concentrations which permitted large aggregations of people during the harvest season. Along the north shore of Lake Superior river mouths provided locations which served both subsistence and logistical needs: spawning runs could be met in season and small hunting units could coalesce for the exchange of information which would guide impending decisions regarding the movement and distribution of people for the summer season (Moore 1981).

The subsistence data from archaeological sites on Isle Royale suggest that the island was occupied primarily from spring to fall. The availability of suitable prey species over the winter months was probably as good as could be found on the mainland, but the irrevocable nature of a decision to remain on the island may have motivated many persons to return to the north shore, leaving behind a few small family groups in a winter hunting range. Spring may have been the time for some groups to return to their favorite fishing sites and to make sugar; summer, the varied strategies of fishing and hunting of beaver, caribou, and small game. In fall groups decamped for mainland hunting ranges where, as dispersed families or hunting groups, they would pass the winter season. There is nothing to suggest that Isle Royale was in any way an inappropriate place to spend a winter, although, in the event of a failure of the resource base on the island winter residents would find themselves committed to privation until the ice and lake conditions permitted a return to the mainland. A network of reciprocal relations among winter groups operating on the mainland would be effectively unavailable to island winterers. Storable resources such as maize, rice, and dried meats acted as a buffer to seasonal scarcity in many localities, and one would expect that on an island these would be of particular value. To date, neither maize or rice has been recovered although it seems highly likely that both, in some measure, were used by the prehistoric visitors and residents of the island.

Faunal remains were not sought from archaeological sites on Isle Royale until the UMMA survey (Bastian 1963a). At this time bone was collected by hand from the ground or from the screens during excavation, a technique which systematically favors larger pieces to the exclusion of entire classes of remains (e.g., fish scales). This bias is expressed in the report on the faunal remains from the Indian Point site (20IR28) in which Cleland (1966) identified beaver, caribou, moose, and lake sturgeon. The moose is questionable on contextual and historical grounds, and is probably not associated with the prehistoric occupation of the site. Cleland (1966) expressed some surprise that more fish was not represented in the collection.

The MWAC survey initiated the use of flotation separation of biological remains from soil matricies from sites on the island, resulting in a much broader image of prey species and subsistence practices (Appendix B). Martin and Masulis (1989a:44ff) have identified a wide range of fish species from both cold deep water and warm shallow water habitats. At Chippewa Harbor #1 (20IR1) evidence for the harvest of spring sucker runs and fall spawners exists with a variety of terrestrial resources. Short term seasonal occupations are masked at this and other large sites by multiple episodes of reoccupation.

Predictably, more restrictive faunal assemblages are present at smaller sites (e.g., 20IR114, 20IR120), but the extent to which these are attributable to any form of specialization in subsistence practices is equivocal. In my opinion, the small sites reflect the relationship between the season of occupation, the intended duration of the occupation, the function or purpose of the occupation, and the surrounding site catchment. Further, considering the shape of the island, its physiography, and the transportation advantages of the canoe, it can be argued that at no location on Isle Royale is one distant from any of the potential resources available there. There is no clear pattern of site location and specialization in subsistence practices or in seasonality of occupation, or as stated by Martin and Masulis (1989a), "the pattern is one of variability."

The MWAC survey strategy of the Isle Royale project concentrated on modern shorelines and developed areas, thus precluding any statistical treatment of site location data. Based on the distribution of known sites the following characteristics are assumed to be among the primary factors in site location: 1) physical characteristics of the setting, 2) proximity to resources, and 3) relations to other human groups.

Occupation sites are found in settings where there is a gravel beach above which is a relatively flat (rarely level) surface of sand, soil, or rock. A combination of physical features which repeatedly occurs on Isle Royale is a configuration of one or two bedrock projections into the water forming a sheltered gravel beach with older and higher beach deposits providing an appropriate living area above the beach. Artifacts and midden deposits have been found in virtually all areas relative to the beach or bedrock; sometimes reflecting the exposed nature of a point of land as it projects into the water, or the sheltered aspects of a location as much as 40 m inland from a beach on a fossil beach strand. Sandy points at or near the lake level are also common site locations; in each case a highly exposed situation.

As stated earlier, nowhere on Isle Royale is one distant from any of the island's resources, provided one has a canoe. The shape of the island, in combination with its physiographic features render it accessible with major limitations being vegetative cover along inland routes and weather conditions for water passage. The major avenue of traversing Isle Royale along the transverse fault between Chippewa Harbor and McCargoe Cove reflects the logistical advantage of this route by the presence of the two largest (most frequently reoccupied) sites: Chippewa Harbor #1 (20IR1) and the Indian Point site (20IR28). Aside from the logistical advantages of certain localities, site location relative to food resources are seen as secondary to the physical setting of the site location. Martin and Masulis (1989a, 1989b) have identified few sites in which the faunal assemblage is sufficiently specialized to suggest that the site was occupied for the express purpose of exploiting a particular target species or habitat.

In many instances the close proximity between copper mines and occupation sites has been noted. At the Siskiwit Mine (20IR41), Phelps (20IR81) and Singer (20IR80) the relation is immediate or separated by less than 60 m. The Threemile #1 site (20IR116) is removed from the nearest known copper mine by a distance of 350 m. By canoe, the relationship between the entire McCargoe Cove area and the Minong mine is effectively immediate, involving only a nominal commute to enjoy the benefits of some of the best copper mining on the island with an occupation setting in easy distance from a wide range of habitats.

One expects that a hunting group newly arrived on the island would anticipate encountering other groups at the most optimal of site locations. Assuming that social interaction and information exchange were operating on the decision making structure of the parties, we predict that these optimal sites, such as Chippewa Harbor #1 , Indian Point, and Daisy Farm, would be the most heavily used sites on the island. Most sites conform to a pattern that suggests the movement of very small units, one or two families, around interior lakes and the Lake Superior shoreline to harvest island resources. Where copper sources occur sites tend to be larger (more freqently reoccupied) but continue to reflect the activities of a small group over a short period of time.

In certain areas of Isle Royale a "non-site" approach is appropriate (Thomas 1975). It is evident from a map showing the locations of sites in McCargoe Cove that it is possible to interpret the distribution of sites both as a configuration of penecontemporaneous activities or as a set of discrete and unrelated loci of artifact concentrations. All occupation sites in this area had immediate access to the Minong Mine copper resources, and likely incorporated it into a daily round of activities. Likewise, there may have been an ancillary function of certain sites to others. For example, McCargoe Cove #4 (20IR151), a small occupation, may have served as a temporary flintknapping site with a hearth used by individuals whose main habitation was across the channel at Indian Point. Likewise, the rich midden concentration of McCargoe Cove #2 could have functioned as a secondary site of domestic refuse which originated at Indian Point. Although a formal non-site analysis is not developed here, the concept should be borne in mind when considering the functional relationships of closely spaced sites in a small resource-rich area.

A hypothetical vignette of site visitation/use hierarchy serves to illustrate: a group consisting of a few families canoes from the north shore to Isle Royale, putting in at the mouth of McCargoe Cove where they know that they are likely to encounter others. They stay at Indian Point for a few weeks fishing and visiting with the relatives/friends they find there, and from whom they learn the disposition of other groups and resources around the island. The group divides into smaller units which disperse for short periods to hunt caribou and beaver, and to fish. Over the next few months they coalesce at popular sites like Chippewa Harbor to visit, after which they depart to resume their subsistence activities and/or to extract some copper. At some point the decision is made to stay or leave the island for the winter and, once again they are found at Indian Point (or Washington Harbor) to prepare for the trip across the lake to the mainland. Perhaps there was some advantage to making the open water voyages with as large a group as possible; in which case it would be advantageous to meet at a site like Indian Point. The dog and tobacco thrown into the lake; speeches made; manitous propitiated; the entourage hove off for the northwest, leaving behind the few families for whom Isle Royale served as a traditional winter hunting range.

ARCHAEOLOGICAL CULTURES AND INTERACTION

The Terminal Woodland substage on Isle Royale is varied with respect to the archaeological cultures represented in ceramic style. There are numerous examples of Huron, Blackduck, Sandy Lake, Selkirk, and Juntunen ceramics. But there are few sherds on Isle Royale which are possibly Oneota in derivation, in contrast to western Upper Michigan where Oneota maintains a limited but regular presence in late prehistory. Similarly, there are few sherds that are immediately comparable to pottery styles of the Lakes phase of northern Wisconsin, or the Sand Point ceramic series of the Keweenaw Peninsula. Assuming a correlation between the absolute minimum number of vessels and the proportionate representation of an actual or potential presence of a given archaeological culture, the data presented in Table 3 indicate this diversity of Terminal Woodland usage of the island.

Huron pottery was found at 13 sites. Baker Point, Chippewa Harbor #3, and Brady Cove #2 appear to be nominally single component Iroquoian sites, insofar as no other ceramic styles occur in association with them. At Belle Isle #1 and #2 the context suggests that the pottery was used in a single event not necessarily in conjunction with other ceramic types. At all other sites Huron pottery is found in a mixed assemblage.

Juntunen pottery is found at eight sites, often with Huron pottery. Although the historic relations between the Ottawa/Chippewa and the Huron ranged from mildly antagonistic to amicable (Trigger 1976), the association between these two ceramic traditions comes as no surprise, representing trade, multiethnic association, or an coincidence of deposition.

Blackduck and Selkirk cultures are represented at eight sites apiece on Isle Royale. In most cases there is a nominal association with ceramics indicative of an eastern orientation. Given the proximity of Isle Royale to the heartland of Blackduck culture in Ontario, Manitoba, and northern Minnesota, a stronger showing might be expected on the island.

Sandy Lake pottery was recovered from two sites. If the paucity is a real one, it may reflect a contraction in the use of Isle Royale's resources by groups with a northwestern affiliation from late prehistory and into the early historic period. It is during the same time that the Huron ceramics begin to make a showing on Isle Royale sites.

The incidence of Lakes phase and Oneota ceramics in any of the Isle Royale collections remains very low. This situation is in accord with expectations which hold Lake Superior as a barrier to regular north-south travel, and which considers the

Table 3 Summary of the Terminal Woodland Archaeological Cultures at Isle Royale National Park.

	Archaeological Cultures* n(%)								
	BDK	HUR	JUN	MAC	ONE	SAN	SEL	UNC	MNV**
SITE#									
20IR1	4(16)	1(4)	3(12)	0	1(4)	0	15(60)	4(5)	25
20IR5	0	0	0	0	0	0	0	3(100)	3
20IR14								n/a	
20IR17	0	1(50)	0	0	0	0	0	1(50)	2
20IR18	0	2(67)	1(33)	0	0	0	0	0	3
20IR27							n/a		
20IR28	1(3)	3(9)	0	1(3)	0	1(3)	10(30)	17(52)	33
20IR29	1(12)	1(12)	0	0	0	0	3(38)	3(38)	8
20IR31	0	0	0	0	0	0	0	1(100)	1
20IR41	0	0	3(60)	0	0	0	0	4(40)	5
20IR42	0	0	0	0	0	0	0	2(100)	2
20IR45	1(33)	1(33)	1(33)	0	0	0	0	0	3
20IR52	0	1(100)	0	0	0	0	0	0	1
20IR53	0	0	0	0	0	0	0	1(100)	1
20IR56	0	0	0	0	0	0	0	2(100)	2
20IR65	0	0	0	0	0	0	1(100)	0	1
20IR81	0	0	0	0	0	0	0	1(100)	1
20IR107	0	0	0	0	0	0	0	1(100)	1
20IR111	2(40)	0	0	0	0	0	0	3(60)	5
20IR114	0	1(33)	2(66)	0	0	0	0	0	3
20IR116	0	1(50)	0	0	0	0	0	1(50)	2
20IR120	0	0	0	0	0	0	0	1(100)	1
20IR124	1(100)	0	0	0	0	0	0	0	1
20IR127	0	0	1(100)	0	0	0	0	0	1
20IR128	0	0	0	0	0	0	0	1(100)	1
20IR134	0	1(100)	0	0	0	0	0	0	1
20IR140	0	0	0	0	0	0	1(100)	0	1
20IR142	0	2(33)	1(17)	0	0	0	3(50)	0	6
20IR143	0	0	0	0	0	0	0	1(100)	1
20IR147	0	1(100)	0	0	0	0	0	0	1
20IR149	0	0	0	0	0	0	0	1(100)	1
20IR150	0	0	0	0	0	1(100)	0	0	1
20IR152	0	0	0	0	0	0	0	1(100)	1
20IR153	0	0	0	0	0	0	0	1(100)	1
20IR154	0	0	0	0	0	0	0	1(100)	1

Table 3 (cont'd)

20IR160	0	0	0	0	0	0	0	1(100)	1
20IR174	4(71)	0	0	0	0	0	0	3(29)	7
20IR175	0	0	0	0	0	0	0	1(100)	1
20IR179	1(50)	1(50)	0	0	0	0	0	0	2
20IR180	0	0	0	0	0	0	0	9(100)	9
20IR181	0	1(50)	0	0	0	0	1(50)	0	2
20IR183	0	0	0	0	0	0	1(100)	0	1
TOTAL	15(11)	17(12)	13(9)	1(<1)	1(<1)	2(<1)	35(25)	54(39)	138

*BDK=Blackduck, HUR=Huron, JUN=Juntunen, MAC=Mackinac, ONE=Oneota SAN=Sandy Lake, SEL=Selkirk, UNC=Unclassified Terminal Woodland

**MNV=Minimum Number of Vessels used to make this determination.

Ontonagon-Keweenaw area as an alternative source of copper not entailing the risks of travel to Isle Royale. Relations to the south are represented by one equivocal example of Oneota pottery from the Chippewa Harbor #1 site (Bastian 1963a). A few ceramics from Chippewa Harbor #1 have been classified as belonging to the Lakes phase, the Sand Point series, and the Door Peninsula types, in addition to those related to the Straits of Mackinac sequence (Mark Lynott, personal communication 1987).

Within the time frame embraced by the Terminal Woodland substage, the Lake Superior basin acts concurrently as a barrier and facility to mobility. Although canoe trips out of sight of land are reported (see Little 1987), and Radisson in 1659 states that trips were made from the Keweenaw Peninsula to Isle Royale when good weather prevailed, voyages across the lake involved immense risks:

> They say that from the isle of copper, which is a league in the lake, when they are minded to thwart it in a faire and calme wether, beginning from sun rising to sun sett, they come to a great island [Isle Royale], from whence they come the next morning to firme lande att the other side; so by reason of 20 leagues a day that lake should be broad of 6 score and 10 leagues. The wildmen doe not much lesse when the weather is faire. [Kellog 1926, quoted in Griffin 1961:38]

Among Griffin's (1961:133) conclusions is a rejoinder to the tenent that "the Indians would not have been able to canoe to Isle Royale." In this analysis, it is assumed that it was possible to travel to Isle Royale across Lake Superior from the Keweenaw. Insofar as archaeology is concerned with patterned behavior, the evidence of regular translake trips should be reflected in the archaeological presence of north shore raw materials on the Keweenaw Peninsula. At the present, there is but one documented example of jasper taconite from an archaeological site on the south shore of Lake Superior: a notched projectile point found on a beach near the mouth of the Misery River in Ontonagon County, Michigan (Larry Sutter, personal communication 1987).

The relations between copper mining sites and associated habitation sites are largely based on an argument of proximity. On the one hand, there are copper mines and their associated artifacts, including hammerstones, hammerflakes and, in one case, chert flakes. On the other hand, there are occupation sites with a relative wealth of artifactual material, including copper and stone waste material, copper and stone tools, ceramics, food remains and domestic features. It is not possible in most cases to demonstrate relations between specific sites other than by the logic of association of copper source and copper tool/ornament fabrication. The relationship between copper mines and specific occupation sites is discussed at length in the following chapter.

The question of propriety of a group or family over a given mine is raised by the apparent discreteness (i.e., the apparent single component nature) of the archaeological remains at some occupation sites. Le Jeune's 1636 oft cited reference to the "master of the trade line" may serve as an hypothetical construct for understanding the "ownership" of a copper pit, the first to discover it or work it being the practical owner. The observation was made concerning the Huron, but has been applied as a heuristic device in the Great Lakes region:

> And first, concerning commerce; several families have their own private trades, and he is considered Master of the line of trade who was the first to discover it. The children share the rights of the parents in this respect, as do those who bear the same name; no one goes into it without permission, which is given only in consideration of presents; he associates with him as many or as few as he wishes. [Thwaites JR 10:223-225]

However, physical possession and occupation of a mine may have defined "ownership" with the subsequent abandonment terminating any proprietary considerations. Although it remains an open question, framing the relationships between access to unique and localized resources and trade involving those resources is an important step in understanding the systematics of the relation between the ethnicity manifest in the material culture of a site and that groups' role in regional trade and exchange. We would predict that more strict hegemony over copper resources would obtain where territorial lines are fairly distinct, the corollary being that, in cases of high group mobility and permeable or fluctuating band territories, access to copper resources will be less restricted or unrestricted. A third alternative is that Isle Royale's copper resources, and the spiritual qualities embued therein constituted an open area of free access to all groups.

Travel parallel to the lake shore, on the other hand, increased mobility and made possible the transportation of quantities of goods that would have been otherwise quite impossible overland. In agreement with Bastian's (1963a:319) conclusions, extant data suggest that goods and persons made frequent use of Lake Superior's east-west routes throughout prehistory, both on the north shore and on the south, resulting in the opportunity for interaction among groups of Algonkian, Iroquoian, and Siouan speaking peoples. In her study of long distance travel Little (1987) catalogs historic documentation which describes canoe trips in the Great Lakes. Marquette travelled from St. Ignace to Green Bay via Lake Michigan in 21 days, Tonti from Green Bay to Ft. St. Joseph down the west side of Lake Michigan in 30 days and Chicago to St.Ignace in 14 days, and Bonnecamps travelled up the St. Lawrence river to the Niagara on Lake Ontario in only seven days (Little 1987:62). Voyageurs and engages could make even better time when so motivated.

It is 35 km to Grand Portage, Minnesota, and 90 km to Copper Harbor on the Keweenaw Peninsula of Upper Michigan. Nonetheless, there has been a strong tendency to associate Isle Royale with the copper district of the Keweenaw and Ontonagon, and to portray Isle Royale as it is today, a part of Michigan and the United States. The idea that most travel to and from Isle Royale originated from the

Keweenaw Peninsula to the south is pervasive in many of the writings concerning the prehistory of the island (e.g., Dustin 1957, Griffin 1961, Karamanski, Zeitlin, and Derose 1988). The reasons for this conclusion emanate from two related sources, one is an implicit belief in the unity of the copper district which links Isle Royale to the Keweenaw and Ontonagon areas of the Upper Peninsula of Michigan, and perceives the entire copper-producing area as an entrepot for points south which saw elaboration of the copper industry in the Late Archaic "Old Copper" complex and in the Middle Woodland substage. The second source is a continuing reluctance to see Isle Royale as part of the north shore's environment and cultural ecology, and to ignore the presence of alternate sources of copper on Superior's north shore. This does not mitigate either the uniqueness or importance of Isle Royale as a major source of copper. For the entire north shore of Lake Superior, Isle Royale served as the single most important mining district, independent of the alternative sources across the lake to the south.

Archaeological evidence for prehistoric use of Isle Royale, either as a copper source or subsistence option, favors the north shore as a point of origin. Evidence in the form of lithic raw materials unequivocally points to the north shore, the Thunder Bay vicinity in particular, as the departure point for trips to Isle Royale. Whatever the purpose for the trip, the need for stone tools was anticipated by the importation from the mainland to the island of finished items as well as unfinished cores and blanks. Lithic raw materials contain a high proportion of types whose primary source is in the Thunder Bay area (taconite, Gunflint formation cherts and carbonate shales), although trace amounts of exotic cherts do occur. Quartz and quartzite which dominate much of the lithics in the Upper Peninsula of Michigan are rare. Unfortunately, there are no good primary sources of chert in western Upper Michigan where Hudson Bay Lowland cherts supplied the necessary raw materials to prehistoric knappers. Thus, it is impossible to categorically state that raw materials obtained in the Upper Peninsula do not occur on Isle Royale sites. On the other hand, it is possible to state that the common raw materials from the north shore do not, with a single exception occur on sites in Michigan's copper district. Isle Royale was part of the north shore cultural sphere, supplying northwestern Ontario with much of its raw and processed copper amid the interactions of a variety of archaeological cultures representing the Straits of Mackinac to the east, the rice and lakes district to the west, and horticultural Huronia on northeastern Lake Huron. The motivation for someone to travel across Lake Superior from the south would necessarily be related to something other than copper, since copper is available in the Keweenaw and Ontonagon areas without entailing such extreme risks.

If ceramics are discounted as trade items, there is almost no evidence of the movement of nonlocal goods to Isle Royale. As we have seen, lithic raw materials were obtained from the Thunder Bay area, and copper, of course, was obtained from the island itself. Exotic durables such as marine shell, and foodstuffs such as wild rice and maize have not been found here. This apparent absence of evidence of trade/exchange must not be construed as evidence of nonpeaceful relations, however. As Gary Wright (1974) has noted, differential preservation probably accounts for much of the one sidedness of the archaeological record. Overall, the interaction among Terminal Woodland groups, as evidenced by the almost ubiquitous co-occurence of Juntunen, Huron, Selkirk, and Blackduck ceramics on many sites, must have been at least amicable.

The only possible case of violent interaction is found at the Massee Rockshelter (20IR14), the only known mortuary site on the island, and even here the interpretation of violence is, at best, speculative. Sauer (1990) found evidence for scalping on one skull. This, in combination with the recovery of two projectile points amid the scatter of secondary interments, may indicate that some of the individuals buried there met a violent death. However, there are no diagnostic artifacts in association with the remains to indicate which archaeological culture(s) may be represented by the skeletal population. The site remains an anomaly with only uncertain bearing on the issue of interaction in the Terminal Woodland substage.

In summary, it appears that several archaeological cultures, Juntunen and Huron from the east and Blackduck and Selkirk from the west, had equivalent access to Isle Royale. But was the nature of access the same in each case, or were certain resources the domain of specific groups? Was the island a neutral area for all who took the trouble to get there? Or was there a substantive difference between the types of resources, copper and subsistence resources for example, that limited the activities of certain groups visiting the island? In the following chapter we examine the role of copper in a regional setting to assess the potential of copper as an indicator of differential interaction in the Terminal Woodland substage.

CHAPTER 6

COPPER AND COPPER MINING IN THE TERMINAL WOODLAND SUBSTAGE.

INTRODUCTION

To what extent did the copper resources of Isle Royale serve as a draw on the prehistoric groups of the surrounding area and to what extent did copper serve as a medium of interaction among these groups? Of what value was copper in the systemic context of the Terminal Woodland in the Lake Superior region? Archaeologically, how should we use copper as an indicator of group interaction? When we examine questions of value, whose value is it that is being measured? In order to assess these questions it is necessary to make certain determinations concerning copper and, where determinations are precluded by an absence of substantive data, assumptions. In this chapter unique resources are discussed with respect to how they condition and are conditioned by social realities, and how copper as a resource of the Lake Superior basin is distributed archaeologically. These data are then used to address the role of copper as a mediating factor affecting group interaction in the Terminal Woodland substage.

Europeans first became aware of Great Lakes region copper in the early sixteenth century when copper ornaments were found among the Indians along the St. Lawrence River valley. In the winter of 1535-36 Cartier was entertained and intrigued by tales of the "Kingdom of Saguenay" which lay in some ambiguous direction to the north and west and from whence had come the copper objects in possession of his hosts, the St. Lawrence Iroquois. In subsequent years there was a flow of rumor and information concerning the source of copper. In 1603 Champlain's Huron informants described a copper mine somewhere to the north where they had obtained some bracelets. Seven years later on a trip upriver from Quebec, Champlain encountered some Montagnais and a single Algonkian who presented him with a piece of native copper said to have been obtained from the bank of a river (Biggar 1925).

With the establishment of a permanent French presence in Huronia and the burgeoning fur trade, more substantive information concerning the source of copper was forthcoming. Penetration into the Superior basin by the traders Brule and Grenole around 1623 brought back copper specimens and more tales of mining from Indians living to the west of Huronia. No mines were actually visited, however, and much of the information was still couched in vague and often mythic language. In his review of references to copper in the Jesuit Relations, Whittlesey (1863) concludes that all such references prior to 1847 are, at best, second hand in nature. Boucher writing in the 1640s describes the process of copper extraction by making "fires on top of it, and then hew pieces out with their axes," a process he probably did not witness. Dablon (Thwaites JR 1669-70) makes mention of the tradition of a floating island of gold (the type of metal is likely an elaboration on the part of the translator) 40 or 50 leagues north of the Sault and opposite Michipicoten Island. His native informants, he tells us, lacked consensus on the matter; "the savages did not agree as to the source of the copper. Some say it is where the [Ontonagon] river begins, others say that it is close to the lake, and others at the forks and along the eastern branch of the river," (Winchell 1881:613).

European interest in Lake Superior copper may be characterized as sporadic and uncertain according to the scattered references in the Jesuit Relations. Some prospecting was done by the French in 1739 at bidding of De la Ronde who employed two German miners in the Ontonagon area. Alexander Henry, in 1771, established a mine on the Ontonagon River which by the following year had failed. Mining of copper and silver by Euro-Americans did not begin on Isle Royale, however, until 1847 by which time any tangible link between the prehistoric miners and their historic survivors had been largely obscured by the processes of cultural change. Goods of European manufacture had since supplanted the exchange in native copper although it continued in use locally and was revered as a manitou in its natural state (Halsey 1983).

GEOLOGICAL DISTRIBUTION OF COPPER

Primary deposits of native copper are found at several places around the Lake Superior basin and along the Keweenaw rift to the southwest (Figure 15). South shore sources are found from the St. Croix River on the Minnesota-Wisconsin border northeast to Ontonogan and the Keweenaw Peninsula (Huber 1975). The Snake and Kettle rivers in Minnesota, tributaries of the St. Croix, are also mentioned as a copper source (Irving 1883:241). Copper-bearing rocks are found on the north shore from Duluth to Grand Portage. There is a gap in the distribution of copper sources from the international border to Black Bay, Ontario. Irving's (1883) survey of copper

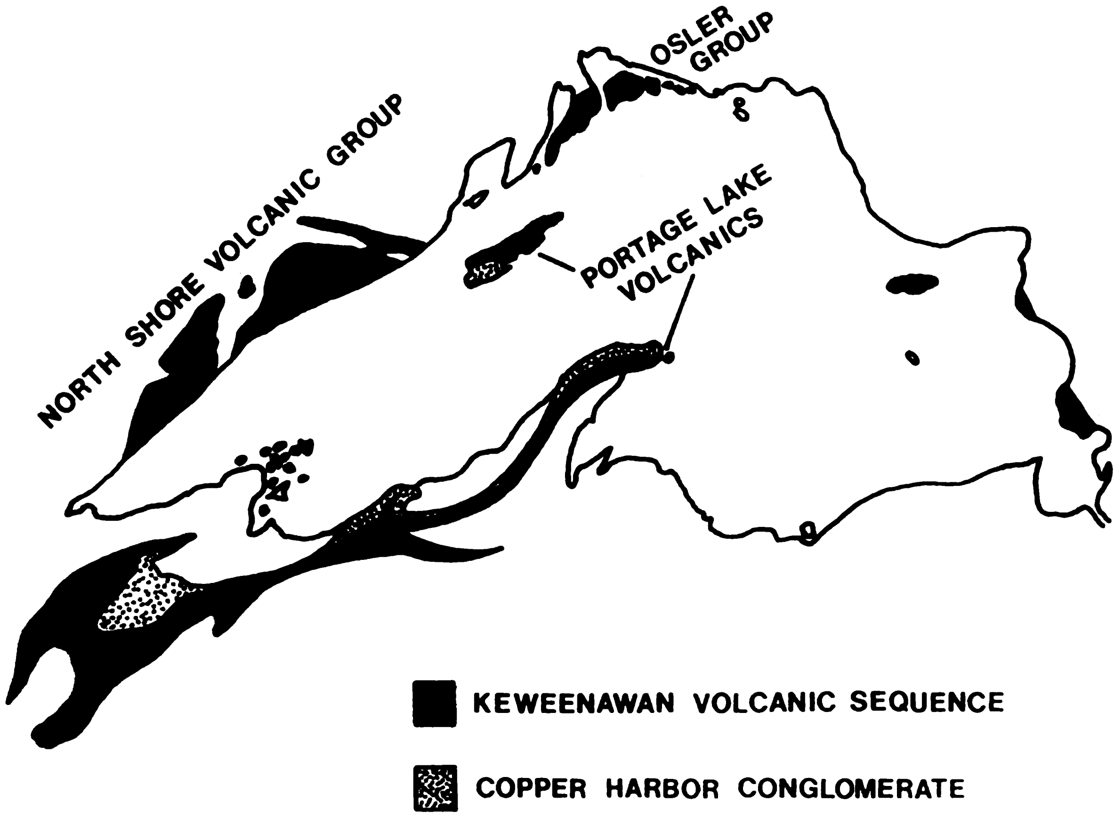

Figure 15. Distribution of Geological Copper Sources.

bearing rocks of the Lake Superior basin specifically names the locations of copper sources from Thunder Bay to the Sault: Edward Island, Point Porphory (Black Bay), Battle Island, Flour Island, Simpson's Island, St. Ignace, North Bay, Michipicoten Island, Point Gargantua, and Point Mamainse (Irving 1883:78).

Secondary sources of copper are found to the south of the areas of primary deposits; particularly in Minnesota, Wisconsin, and the Upper Peninsula of Michigan. Glacial till deposits and sorted till and outwash occurring on river bottoms and lakeshores in this area have produced large amounts of native copper, ranging from small pieces to large masses weighing thousands of pounds (e.g., Winchell 1911:505). Drift or float copper, as it is called, has the advantage of being free of surrounding matrix, making it easier to work into large items. However, this advantage is diminished by the difficulties in locating float copper. No data exist by which to assess the relative frequency of the use of secondary copper as opposed to primary sources. It is assumed that, in most instances, the procurement of float copper was the result of accidental finds, although it is expected that a level of awareness of the likelihood of encountering copper in certain areas must have operated. This was certainly the case in the "Old Copper Culture," the distribution of which is largely coterminus with the distribution of float copper south of Lake Superior.

DISTRIBUTION OF ABORIGINAL COPPER MINES

Given the large area of primary copper sources, the number and distribution of aboriginal copper mines is surprisingly limited. Excluding Isle Royale, prehistoric copper mines are reported from few locations: the eastern end of Lake Superior at

Point Mamainse where three pits are recorded (Griffin and Quimby 1961:77), the Ontonagon and Mass City area, and on the Keweeenaw Peninsula at the Calumet Ancient pit (Griffin 1966) (Figure 16). By contrast, there are 15 prehistoric copper mines recorded on Isle Royale with anywhere from one pit or fissure to more than one hundred. This reflects the archaeological knowledge of the region, rather than the actual distribution and density of copper mining in prehistory, and explains the historic tendency to over emphasize the role of Isle Royale as the source of prehistoric copper.

Tyler Bastian's (1963b) thesis on the aboriginal copper mines of Isle Royale is the most comprehensive treatment to date. Although inconclusive with respect to the cultural-historical aspects of prehistoric mining and the systemic cognates of copper extraction, fabrication, and redistribution, Bastian describes the geological context of native copper deposits on Isle Royale, the aboriginal copper mines, and associated artifacts. He defines two forms of aboriginal mines: pits and fissures. Pit mines are, as the name implies, generally circular excavations in bedrock usually associated with a lode deposit, while fissures are linear excavations that follow a copper vein.

Seven copper mines on Isle Royale can be placed in the Terminal Woodland substage, some by radiocarbon dates, some by direct association of Terminal Woodland artifacts, some by their elevation relative to modern lake levels, and some by an inference of proximity to documented Terminal Woodland occupation sites. Only one other site in the entire region, the Calumet Ancient Pit on the Keweenaw Peninsula with an uncorrected radiocarbon date of A.D. 770 +/-140 (M-1776) has

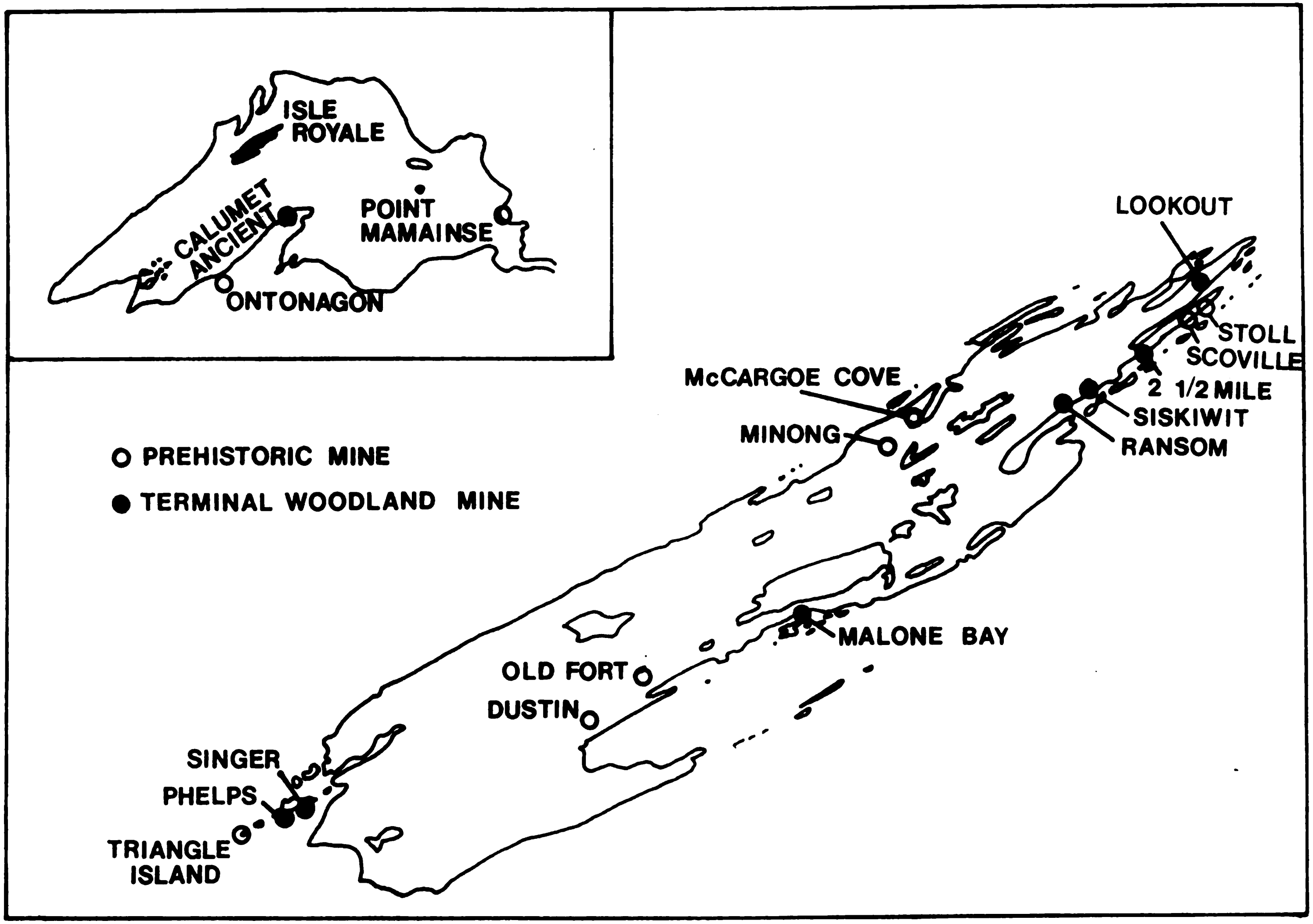

Figure 16. Distribution of Prehistoric Copper Mines.

been documented for the Terminal Woodland (Griffin 1966), although there are no diagnostic artifacts associated with the site. The following detailed site descriptions are used to deduce the social and technological requirements of extraction and fabrication of Isle Royale copper in the Terminal Woodland substage.

20IR30 (LOOKOUT): One of the first aboriginal mines identified by whites on the island, this site was first discovered by Shaw in 1847 who excavated at least a portion of one pit (Foster and Whitney 1850:162). The site was then forgotten until its rediscovery by Park Superintendent R. Gibbs in 1950. Ten years later the UMMA survey located five fissure mines and excavated two pits (Pits 4 and 56) (Bastian 1963a:49-53). In addition to the wide range in radiocarbon dates, six hammerstones and five "scrapers or choppers" were found.

20IR41 (SISKIWIT MINE): This site is a combination of mine and occupation/fabrication site on the north side of the Rock Harbor channel opposite Mott Island. The Siskiwit Mine site is the location of a prehistoric mine and occupation, an American Fur Company fishing establishment, and a nineteenth century copper mine (Bastian 1963a:55-56, Clark 1987).

The University of Michigan survey (Bastian 1963a) recovered 16 hammerstones from a fissure mine at this locality. Crane and Griffin (1965:128) report an uncorrected radiocarbon date of 1420 B.C. +/- 130 from charcoal collected from the mine (erroneously reported as coming from 20IR6, the "Siskiwit [River] site"). In 1986 a sheet midden was located and samples recovered. The midden contained beaver and fish bones, stone tools and debitage, copper waste, and very small amounts of nondiagnostic pottery. A radiocarbon date from the midden places the occupation in the Terminal Woodland and Historic time frames (Clark 1987). In order to clarify the nature of the occupational deposit and its relationship to the mining area above, the Siskiwit Mine site was selected for limited test excavation in the spring of 1987.

Historic artifacts were limited to the first 27 cm BS. Prehistoric materials were present in small numbers in this mixed upper zone. Feature 1 was initially defined as a hearth feature on the basis of a shovel test (Clark 1987). The black soil was found to be a sheet midden with a maximum thickness of 22 cm. It was restricted to the westernmost excavation unit where it was encountered from 12 to 34 cm BS. Midden contents included copper in both waste and finished tool forms, unifacial stone tools and debitage, abundant calcined bone, wood charcoal, and several examples of Terminal Woodland pottery. No historic artifacts were recovered from the midden.

Feature 2 was defined at 17 cm BS as an area roughly 80 cm by 80 cm of closely spaced pieces of FCR and dark charcoal rich soil. Thirty centimeters in thickness, the feature ended at 47 cm BS. In profile Feature 2 consists of five discrete layers of alternating sterile soils and organic rich fill. The uppermost level was the area of greatest FCR density, although FCR continued throughout the deposit. At 30 cm BS in the center of the feature a bright red-orange lens of burned clay was found. Radiocarbon dates are consistent with the artifacts and previous date, placing occupation at the Siskiwit Mine site in the Terminal Woodland substage.

A total of 27 pieces of waste copper and two finished tools were found in the 1987 excavation units. Initial stages of fabrication are well represented by raw copper with and without matrix, as well as examples of all flat copper waste types. Two small butterknives were also found in the midden deposits. Both exhibit a narrow tang and are made of relatively homogeneous pieces of copper although laminated structures are present on both. They are quite short, even for this category (43.21 mm and 35.58 mm).

Fragments of three Terminal Woodland vessels were recovered from the excavation units at the Siskiwit Mine site. All have typological affinities with Juntunen phase pottery of the Straits of Mackinac sequence.

Faunal remains at the Siskiwit Mine site consist of 1600 total elements, 1100 of which are identified to class (T. Martin and Masulis 1989a:21-26). Fish constitute 40%, including lake trout (91% of all fish) and lake whitefish. Mammals account for 48% with examples of cow, pig, moose (?), caribou, beaver, and hare. Small amounts of loon and turtle were also recovered.

20IR46 (ISLE ROYALE AND OHIO MINE): Located above the Daisy Farm campground (see 20IR45, Appendix A), the Isle Royale and Ohio Mine, also known as the Ransom site, operated between 1846 and 1849. In 1986 a single hammerstone was located here, identifying the site as an aboriginal mining site (Clark 1987:23). Based on its close proximity, this site may have served some of the immediate needs of the Daisy Farm occupants for copper. It should be noted that the Daisy Farm site has both Laurel and Terminal Woodland components, making the temporal placement of the associated mine site uncertain.

20IR80 (SINGER): The Singer site is located on the south side of Washington Island on steep bedrock (Portage Lake flow volcanics) just to the east of a level saddle which formerly was the site of a cabin. A site was recorded by the UMMA survey and described by Tyler Bastian as a historic mining prospect:

> There are at least seven veins in a distance of about 400 feet which have been very superficially mined or prospected. Drill holes are present in a few cases indicating that at least some of the mining can be attributed to Euro-American miners, but there is no way to demonstrate that any of the veins have also been worked by the Indians. The only known historic records of mining on Washington Island are from 1847 or earlier (Foster and Whitney 1850:91, Jackson 1849:426). The workings of the Ohio and Dead River Company on the north side of Washington Island could not be located by the survey. [1963a:70]

Dustin notes that early mining explorations on Washington Island, "have been reported on the site of ancient works" (1957:11). The location indicated by Bastian was relocated by the NPS-MWAC crew in 1989 which found that the site is an intact and undisturbed aboriginal copper mine with associated copperworking and living sites (see 20IR160, Appendix A). No evidence of historic disturbance was found and Bastian's assessment remains a puzzle. There is a gap in site information between 20IR79 and 20IR82 in Bastian's field notes, suggesting that this site and Phelps (20IR81) were described on the basis of secondhand information.

Three mining pits (Features 1-3) were identified and documented and two test units excavated on a level area immediately above the pits. Hammerstones, hammerflakes, and worked copper were collected from the exposed surface, shovel tests, and excavation units.

Feature 1, the largest of the mine pits and the one closest to the water, was located by following a copper vein from the water's edge upslope. At the time of its discovery Feature 1 was water filled. The water was pumped and bailed to reveal numerous large to small boulders, sand, and driftwood. All but one large boulder were removed. The pit has dimensions of 3 m following the vein, 1.75 m perpendicular to the vein, and is 1.25 m deep, measured from the water mark. The vein of pure copper averages 5 cm in width and exhibits battering from wave action on the cobbles and debris which had collected in the pit.

The second pit, just above Feature 1 and following the same vein, measures 2.2 x 1.0 x 0.3 m deep. Large rocks that had fallen from the bedrock face above this pit have filled the upper end of the feature and were too heavy to remove. Metallic copper is visible at the southern end of the pit.

A third feature along the same vein was not excavated, although it has the greatest potential for in situ remains from prehistoric mining activity as it is well above the level of Lake Superior and is spared the impact of the waves. The pit is filled with vegetation and is partly obscured. It is roughly rectangular in shape, measuring 65 x 47 cm. Depth is at least 37 cm.

Two excavation units were located on a level area just above these pits to investigate the possibility of copperworking activities. One shovel test contained one piece of flat, vesicular copper. The unit at this location, however, was otherwise sterile. Owing to the saturated condition of the soil it was excavated to a depth of 15 cm BS. A second test unit 5 m to the southwest contained one piece of flat, laminated copper and two basalt hammerflakes.

Hammerstones were collected from three areas of the site. A small basalt fragment was located on the surface between Features 2 and 3; a quartzite hammer fragment was found in an a shallow depression above Feature 1. In an actively eroding area to the east of the primary vein, one complete and two fragmentary basalt hammerstones were collected. Massive boulders in this area have thin sheets of copper on some outer surfaces which could be easily detached, suggesting a low energy alternative to copper extraction.

The activities reflected in this site indicate only copper extraction and preliminary fabrication. The nearby occupation site (20IR160) probably served as the focus of related domestic and subsistence activities for the miners of the Singer site.

PHELPS (20IR81): Phelps Island was one of the early names for what later became Washington Island. There is no known record of who Phelps was in the history of the island, although this information might shed some light on the basis upon which Bastian initially identified this site. The name Phelps was not found on any of the available documents of persons holding mining claims or among the employees of the Wendigo Mining Company which operated in this area in the late nineteenth century. As was the case with the Singer site, the Phelps site was apparently misidentified by Bastian:

> The mines are near the middle of the south coast of Washington Island about 2100 feet due east of the line between sections 9 and 10. There are at least five mines in a distance of 300 feet, but only one amounts to more than a superficial prospect. As in the case of the mines at the Singer site, it was not determined if they had been worked by the Indians. [1963a:70]

In an attempt to ground truth Bastian's report, the NPS-MWAC survey team found one well defined aboriginal pit with hammerstones, hammerflakes, worked copper, and a small quantity of Terminal Woodland ceramics liberally strewn around the pit and across the bedrock surface of the site. No evidence of drilling or other historic disturbance was noted. Although only one pit was identified, other areas of exposed copper veins were recorded to the southwest of the site. These areas are subject to heavy wave action from Lake Superior and, as a consequence, no surface evidence of aboriginal mining was preserved.

The mining pit (Feature 1) is located astride a copperbearing vein. The pit measures 3 m along the vein, 1.4 m perpendicular to the vein; its depth could not be determined due to the fill in the pit. Test unit #1 was initiated at the northern edge of the pit where a natural drainage had redeposited soils containing ceramics and hammerflakes. Fragmentary hammerstones and hammerflakes were abundant around the orifice of the pit.

Localized shovel testing in the area immediately above the pit feature located an activity area associated with the mining. One shovel test contained black anthrosols with five chert and two basalt hammerflakes. A second unit, TU #2, was opened to explore this deposit. A thick duff layer extended to 13-20 cm BS where it gave way to a dense deposit of cultural material in a matrix of black loam and pea gravel. This midden deposit (Feature 2) persisted to a depth of 32 cm BS and contained a sandstone anvil, hammerflakes, worked copper, and small amounts of chert debitage, sherds, charcoal, and calcined bone.

The lithic artifacts from this site are almost exclusively associated with the extraction and fabrication of copper. A total of twelve chert flakes include HBL (10), JST (1), and PLQ (1). By contrast, there were 125 hammerflakes, 35 of which were from the mine pit. Basalt is the most common material. Ten hammerstone fragments and two complete hammerstones were collected from the combined provenience units. One is bilaterally notched for hafting. All specimens are basalt except for one example of granite. The sandstone anvil from the midden exhibits a central area of pitting on an otherwise smooth surface. The lateral edges of the anvil are trimmed by flaking. No copper tools or ornaments were recovered although limited testing produced a typical range of waste categories.

One neck, 13 body, and 26 indeterminate sherds were collected from Feature 1, seven of which are attributable to a pipe or miniature vessel. The midden feature contained four indeterminate sherds from a single vessel. The ceramics are significant as the first which are directly associated with a mining feature on Isle Royale; unfortunately they are not diagnostic beyond a general similarity to Terminal Woodland pottery.

The Phelps site, in combination with Singer and Washington Island #2, constitutes a configuration of activities associated by proximity and necessity. Copper extraction and initial processing took place very near a site of domestic activity where pottery and tools used in tasks not related to mining were repaired and discarded. The midden feature is likely a product of fires for annealing and warmth. While it meets the requirements of artifact and feature content of our operational definition of an occupation/mine site, the physical characteristics of the site suggest a high intensity of copper working, but low intensity of domestic activities.

20IR118 (2 1/2 MILE): This site was recorded as a spot find at the time of its discovery, but during a reexamination of the site hammerstones, hammerflakes, and chert flakes pointed to a much more complex deposit. The site is located about 400 m from the Threemile campground in a broad area of exposed bedrock and jack pine within 20 m of the Rock Harbor channel.

Artifacts were collected from the main trail and its branches over a distance of about 70 m. Major concentrations of hammers and hammerflakes occur immediately above two vegetation-filled depressions designated mine pits #1 and #2. Additional pits are located nearby: a total of five pits were mapped as probable mines. A small number of chert flakes were collected from one area adjacent to pit #3: an unusual association for a mining site. Hammerflakes were collected from a bedrock exposure at the northeast end of the site (where the initial spot find was found), some distance apart from the pits and major concentrations of artifacts, suggesting an ancillary area of initial processing.

Seven hammerstones, 19 hammerflakes, and 12 chert flakes were collected from the vicinity of the mine pits. The hammerstones are all waterworn basalt cobbles, probably collected from the beach immediately to the west of the site. All show well developed battering on one or more surfaces and several have massive flake scars from the detachment of hammerflakes. One unusual hammer has, in addition to the typical wear on both poles, an area of battering and flake detachment on its midsection indicating that it was held by both ends while the middle of the hammer served as the percussive surface.

The hammerflakes constitute an important means of identifying an aboriginal mining area, even when the pits are filled with vegetation and difficult to recognize. They exhibit the same morphological characteristics as other flakes, but are usually larger and are made of igneous rock rather than chert. Platform characteristics are a function of use and do not reflect modification for detachment found in reduction trajectories for chert or quartz tools. Of the 12 chert flakes recovered, six are JST and six are unidentified chert. All are very small in size and represent on-site maintenance of chert tools.

The 2 and 1/2 Mile site is probably related to the Threemile site (see 20IR116, Appendix A), the latter serving as the occupation and fabrication locus of a small Terminal Woodland encampment (Clark 1989a).

20IR183 (MALONE BAY #3): The Malone Bay #3 site is the only recorded aboriginal copper mining site which occurs in the Copper Harbor conglomerate formation. Located on the south shore of the island a short distance from the Malone Bay Campground, this site was initially identified by the presence of hammerstones, worked copper, and ceramics lying on the open surface of a flat conglomerate shelf, sparsely covered with mosses and juniper. The site was mapped, and careful removal of moss revealed the presence of additional artifacts, mostly hammerflakes and hammerstones, and a pot break was found near the edge of a fissure. Closer examination of the fissure revealed a seam of copper running from the water of Lake Superior up to the level of the site about 5 m above the lake.

Here the single fissure split into two which continued in a northeasterly direction defining the southern edge of the site. Three excavation units were dug to further investigate this site. Artifacts include hammerstones, hammerflakes, worked copper, chert and quartz debitage, and a Sandy Lake (grit tempered) pot break. No midden or datable materials were recovered. This Terminal Woodland site probably represents a single episode of copper extraction and fabrication conducted by a small group with affinities to northern Minnesota.

The content and distribution of mining sites, associated fabrication loci at occupation sites, and sites more peripheral to the copper industry on Isle Royale establishes a pattern which can be applied to other areas within the Lake Superior basin.

Mining sites must be located where there are primary sources of copper and are characterized by the presence of hammerstones, hammerflakes, and pits and/or fissures in bedrock matrix. In at least two instances (Malone Bay #3 and 2 1/2 Mile) the presence of aboriginal copper mines was inferred prior to their actual discovery based on the surface recovery of these artifacts in a quantity sufficient to indicate that a mine was nearby.

Fabrication loci may be found at any distance from the actual source of copper; either immediately proximate to the mines or well away at a location more suitable for occupation and subsistence preferences. Fabrication is indicated by the presence of worked waste copper and smaller hammerstones than those used for mining. On Isle Royale, fabrication loci are most frequently associated with occupation sites, and only at the Phelps site is the association an immediate one.

More typical is the spatial separation between mine and fabrication loci, as is the case between the 2 1/2 Mile and Threemile sites, Singer and Washington Island #2, and more generally between the Minong Ridge area and the McCargoe Cove sites, respectively.

Sites peripheral to the extraction and fabrication of copper, but where copper was used are more typical of the areas outside the copper range, reflecting the movement of copper from source to ultimate place of loss or discard. Finished items, typically beads, awls, small knives, or other utilitarian items are usually encountered at these sites.

These patterns are used to evaluate the distribution of copper in the Lake Superior basin and surrounding areas. These artifact patterns suggest, on a regional level, the degree to which specific archaeological cultures participated in copper mining or fabrication, or if their acquisition of copper was dependent on some agency other than direct procurement.

DISTRIBUTION OF ARCHAEOLOGICAL COPPER IN THE TERMINAL WOODLAND SUBSTAGE

The subsequent movement of copper opens the question of relations with other groups and the nature of social interactions required to either preclude access to copper or make it available to one's neighbors. This inquiry begins with an examination of the geographic distribution of archaeological copper around the Lake Superior basin as means of determining whether or not certain archaeological cultures seem to have had differential access to, or interest in, copper. Renfrew

(1977) offered a number of alternative models for reviewing the distribution of unique resources across cultural landscapes, all of which require the reduction of archaeological data to mathematical equivalents. Another requisite is knowing in precise terms the source of the unique resource so that the relation of the distribution of the products originating at that sources may be measured. Unfortunately, we are not in a position to differentiate Isle Royale copper from Keweenaw copper, or any of the other alternative copper sources within the Lake Superior basin, rendering any mathematical approach absurd. Trace element analysis is currently in progress that may make this possible in the future. Therefore, the distribution of Terminal Woodland copper in the Lake Superior basin is presented in a narrative form which considers in general terms the density, form, and context of copper artifacts.

NORTHWESTERN ONTARIO AND NORTHERN MINNESOTA: Published sources were consulted to investigate the distribution of archaeological copper in the area viewed as the territory of the Blackduck and Selkirk archaeological cultures. The area includes the western end of the Lake Superior copper district (i.e., Isle Royale and north shore sources from Minnesota at least as far east as the Sault). A survey of sites from the western end of Lake Superior to the northwest, including parts of northwest Ontario, northern Minnesota, and southeastern Manitoba suggest, informally, a sudden decline in density with increased distance from the geological sources of copper. An inventory of copper tools, ornaments, and waste copper from Isle Royale is presented for the Terminal Woodland sites in Appendix A.

Cultural site surveys in the Superior National Forest of northern Minnesota have contained only small amounts of copper. Out of 39 sites with Terminal Woodland diagnostics (typically Blackduck pottery) four also yielded copper artifacts (Peters et al. 1983, Peters 1984, 1986). Most sites found in the forest survey are lithic scatters and probably include a number of aceramic Terminal Woodland components which are not counted here. But even with the addition of these, the numbers of sites which contain copper artifacts do not increase significantly. Excavation by the Superior National Forest at the Big Rice Lake site revealed a large occupation with Blackduck and Sandy Lake ceramics. Copper artifacts were limited to a single awl and three pieces of waste (Peters 1984).

At the Martin-Bird site on Whitefish Lake (southwest of Thunder Bay) one awl and 46 pieces of worked copper were found in what Dawson (1987) interprets as an annealing hearth. Also on Whitefish Lake is the Mound Island site where Dawson (1978) found a major occupation site with Blackduck, Mackinac (?), Pickering Branch, and Peninsular Woodland ceramics: no copper was recovered here. In a survey of sites at Voyageurs National Park on the international border, including Rainy, Namakan, and Kabetogama Lakes, only three sites (21SL47, 141, and 153) out of a total of 35 Terminal Woodland sites contained one or two pieces of copper in association with Blackduck and/or Selkirk pottery (Lynott, Richner, and Thompson 1986). Nearby at the Long Sault site on the Rainy River, which was intensively excavated and produced evidence for a Blackduck and Selkirk habitation and burial site of long duration, one copper awl was recovered (Arthurs 1986).

In Kenyon's (1986) survey of burial mounds in western Ontario one finds only sporadic use of copper associated with burials. At the Hungry Hall site on the Rainy River only two copper beads were found with Blackduck burials in Mound 1, although there was a wide assortment of other goods included (e.g., clay pots, marine and freshwater shell and bone beads, scrapers, bone awls, and other worked bone, shell gorgets, and a lump of hematite). At Mound 2 grave goods included clay pots, marine and bird bone beads, Catlinite tubes, and a bone awl. Kenyon describes a number of other Blackduck mounds which have sparse or no grave goods and lack copper.

At the Ballynacree site in the Lake of the Woods area no copper was recovered in the excavation of the Blackduck and Selkirk occupation (Rajnovich and Reid 1987). Also near Kenora, the Ballysadare site produced no copper (Rajnovich 1980). The Spruce Point site at the north end of the Lake of the Woods also failed to produce copper with its late prehistoric Blackduck and Selkirk occupations (Rajnovich 1983). North of Kenora at the Forestry Point site one awl and two pieces of waste copper were found with Blackduck and Selkirk ceramics (Pelleck 1983).

The West Patricia District of northwestern Ontario covers 223,500 square kilometers (86,300 square miles) of rivers and lakes of the southern boreal forest. The extensive survey of this area disclosed approximately 364 Terminal Woodland sites of which eleven contained copper artifacts (Reid 1980, Reid and Ross 1981, Ross 1982). In most cases the components are identified as Blackduck and/or Selkirk, and in most instances where copper artifacts were found, only one item is involved. Artifacts include butterknives, awls, bars, and socketed or conical points.

A survey in the North Caribou Lakes area 500 km north of Isle Royale disclosed five Terminal Woodland sites, no copper artifacts were found (D. Gordon 1985). Similarly, a survey in the extreme southwest corner of northwestern Ontario which found 14 Blackduck and Selkirk sites contained no copper (Halverson 1988).

NORTH CENTRAL ONTARIO: By contrast, Terminal Woodland sites along the north shore of Lake Superior contain larger amounts of copper artifacts. The attribution of this copper to a specific archaeological culture is, however, rendered uncertain by the association of the widest range of ceramics. The problem is further exacerbated by the presence of primary copper sources at a number of points along the north shore which make any association with the Isle Royale sources equivocal.

The Cobinosh Island site is located on the north shore of that island at the eastern end of the Nipigon Bay archipelago in Lake Superior. According to David Arthurs (personal communication, 1990), the site is stratified and includes copper artifacts (mostly awls) with Heins Creek, Madison, Mackinac, Juntunen, Blackduck, Selkirk(?), and Iroquoian ceramics. In one test excavation there is a direct association of Blackduck ceramics and a copper awl.

The Michipicoten site at the mouth of the Michipicoten River on Lake Superior contains stratified deposits ranging from A.D. 1100 to A.D. 1700 (J.V. Wright 1968). One copper awl was found in Stratum VII (ca. A.D. 100-1400) with Juntunen and Peninsular Woodland ceramics. Stratum III (A.D. 1460) contained 9 awls, 1 knife, 1 punch, and 17 pieces of waste copper with Huron, Juntunen, and Peninsular Woodland ceramics. Stratum II (ca. A.D. 1700) contained 2 rings, 1 awl, and 7 pieces of waste copper in association with Huron, Juntunen, and Peninsular Woodland ceramics.

The Whitefish Island site at Sault Ste. Marie produced an assemblage which duplicates the association of copper artifacts and ceramic wares seen at Michipicoten and at several Isle Royale sites. Conway (1977) describes 10 awls, 4 bars, 2 earrings, 3 beads, 1 ring, and 15 pieces of waste copper in association with Huron, Mackinac, Bois Blanc, Juntunen, Blackduck, and Algoma style ceramics. ("Algoma" ceramics represent Conway's interpretation of a local Algonkian ceramic tradition. It has not been formally published or described, however.) Based on what is known from Isle Royale, this assemblage of worked and waste copper is what one would expect from a site in close proximity to a primary copper source, in this case, probably the Point Mamainse and Point Gargantua sources.

STRAITS OF MACKINAC: As both McPherron (1967) and Bastian (1963a and 1963b) noted, the copper assemblage at the Juntunen site is one of the largest east of Isle Royale. A total of 776 copper artifacts from 133 provenience units are described by McPherron (1963:164-175), and in form and inferred technology recapitulate the findings on Isle Royale. The large numbers of copper artifacts must, in part, reflect the intensity of excavation of the Juntunen site as compared to the more limited testing at most of the other sites considered here. However, McPherron's hypothesis of a resurgence of a local copper industry (the first since the Archaic) based on the stratigraphic distribution of copper at the Juntunen site appears to be borne out by the paucity of Mackinac phase ceramics elsewhere in the

Lake Superior copper district coupled with the widespread occurrence of Juntunen ceramics in this area.

LOWER MICHIGAN AND SOUTHWESTERN ONTARIO: In the Lower Peninsula of Michigan the problem of different sources of Lake Superior copper becomes irrelevant, since most of it would have had to funnel through the Straits of Mackinac regardless of geological source. Here, too, the context of copper takes on a different value with increased distance where it shifts from secular utilitarian forms and contexts into increasingly ritual contexts as burial goods or items of personal adornment (usually beads). In northern Lower Michigan at the Pine River Channel site on Lake Michigan two beads, one tool fragment, and four pieces of waste copper (?) were found (Holman 1978). Nearby at the O'Neill site one rolled tubular bead, one butterknife, and three pieces of waste copper were found with Mackinac, Juntunen, Skegemog, and Traverse wares (Lovis 1973).

On the western side of the Lower Peninsula at the Dumaw Creek site Quimby (1966) describes a late prehistoric (ca. A.D. 1605-1620) burial component. Copper artifacts are numerous and include hair pipes (rolled tubular beads), beads, tinkling cones, and a snake effigy. These in combination with the many other items of personal adornment and utilitarian function included as grave furniture suggest an ascribed "value," but one which ranks along side of stone projectile points, ceramic vessels, and marine shell beads as a reflection of social prestige of the interred individual and not necessarily an intrinsic value of the material itself.

Far to the south at the Riviere Au Vase site in Macomb County, Michigan, one awl and 34 beads were found with a burial (Fitting 1965). Copper was also a common constituent in the Wayne Mortuary Complex of the Saginaw Valley and southeastern Michigan (Halsey 1976), although the relations to Middle Woodland cultures renders this marginal, both culturally and geographically to this consideration of Late or Terminal Woodland copper.

Copper does not appear to have been an important component of sites in Huronia in spite of evidence of long distance contact between this area and the Lake Superior region. At the Nodwell site on Lake Huron awls were found in a longhouse, midden, and pit contexts (J.V. Wright 1974). One awl was found at the tenth century A.D. Iroquoian Boys site, north of Lake Ontario (Reid 1975). And, in general comments concerning the use of native copper in Glen Meyer sites in southwestern Ontario, Noble (1975:48) states that, "A second non-indigenous commodity, native copper, also appears in Glen Meyer territory, but again not in marked volume. Wright (1966:39) reports one rolled bead from the Stafford site, while Fox (1972:23) recovered two beads from DeWaele. Reputedly, a native copper awl came from Van Beisen."

UPPER PENINSULA OF MICHIGAN AND NORTHERN WISCONSIN: In the area of the Upper Peninsula and northern Wisconsin, the problem of Isle Royale versus other sources of copper is a moot point. In practical terms, one must accept that virtually all of the archaeological copper encountered here is from sources on the south side of Lake Superior. While there are a few well documented sites, the area is, overall, poorly known.

In the protohistoric component at the Summer Island site in northern Lake Michigan there are 3 rolled beads, 4 conical points, 3 awls, and one snake effigy (?)

(Brose 1970:211) in association with Lake Winnebago Trailed, Huron Incised, Bell Type II, and Dumaw Creek ceramics.

On the Keweenaw Peninsula in the Upper Peninsula's copper range and to the southwest toward the Wisconsin border archaeological copper takes on expected similarities of form and context comparable to that found on Isle Royale and north shore sites. At the Sand Point site at the southern end of Keweenaw Bay the copper assemblage includes waste, beads, crescents, awls, conical points, and fishhooks with a total of 130 copper artifacts (Hoxie 1980). The site is dated between A.D. 1100-1400 and is associated with a ceramic complex related to the Lakes phase of northern Wisconsin with stylistic ties to the Juntunen phase (Claire McHale Milner, personal communication 1989). The site includes eleven burial mounds and the remains of a minimum of 117 individuals was recovered from site testing (Cremin 1980). The context of the copper artifacts is nowhere specified: one gets the impression that copper is found throughout the site with other domestic refuse.

At a site near the tip of the Keweenaw Peninsula, the Montreal River site, copper waste, one awl (?), and one bar (?) fragment were surface collected in an assemblage which is dominated by Mero phase grit tempered Oneota ceramics and also includes Sand Point and Juntunen ware. The artifacts from this site reside in the Archaeology Laboratory, Michigan Technological University, Houghton, and in the private collection of John Williams, Arcadia, Michigan, and were examined by the author.

Buckmaster's (1979) settlement analysis of the Menominee River watershed on the Michigan-Wisconsin border also recapitulates the forms and context of copper on the north shore of Lake Superior, although there are differences in some of the artifact forms and, of course, in ceramic associations. Knives, awls, beads, and waste copper predominate and are found with Heins Creek, Pt. Sauble, Madison, Grand River, Carcajou, and Lakes phase ceramics.

In the interior of the Upper Peninsula of Michigan United States Forest Service surveys are the primary source of archaeological site data. A cursory examination of the 1985 and 1986 annual reports from the Hiawatha National Forest cultural resource surveys produced no examples of prehistoric copper (Franzen 1987, Gilbert/Commonwealth 1987). No data were obtained for the Ottawa National Forest, although in the northern part of the Forest copper mines are known but not formally reported.

Out of a total of eight Terminal Woodland sites in the St. Croix river drainage on the Wisconsin-Minnesota border two sites have copper artifacts (Perry 1986a, 1986b). One includes six pieces of "raw and worked copper" nominally indicative of fabrication activities. These are lower than expected densities for an area in which native copper is known to occur in primary contexts.

EXAMPLES OF OTHER UNIQUE EXOTIC RAW MATERIALS

Copper was not the only material to capture the fancy of prehistoric craftsmen, or the only substance to be carried long distances across cultural boundaries. Unique raw materials other than copper which occur on archaeological sites may offer some insight with respect to inferring the technology and organization required to extract, fabricate, and distribute the products of that material, and the nonmaterial cognates of its use. To the extent that it will explicate some of the more general aspects of the role of unique raw materials, a brief discussion of some analogous archaeological and ethnographic examples is in order.

Holmes (1919) describes a number of quarries, among which is the Flint Ridge chert quarry in Ohio, as well as sources of obsidian, mica, steatite, hematite, and turquoise. To generalize, in all cases there is a basic pattern in the structure of activities and activity areas relative to the quarry pits and mines. Workshops are close to the primary source where extraction and initial reduction anticipatory to fabrication take place. Intermediate and final stages of working tend to occur at or near the living sites. Holmes, does not consider the social implications of these activities.

Pipestone or catlinite was quarried from shallow surface pits at its source in Minnesota, and has been of interest to explorers, missionaries, and archaeologists since the early seventeenth century. It found mention in the writings of the Jesuits in 1637, Groseilliers and Radisson in 1658-60, Marquette in 1673, Le Sueur in 1700-02, Lewis and Clark in 1804, and Catlin in 1837 (Beaubien 1957). Only Catlin supplies an eye-witness account, however.

Holmes (1919:253-264) visited the quarry where he found shallow pits, hammerstones (grooved and ungrooved), with nearby occupation sites where fabrication took place. The tradition of the quarry as a neutral ground where all intergroup hostilities were suspended was already well established in the oral history surrounding the pipestone quarry. In the mid eighteenth century Jonathan Carver, who did not himself visit the quarry, left this account:

> On the plains between the river St. Piere and Missouri is a large mountain of red marble where all the neighboring nations resort for stone to make pipe of. Even those who hold perpetual wars in all other parts meet here in peace. The pipe being a symbol of peace, it shews the prevalence of custom when people of so cruel and implacable a disposition can so far bridle their impetuosity as to be diverted from revenge by any means. [Parker 1976:138-139]

Beaubien (1957) questions the veracity of the notion of neutral ground. But, unfortunately, there are no data of an archaeological or ethnohistorical nature to confirm or refute it. Further, there are alternative sources for pipestone elsewhere in the Midwest to complicate the situation. However, the physical layout of the quarry, and the associated domestic and fabrication debris is similar to the Isle Royale copper mines on formal grounds.

Catlinite, unlike copper, cannot serve basic technological, subsistence related needs: its domain is strictly socio-religious or, at the very least, ornamental. The importance of the pipestone calumet is amply documented (e.g., Swanton 1911), but in no instance is there an account of pipestone serving as a tool in the same sense as copper or other harder stone. In this regard the analogy between it and copper is imperfect.

Galena is known from prehistoric archaeological sites in the Midwest. Like pipestone, its use in prehistory was for nonutilitarian purposes. Galena, a source of white pigment or occasionally worked into effigy forms, occurs on both ceremonial/mortuary and occupation sites (Walthall 1981:3ff). There is historic documentation of mining which took place in the seventeenth through the early nineteenth centuries when it was used as a source of lead for shot and ornaments

(Walthall 1981:18-25). The historic extraction and use of galena are strongly influenced by European technology. However, Schoolcraft's (1821:345-346, quoted in Walthall 1981:19) observations of a galena mine which he observed in 1820 are instructive with respect to the use of labor and mining techniques:

> The lead ore at these mines is now exclusively dug by the Fox Indians, and, as is usual among savage tribes, the chief labour devolves upon the women. The old and superannuated men also partake in these labours, but the warriors and young men hold themselves above it. They employ the hoe, shovel, pickaxe, and crow-bar, in taking up the ore. These things are supplied by the traders but no shafts are sunk, not even of the simplest kind....They run drifts into the hills so far as they can conveniently go, without the use of gunpowder and if a trench caves in, it is abandoned. They always dig down at such an angle that they can walk in and out of the pits, and I descended into one of these which had probably been carried down forty feet. All this, is the work of the Indian women and old men, who discover a degree of perseverance and industry, which is deserving of the highest commendation.

Walthall's analysis identifies several chemically discrete sources of galena in the Midwest and middle South, and traces the exploitation and archaeological distribution of galena through prehistory. The issue of differential access to the resource is not addressed, but at a broad level his conclusions support the decline of widespread interaction networks with increasing emphasis on local sources (1981:44). His inferential linkage of galena and Great Lakes copper is stated in terms of "abundance" of the latter resource, which he feels declined in late prehistory.

The question of social boundaries is raised in the study of the distribution of greenstone axes in southeastern Australia (Gould 1980:206-212). The physical characteristics of the quarries is essentially the same as the other examples cited earlier, with shallow pits and concentrations of debris and blank production near the quarry. But the interpretation of the archaeological distribution of the final products across the landscape is of interest. Citing a study by McBryde, Gould (1980) describes a nonuniform distribution of axes from the point of geological origin to as far away as 500 km. The distribution lacked a simple fall-off profile (Renfrew 1977), and in one case increased in frequency at the most distant point of the survey. The distribution suggested that axes followed major avenues of travel along river valleys while avoiding open plains. Ethnohistoric evidence showed that the distribution of these axes corresponded to the historic distributions of two competing groups with traditionally antagonistic relations. The lack of knowledge of competing sources for other axes, and a real uncertainty of the chronological dimensions of the axe sample used by McBryde limit the conclusions of her study: for example, it is not known to what extent the archaeological distribution of greenstone axes can be attributed to the ethnohistoric groups referred to in the study. Gould (1980) is quick to point out that discontinuities in material distributions do not necessarily signal a cultural boundary.

VALUE

The archaeological determination of value of an object, substance, or commodity often presupposes an environment which includes a market economy, or an established system of trade/exchange equivalencies that mediate the transfer of goods among groups (e.g., Earle and Ericson 1977). Value is also inferred from the presumed function of the object, substance, or commodity relative to a continuum from utilitarian to nonutilitarian domain (Binford 1962). The distance a given item or material has travelled is used as an indication of its value (e.g., Brose 1990). The context of an item's ultimate entry into the archaeological record, such as grave furniture or general domestic refuse, also suggests the value invested in that item or material (Binford 1962).

According to Sahlins (1972:277), "The diverse values put on things depend specifically on barriers to their interchange, on the inconvertibility of goods from different spheres; and as for the transactions ('conveyances') within any one sphere, no determinants of the rates have yet been specified." Within the Lake Superior basin, the question of value of copper is translatable into a question of access to copper sources, rather than in the area of exchange or trade. By extension, the question of access is translatable into the question of territory and group boundaries and, more fundamentally, the area of intergroup interaction. Traditional definitions of value become largely irrelevant when one concedes that copper resources are widespread (if nonuniform) throughout the basin, and only become important when the resource is considered outside the region. In the context of direct acquisition of copper or exchange between nearest neighbors there are no fixed values ascribed: "a 'reciprocity' that comprehends precise material rates is rarely encountered. The characteristic fact of primitive exchange is indeterminacy of rates" (Sahlins 1972:278). If, as Sahlins (1972:279) asserts, the rules of exchange are modelled after the social and moral spheres of social organization, archaeological data indicative of boundary permeability, or the absence of boundaries, must be interpreted as evidence of equal access to copper resources by all groups proximate to the copper district of the Lake Superior basin.

Similarly, mathematical models which describe the distribution of commodities or materials across a cultural landscape are inapplicable within the area of the source(s) of that material. Down-the-line exchange, directional trade, and concentration effect models (Renfrew 1977) only make sense if one maps the distribution of the material in a regional universe that precludes direct acquisition. Monotonic decrement, the decline in frequency with increased distance from the source, is applicable in the case of copper and lithic raw materials with discrete spatial sources. However, the problem is complicated by the lack of ability to discriminate among the different copper sources within the region, making suspect any quantitative approach which, for example, measures the density and distribution of copper from one end of the Lake Superior basin to the other.

In contrast to earlier cultural manifestations in Archaic or Middle Woodland cultures where it occurs as a frequent inclusion as grave furniture or as an exotic in ritual settings, the role of copper in the Terminal Woodland appears to have had less value, status, or importance. This determination is based on the archaeological context of copper which, in the Lake Superior region, is found along side of such domestic refuse as ceramics, lithic waste, and food remains. The fact that the regional setting of this analysis is coterminous with the range of native copper deposits may explain a large part of the secular nature of copper during this period of prehistory: the material was, in effect, on a par with chert quarries or good sources of clay. Secondly, the objects from which copper is made fall into utilitarian and ornamental categories, but do not rank any higher or lower than lithics or ceramics as status articles when the archaeological context in which they are found is considered. All of the utilitarian items, awls, gaffs, fishhooks, small knives, can be duplicated on other materials. Perhaps only copper beads are unique products unavailable in another medium: copper artifacts are unique only by virtue of their being copper. Therefore, while copper served a number of technological functions related to subsistence and fabrication needs, it was not essential or critical to survival.

It is argued that the social organization required to extract, fabricate, and ultimately redistribute copper items did not exceed that which was required to pursue other forms of subsistence or technological necessities. Those mines which can be associated with the Terminal Woodland substage, and which have evidence of related occupation and fabrication activities, suggest that the effective group required for extraction and fabrication of copper did not exceed one or two families or the equivalent number of individuals. There are no data to indicate that, in the Terminal Woodland substage, there were special groups whose sole purpose was to go to Isle Royale to extract copper for a trade with neighboring or distant archaeological cultures. Rather, the extraction and fabrication of copper seems to have been one of many activities undertaken in concert with the pursuit of subsistence needs and probably did not require any special organization or planning outside of that which was required for other activities.

Specific associations between copper mines and the archaeological cultures engaged in mining activities are generally wanting. Argument by geographic proximity in which the distribution of an archaeological culture and primary sources of copper are contrasted indicates that all groups had access to copper in varying degrees. The people of the Juntunen phase had access to virtually all of the Lake Superior sources from Isle Royale to Point Mamainse, and probably some access to the Keweenaw sources as well. The extent of Blackduck and Selkirk pottery suggests that their producers had access to Isle Royale and north shore sources at least as far as the Michipicoten River. The Wanikan culture, while only marginally represented at Isle Royale probably had access to some north shore copper sources, those in the St. Croix drainage, and may have utilized drift sources in Minnesota and Wisconsin as well. Oneota and Lakes phase groups clearly did not use Isle Royale or north shore copper sources: their needs were more than met by south shore (Keweenaw and Ontonagon) and St. Croix copper deposits.

Among those groups with the highest frequency of occurrence on Isle Royale, Blackduck, Selkirk from the west, and Juntunen and Huron from the east, we may conclude that all had some access to primary sources of copper. The apparent coincidence of the distribution of the Juntunen phase and most of the primary copper sources may inflate the seemingly greater incidence of copper on Juntunen sites, or it may reflect a differential interest in copper by these people. Assuming roughly equivalent geographical access to copper among these groups, the regional distribution of copper suggests, on the contrary, that differences exist which may indicate differential access to or interest in copper which may have been conditioned by factors of intergroup interaction. This conclusion will be further explored in Chapter 8.

CHAPTER 7

THE MOVEMENT OF POTS AND POTTERS IN THE TERMINAL WOODLAND SUBSTAGE: TRACE ELEMENT ANALYSIS.

INTRODUCTION

This chapter presents the results of the neutron activation analysis of 95 archaeological and five geological clay samples from sites within and near the Lake Superior basin. It was suggested in the previous chapter that, although most archaeological cultures were in a geographical position to exploit copper resources on Isle Royale, the distribution of copper on a regional basis indicate that sociocultural factors may be responsible for the differential access to and use of copper. Explanation of this requires some confirmation of the distribution of archaeological cultures, the extent to which the presence of their diagnostic ceramics on Isle Royale reflects sustained use of the island or merely sporadic visits. Hypotheses pertaining to the potential interaction of groups manufacturing Blackduck, Juntunen, Huron, Oneota, and Lakes phase style ceramics are addressed. Results identify geographic zones of ceramic production which may correspond to the distribution of Terminal Woodland archaeological cultures.

This study has created a body of reference data for the use of neutron activation analysis (NAA) as a means of enhancing the use of ceramic data in addressing fundamental definitions of group membership and mobility in the Great Lakes region. While it is not anticipated that the results of NAA will lead directly to conclusions about ethnicity manifest in ceramic style, information concerning the relationships among clay sources used in the production of a variety of types which, in turn, are attributable to discrete archaeological cultures, contribute to the understanding of interaction in the context of the Terminal Woodland substage.

In the Lake Superior region we are dealing not with craft specialists in relatively well circumscribed cultural and geographical units. Instead, the Great Lakes potters, and particularly those in the nonhorticultural Algonkian-speaking groups, are characterized as persons who, through a variety of agencies, moved across permeable boundaries in a seasonal pattern of subsistence and/or socially motivated transhumance. The affects of mobility and boundary permeability on the distribution of ceramic vessels, both in terms of style and clay source, can be tested using NAA but will likely result in a different and more diffuse patterning than is seen in residentially stable societies.

ASSUMPTIONS

Trace element analysis is not unknown in the Great Lakes and surrounding areas where it has been applied by geologists and archaeologists on clays, lithics, and copper (e.g., Brizinski and Buchannan 1977, Brumbach 1975, Brumbach and Bender 1986, Julig, Pavlish, and Hancock 1988, Kuhn 1986, Luedtke 1976, Nussman 1965, Ramsden 1988, Rapp 1984, Trigger et al. 1984). The fundamental underlying assumption of trace element studies is that the data are structured and may be explained by geological and/or cultural factors. This type of analysis has as its weakest point the explanation of the patterns which ensue from the statistical manipulation of the data. Sample sizes are rarely large enough or lack contextual and chronological controls sufficient for definitive conclusions. Furthermore, the various applications of trace element analysis done within a region have not been pooled in order to maximize the potential for a more broad consideration of these types of data on a panregional level. Nonetheless, trace element studies have made possible the evaluation of the epistemology of ceramic types (Syms 1977) and the interpretation of style with respect to the composition of prehistoric archaeological cultures.

Beyond the assumption of underlying structure are other assumptions regarding the systemic context of ceramic production and use in the Upper Great Lakes region. Pots can be made at any time of the year, but the period from spring through fall is most likely, since the acquisition and processing of clay is easier during the warm months (Syms 1977:63). Pots as curated items are more likely to be made at intervals of greater residential duration as a function of practical limits of mobility, however, pots as expedient items could be produced under almost any conditions. The greatest residential stability occurs at spring and early summer fishing sites, early spring sugaring camps, or fall ricing camps. It is under these conditions that factors operate on the use of style during ceramic decoration, and have the highest potential for transfer of vessels among groups. It is assumed that style encodes some level of corporate membership, and that the comingling or discreteness of style will reflect a level of interaction or integration among and within groups (see Chapter 3). Further, it is assumed that most pottery was made by women and that the conceptual and procedural steps involved in ceramic production were transmitted through the female line (Syms 1977:59). Finally, it is assumed, following Syms (1977:43), that for the most part, ceramics were not articles of trade in this region.

CONDITIONS AND IMPLICATIONS OF COVARIATION

The conditions and implications of covariation anticipated in the application of NAA to the sample include the following:

1) Conditions: Pots from area A are consistently made of geologically related clays from the same area.

Implications: There is a degree of sedentism or, at least, a correlation between where a pot is made and where it is used and discarded.

Archaeological Expectations: A local ceramic tradition, interpreted as a resident population, may be defined on the basis of a localized distribution of pots on related clays.

Comment: Within-style-group homogeneity in trace elements suggests that the same (geologically related) source was used by potters from a related archaeological culture and implies spatial integrity of an archaeological culture with minimal production, use, or discard of ceramics outside of the area.

2) Conditions: A pot from style group A made of clay associated with area A is found in area B.

Implications: The finished pot has been physically transported from area A to area B. Alternatively, raw clay may have been transported from area A to area B where it was formed, fired, and discarded.

<u>Archaeological Expectations</u>: Ceramics identified as exotic, foreign, or nonlocal are present on a site or in a region.

<u>Comment</u>: Between-style-group heterogeneity in trace elements suggests that different (geologically unrelated) clay sources were used by potters from unrelated archaeological cultures. As a corollary of the first stated condition, the movement of finished pots from the site of manufacture to the site of discard is implied.

3) <u>Conditions</u>: A pot of style group A is found in area B and is made of clay associated with area B.

<u>Implications</u>: Three interpretations are possible. The potter has moved from area A to area B where the pot was manufactured on local clays; a potter from area B has copied a style associated with area A; and style and source areas for clays overlap used by two groups.

<u>Archaeological Expectations</u>: Different recipes for ceramic production may be used: e.g., the pot that is stylistically exotic may be thicker and more heavily tempered than stylistically equivalent ceramics actually from the area of presumed cultural origin.

<u>Comment</u>: Within-style-group heterogeneity in trace elements may correspond to technical or stylistic variables, such as the thick-walled, heavily tempered vessel made on local clays or the thin-walled temper-poor vessel made on nonlocal clays,

or may relate to the mobility of the potter from a familiar clay source to one which is less familiar.

4) Conditions: Pot styles A and B are manufactured on the same clay(s) and are found in both areas A and B.

Implications: Potters from both groups share access to the same or geologically similar clay sources, and there is extensive movement of pots and potters between areas, and/or a single group is producing two stylistically distinct products.

Archaeological Expectations: Ceramics from both style groups will be frequently associated on sites. If two groups are represented there should be some proportionate difference between the two groups in certain areas of their range, depending on their seasonal pattern of movements. Alternatively, the composition of the group responsible for the two ceramic styles includes members from two distinct ceramic traditions and is independent of factors such as seasonal movement.

Comment: Between-style-group homogeneity in trace elements suggests that the same (geologically related) clay sources were used by potters from unrelated archaeological cultures, or that potters manifesting discrete stylistic traditions were members of a common group.

5) Conditions: Clays are selected from a wide variety of sources which are geologically unrelated; ceramic production takes place under conditions of mobility.

Implications: There is insufficient homogeneity in the clay sources selected for ceramic production for patterning of trace elements.

Archaeological Expectations: Differences at this level may not be discernable without trace element analysis. Under these conditions, trace elements from a given style group or region will fail to cluster.

Comments: Within style group heterogeneity in trace elements suggests that several (geologically unrelated) clay sources were used by potters from related archaeological cultures, or that similar styles were employed by unrelated archaeological cultures using different clay sources. The mobility of potters and the production of vessels at several loci is implied.

THE SAMPLE

NAA is applied to ceramic artifacts and geological clay samples to determine the statistical relationships of composite materials among and within stylistically coherent groups. Geological clay samples were obtained from five localities: three on Isle Royale, one from the north shore of Lake Superior at Grand Portage National Monument, and one from the Apostle Islands in northern Wisconsin (Figure 17). The archaeological samples were selected on the basis of stylistic, geographical

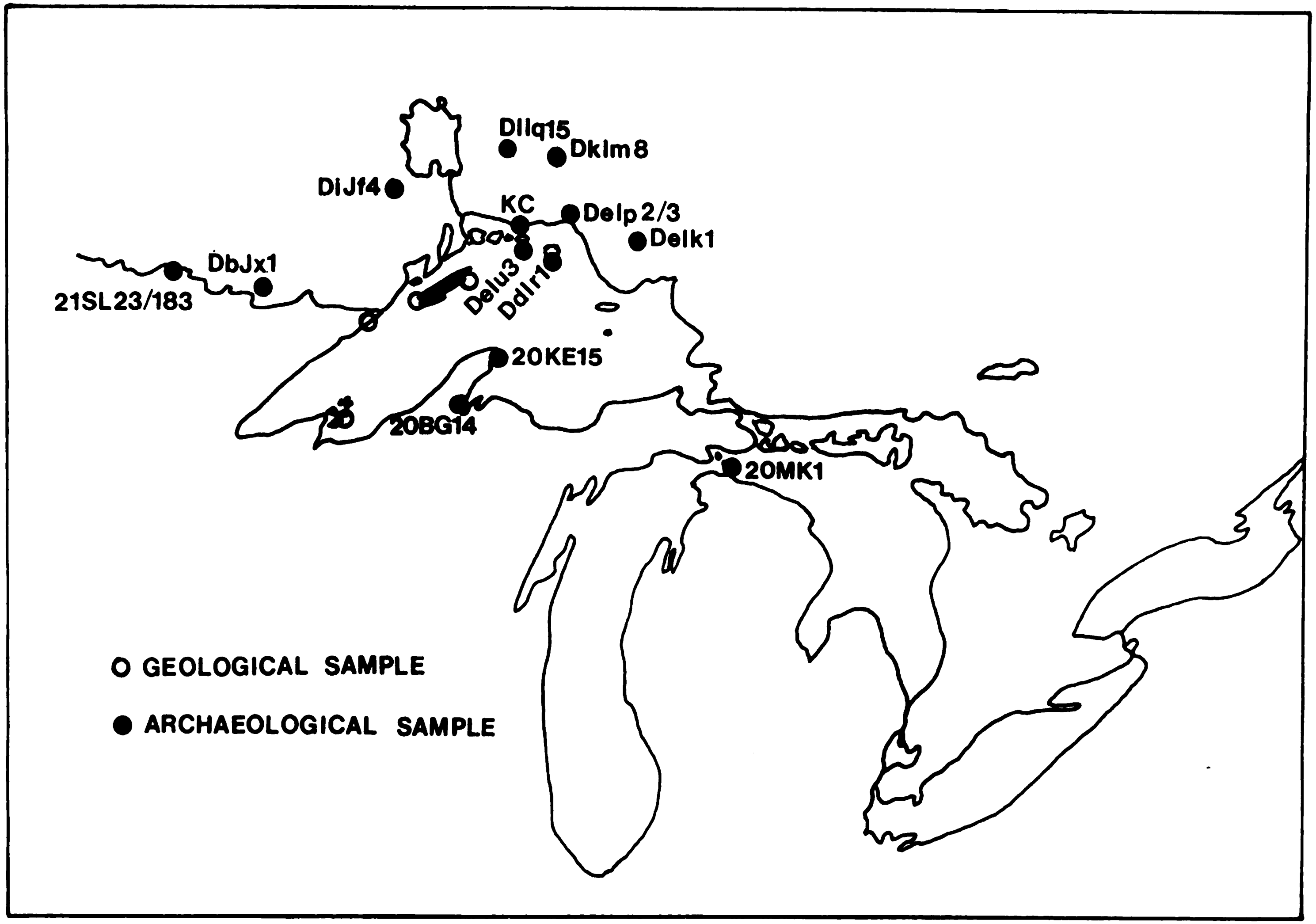

Figure 17. Location of Geological and Archaeological NAA Samples.

and temporal qualities. A minimum number of ten vessels per ware group was initially sought and, in most cases, attained. However, problems in provenience, identification, or with the potential destruction of small sherds account for the actual sample. The sample was drawn to address specific questions of relationships described in the hypotheses below. A catalog of NAA samples is provided in Appendix D.

CULTURAL AND CHRONOLOGICAL DIMENSIONS OF THE SAMPLE

Terminal Woodland substage sites dating ca. A.D. 700-1600 in the Upper Great Lakes and southern boreal forest typically contain a number of stylistically diverse ceramic ware groups. Common among them are Blackduck, Sandy Lake, and Selkirk from northwest Ontario and northern Minnesota, the Straits of Mackinac sequence, the Lakes phase from northern Wisconsin, and Ontario Iroquois Tradition ceramics from the Lake Huron basin. Ware groups utilized in this analysis include Blackduck, Mackinac, Juntunen, Huron, Sand Point, and Mero phase Oneota. While no less important, samples of Selkirk and Sandy Lake were not included.

BLACKDUCK: Blackduck has both a broad geographical and temporal distribution in the Lake Superior basin and in the lakes district to the northwest where they become common after A.D. 800 and persist until contact. Blackduck samples are drawn from three areas: eight from Isle Royale National Park, twelve from an assortment of sites in Ontario on Lake Superior's north shore, and ten from Voyageurs National Park in northern Minnesota.

STRAITS OF MACKINAC: The Straits of Mackinac sequence (McPherron 1967) includes the Mackinac phase (A.D. 700-1000), Bois Blanc phase (A.D. 1000-1250), and Juntunen phase (A.D. 1250-1450). The Juntunen site has been an important datum for late prehistoric ceramic analysis in the Upper Great Lakes, and it is important to include it in a comparison with western Lake Superior basin ceramics. The Juntunen site (20MQ1) provided ten specimens of Mackinac ware and ten of Juntunen ware. Isle Royale contributed ten samples of Juntunen style pottery, while sites in northwestern Ontario and the Montreal River site on the Keweenaw Peninsula in northern Michigan contributed two each.

HURON: Huron ceramics are believed to be a late (post A.D. 1450) arrival in the Superior basin, however, ceramics with stylistic affinities to the Ontario Iroquois Tradition are widespread throughout the Terminal Woodland substage. Ten samples of Huron style ceramics were submitted from sites on Isle Royale.

SAND POINT/LAKES PHASE: The Sand Point phase (Dorothy 1980) was defined for ceramics from one of the few excavated sites on the Keweenaw Peninsula in Upper Michigan and is believed to belong to the latter part (ca. A.D. 1100-1400) of the Lakes phase defined for northern Wisconsin by Salzer (1974). A sample of ten vessels was obtained from the Sand Point site, as well as a single specimen from the Montreal River site.

ONEOTA: Grit tempered Mero phase Oneota pottery from the Upper Peninsula of Michigan was included to provide a contrastive data set. The Sand Point and Montreal River sites from which the samples were obtained are located in Michigan's mainland copper district and are included here to evaluate the possibility of regular travel across Lake Superior between the Keweenaw and Isle Royale suggested by Raddison in 1659 and subsequently reiterated by a number of archaeologists (e.g., Dustin 1957, Griffin 1961). Oneota is at best only nominally represented on archaeological sites on the northern side of the Superior basin and is virtually unknown from sites on Isle Royale. The Montreal River site is near the tip of the Keweenaw Peninsula and also in the mainland copper district of Upper Michigan, provided ten samples of Oneota pottery.

GEOGRAPHICAL DIMENSIONS OF THE SAMPLE

The sources of the archaeological samples used in this analysis was largely directed by the availability of materials as much as by the integrity of the sample. In the case of the samples from Voyageurs National Park, the Straits of Mackinac, and the Keweenaw Peninsula, samples were drawn from only a few or single sites. Artifacts from Isle Royale were obtained from the entire island, representing sixteen different sites. The Ontario samples are from twelve sites from across the north shore of Lake Superior, some from submerged contexts (Figure 17). Specific data for each sample submitted for NAA are provided in Appendix C. A general breakdown of the sample is presented in Table 4.

Table 4. NAA Sample Locations.

8	Blackduck ware, Isle Royale National Park
12	Blackduck ware, Northwest Ontario
10	Blackduck ware, Voyageurs National Park
10	Mackinac ware, Straits of Mackinac
10	Juntunen ware, Straits of Mackinac
10	Juntunen ware, Isle Royale National Park
2	Juntunen ware, Northwest Ontario
2	Juntunen ware, Montreal River site, Keweenaw Peninsula
10	Huron, Isle Royale National Park
10	Sand Point ware, Sand Point site, Keweenaw Peninsula
1	Sand Point ware, Montreal River site, Keweenaw Peninsula
10	Oneota, Montreal River site, Keweenaw Peninsula
3	clay samples, Isle Royale National Park
1	clay sample, Grand Portage National Monument
1	clay sample, Apostle Islands National Lakeshore

RESULTS

The processing of the samples and statistical manipulation of the resulting data were performed by Michael Glascock and Hector Neff of the University of Missouri Research Reactor Facility, Columbia, Missouri (Appendix C; Glascock and Neff 1990). Cluster analysis utilizing the elements LA, LU, SM, YB, CE, EU, FE, RB, SB, SC, TB, TH, BA, DY, MN, TI, and V, suggested divisions along the east-west axis. Principal component analysis further refined these groups, the first four of which account for 78% of the total variance. Bivariate plots of principal components (Figures 18-19, Appendix C) and selected elemental (SC/FE and EU/LA) concentrations (Figures 20-21, Appendix C) illustrate the results.

Five reference groups resulted which are broadly associated with zones of clay procurement. These are identified by geographical designations: Isle Royale, Thunder Bay/Voyageurs, Straits of Mackinac, Sand Point and, Montreal River. The

Isle Royale, Thunder Bay/Voyageurs, and Straits of Mackinac groups are strongly correlated, indicating their common membership in a similar geochemical regime extending from northern Minnesota to northern Lake Huron across the north shore of Lake Superior. Straits of Mackinac samples were distinguished from the Thunder Bay/Voyageurs group, but the latter could not be further broken down, indicating either a closely related geochemical system or widespread movement of pots between these areas. Although mutually distinct at certain levels of analysis, the Keweenaw Peninsula samples from the Montreal River and Sand Point sites constitute a zone(s) of clay procurement unrelated to any of the other samples.

HYPOTHESES

Specific hypotheses pertaining to the relations of trace elements in the ceramic sample are derived from the cultural-historical data and the implied or hypothesized relationships among the sites/regions and archaeological cultures considered. These are presented with the interpretations of the NAA:

> H1: Mackinac ware is distinct from Juntunen ware from the Straits of Mackinac. The sociocultural changes hypothesized by MacPherron (1967) regarding a fundamental shift in interaction orientation from the Algonkian groups to the west (Wisconsin) to the northern Iroquoian in the east and southeast involved a change in the use of clay sources.

NAA results suggest that clay sources used by Mackinac and Juntunen phase potters remained the same in spite of possible shifts in cultural interaction spheres. Ceramics were produced from clays obtained from within an area habitually utilized by Mackinac and Juntunen phase potters. Selection of clays used for pots discarded at the Juntunen site in both phases remained the same in spite of changes in stylistic elements of the industry.

> H2: Blackduck samples from Voyageurs National Park will form a discrete cluster apart from other samples of Blackduck and from other styles of pottery. This sample exhibits homogeneity in paste qualities but variety in decorative elements. All but one sample are drawn from a single site, also increasing the potential for homogeneity in source derivation.

NAA identified a cluster of Voyageurs and Thunder Bay samples with additional geochemical linkage with clays from the Straits of Mackinac making a clear chemical distinction between them impossible. A cultural explanation involves the widespread movement of ceramics between the Voyageurs and north shore areas; a geological explanation points to related geochemical sources.

> H3: Ontario Iroquois Tradition ceramics will form a discrete cluster. Huron style ceramics are included in the analysis to test the proposition that what is stylistically Huron in Lake Superior is derived from Algonkian groups who either copied the style or obtained them through trade or exogamy.

In their analysis Glascock and Neff (1990:6-7) note that the Huron sample from Isle Royale, while belonging to a related ceramic source zone, exhibit geochemical differences explainable by the use of contrasting manufacturing techniques which call for greater amounts of temper in the clay body. It has been suggested that potters unfamiliar with a clay source will increase the amount of aplastic to diminish the possibility of firing failure (David Arthurs, personal communication 1988). If this is the case, it demonstrates a technological distinction suggestive of the actual presence of Huron potters on Isle Royale instead of the mimicry of Huron styles by Algonkian potters. Not all of the Huron style ceramics fall into the Isle Royale cluster and may represent ceramics transported from areas outside the north shore-Straits of Mackinac geochemical area (i.e., Huronia).

H4: Juntunen ware from Isle Royale will form a cluster distinct from Juntunen ware from the Straits of Mackinac.

The NAA results suggest that the Juntunen ware samples are the best evidence of regional mobility (in terms of movement of vessels) with <1% probability of membership in other groups sampled (Glascock and Neff 1990:7). Among the Juntunen ware vessels from Isle Royale two belong to the Straits of Mackinac geochemical cluster. Long distance movement of Juntunen pots is also evident in the inclusion of one Juntunen specimen from Ontario and three from the Keweenaw Peninsula in the Straits of Mackinac geochemical cluster. One Juntunen sherd from the Keweenaw Peninsula is grouped with Isle Royale, giving limited support for travel across the lake. In concert with the evidence for widespread movement of Juntunen style pottery is the strong indication that it was locally produced on Isle Royale and at north shore sites in Ontario. In sum, the distribution of Juntunen ceramics and the combined evidence for long distance movement of pots and local manufacture are taken as an indication of the geographical extent of the Juntunen phase encompassing all but the western end of the Lake Superior basin.

H5: The peoples of the Lakes phase and Mero phase did not travel across Lake Superior to Isle Royale. Therefore, it is expected that Sand Point and Oneota ceramics will form a discrete mutually inclusive cluster.

The NAA identifies a loose association between Sand Point and Oneota ceramics, suggestive of a geochemically related source on the Keweenaw Peninsula and one which is distinct from the both the Isle Royale and Thunder Bay/Voyageurs reference groups. Supported by the lack of evidence of the movement of Oneota or Sand Point ceramics from south to north, or of the movement of lithic raw materials from north to south, the notion of regular traffic across Lake Superior is rejected.

It is apparent, and by no means surprising, that the conclusions indicate a combination of geographical discreteness and intraregional movement of ceramics and style. Returning to the conditions and implications of covariation of trace elements, ceramic style, and location of discard of ceramics, one finds examples of each possibility outlined there. Through NAA it has been determined that the local production of ceramics, the movement of finished vessels (or raw clays) across the region, and the use of more than one decorative style occurring on chemically related clays are all operative factors contributing to the ostensibly chaotic condition of the archaeological record of the region.

If one accepts the premise that a seasonally resident population is, in part, defined by the manufacture of stylistically discrete ceramics on locally obtained clays, the range of the Juntunen phase must include the northern shore of Lake Superior as far west as Thunder Bay and including Isle Royale. Here, the Juntunen phase potters and their families interacted with the makers of Blackduck ceramics, although the specific content of that interaction is unknown. Huron potters may have also traveled with Juntunen groups where they mined copper, fished, and hunted with Blackduck and Selkirk people from the west, bringing with them a distinctive set of techniques for pottery manufacture.

The social setting of ceramic production, use, and discard in the Lake Superior region places very high demands on the sample size and stylistic integrity of the ceramics used in trace element analysis. The small number of samples used here cannot provide more than an introduction to the potential of NAA for understanding the cultural dynamics of interaction vis-a-vis ceramics in the Terminal Woodland substage. Glascock and Neff (1990:8) recommend for further research a minimum of 20-30 geological clay samples and 50-100 additional samples of Juntunen ware ceramics to explore the question of movement of pots and potters. In addition to their suggestions, other specific samples tailored to the hypotheses discussed above could be stipulated. The question of Huron ceramics, for example, could be further explicated by merging extant trace element data from previous studies (e.g., Brizinski and Buchanan 1977, Ramsden 1988, Trigger et al. 1984) could be merged once interlaboratory variation is controlled (see Bishop et al. 1990). This notwithstanding, the initial application of NAA to this sample has resulted in the identification of zones of clay procurement which have been linked to other data (lithic and ceramic style) to suggest that there is some correspondence between them and the distribution of prehistoric archaeological cultures. The implications of these findings for the broader issue of intergroup interaction is discussed in the final chapter.

CHAPTER 8

CONCLUSIONS

In this analysis we have moved from an examination of interaction between ethnographically and ethnohistorically documented groups to the sphere of archaeological cultures. In the transformation between the two, we have noted that, in the case of the former, the levels of specificity in context wherein interaction occurs is a structurally relative one in which the operative parties have available to them a wide variety of interaction alternatives which are conditioned by several factors, and which may or may not independently reflect the general patterns of interaction between two groups. In the archaeological case, interaction among archaeological cultures must, by necessity of the more general nature of the data base, be seen as a correspondingly generalized phenomenon which is not expected to reflect the subtle variations of interaction between households and individuals, but instead represents broad patterns of interaction among archaeological cultures on a regional level. This analysis has not rendered archaeological cultures obsolete, but recommends that their application to the area of interaction and group composition may color the outcome. Boundaries are not of one type: a situation of passive territoriality may have been inclusive with respect to the harvesting of subsistence resources, but proprietary restrictions may have operated simultaneously to limit the access of certain groups to copper. The comingling of a wide variety of ceramics in the Upper Great Lakes is a fair representation of the ethnic composition of the groups responsible for leaving the archaeological record; what Cleland (1977:93) has referred to as "the cosmopolitan quality" of the Late Woodland sites throughout the region. Schortman (1989) also advocates the need to depart from a spatially bounded and environmentally based view of culture. As an alternative he suggests:

> Salient social identities, ethnic or class based, are self-ascribed cultural categories whose members share common assumptions, values, and standards for evaluating proper behavior. In order to recognize salient affiliations archaeologically, therefore, emphasis must be placed on the specification of consistent associations of materials that functioned in those behavioral spheres which are most likely to reflect the operation of these assumptions, values, and standards. [1989:57]

More than two decades earlier, J.V. Wright anticipated the difficulty associated with discerning boundaries between groups who shared fundamentally similar life-ways:

> The broad mosaic of politically independent bands, loosely related at the specific level through clan and/or marriage and, at a more general level, through language and way of life, limits, in part, the reality of discrete tribal designations to taxonomic units of anthropological convenience. [J.V. Wright 1965:90]

Clearly, archaeologists are faced with a dialectical dilemma; that is, the juxtaposition between archaeological cultures which are by definition exclusive and homogeneous, and the real actors on the prehistoric landscape which were inclusive and heterogeneous. The search for Mason's (1976) "site-unit ethnicity" or sites which manifest the remains of a single historically identifiable group may, in fact be a hollow victory, given the overall pattern of cultural diversity throughout the region.

The Terminal Woodland substage offers an incredible diversity of ceramics, interpreted here as the product of several archaeological cultures who utilized Isle Royale's resources independently and/or in concert with one another. Blackduck, Selkirk, Juntunen, and Huron are the most prevalent manifestations occurring on the island with additional but numerically minor examples of Sandy Lake. Lithic raw materials suitable for tool production are not available on the island and were imported from north shore sources where embarkation to the island likely originated. Evidence for trans-lake travel is limited to isolated examples of lithics and ceramics which, in aggregate, do not suggest that it formed a regular pattern of cultural behavior. Copper cannot be used in this determination since it is widely available on both sides of Lake Superior, and has not yet been chemically differentiated among its various sources.

There is no evidence for trade or exchange with neighboring areas if one discounts ceramics as a possible commodity. Even in the event that ceramics were traded, the evidence is largely restricted to the Juntunen phase. In this case, mobility of Juntunen potters between the Straits of Mackinac and Isle Royale across the north shore seems a more parsimonious explanation. The extent to which Huron potters travelled with the Juntunen people remains uncertain. The association between the two ceramics may reflect cooperation between them, or may be accidental, although given McPherron's (1967) comments regarding the basic elements of shared or borrowed style and other dimensions of culture, cooperation is more likely.

That Blackduck and Selkirk occur together reflects an ongoing use of the island by people from the west of Lake Superior, whether or not one ascribes to the theory that they are coeval or that one supplants the other through time. Isle Royale, while clearly within the range of Blackduck and Selkirk, is in an area where both begin to diminish in occurrence as one moves east. Isle Royale was a peripheral area in terms of Blackduck and Selkirk territory, periodically used for subsistence but not apparently held in the same manner by them as by the Juntunen phase people.

Interaction among all groups represented on Isle Royale appears to have been at least ambivalent, and at best, amicable. There is no substantive evidence for violent interaction, or of exclusive boundaries which precluded access to the island except in the case of south shore Oneota and Lakes phase groups. South shore groups had no material need to cross the lake and would have done so only for social or religious purposes: there is no evidence that they did. Thus, the strongest exclusive boundary, and that a barrier, seen in the region is the physical presence of Lake Superior.

The definition of archaeological cultures employed here utilizes an isomorphic view of the relationship between style and raw materials, and a corresponding archaeological culture. But as we have seen from the Isle Royale data, archaeological sites usually include a wide variety of ceramic styles indicative of more than one archaeological culture. Traditional explanations of this phenomenon include exogamous marriage practices, raiding and warfare in which female potters are captured, stylistic mimicry, trade, and exchange. All can be documented to varying degrees for the Upper Great Lakes region, but none fully or independently explain the archaeological association of so many different varieties of pottery on so many sites in so large a region, nor do they exhaust the scope of potential explanations of this phenomenon.

If heterogeneity in ceramic style is the rule and not the exception, several questions must be addressed with respect to regional culture-history and more broadly applicable principles.

1. Is the apparent association of diverse ceramics a function of a lack of chronological control wherein these diverse ceramics represent unrelated episodes of deposition?

Chronology, both on Isle Royale and in the region as a whole, is poorly controlled with respect to the fine-tuning of ceramic traditions. Seriation of Blackduck (Lugenbeal 1978), Selkirk (Rajnovich 1988), and Juntunen ceramics (McHale Milner and O'Shea 1990) has begun to refine the formal evolution of ceramic styles, but the fundamental problem of relating these parts to a panregional whole remain. Clearly, the very general approach to chronology used in this analysis, in which the entire Terminal Woodland substage is treated as a single entity greatly oversimplifies the actual range of interactions which occurred in prehistory. However, the requirements of the data to treat the historical realities in specific terms cannot be met by the archaeological record now extant. A large portion of the chronological uncertainty stems from the spotty documentation of archaeology along the north shore of Lake Superior. Conway's "Algoma" pottery (1977) and perhaps other undocumented archaeological cultures between Lake Nipigon and the Sault may have influenced the direction and scope of interaction in the region in both spatial and temporal terms.

2. Is the situation of heterogeneity as it has been interpreted caused by an inappropriate definition of archaeological cultures which effectively precludes other possible permutations of group composition?

The isomorphic view of material culture's relation to a sociocultural counterpart, defined here as an archaeological culture, is a technique to simplify data so that they can be used to address questions posed on the regional level. Hamilton (1988) has pointed out that ceramic typologies which are formulated to define archaeological cultures remain specific to a limited range of issues and are not appropriate for all research goals. His interest in intermediate styles reflecting the diffusion, evolution, or other mixing of design and its implications for social organization and interaction looks for the interstices between traditionally defined archaeological cultures. In the absence of evidence for stylistically or technologically intermediate forms, the mixing of archaeological cultures is further indicated by the consistent association of diverse ceramics on sites. Discounting for the moment all of the alternative explanations mentioned earlier (exogamy, raiding, warfare, mimicry, trade, and exchange) the potential of mixed group composition requires further consideration.

The association of Juntunen and Huron ceramics, or Blackduck and Selkirk ceramics does not require any of these vehicles to account for their co-occurrence on individual sites or across the region as a whole, since they represent closely related cultural phenomena associated in space, time, and by the sharing of fundamentally similar adaptive strategies and cultural values. Therefore, the conceptualization of a group of people responsible for the archaeological record should assume some degree of diversity in their composition, rather than resorting to a de facto assumption of homogeneity in which the isomorphic view prevails. This is not to be confused with a redefinition of an archaeological culture: these will likely continue to be defined as unitary constructs necessary for the organization of archaeological data for the reconstruction of cultural-historical issues. The operative unit responsible for depositing the archaeological remains, however, may be composed of a fluid membership, potentially representing elements of any or all members of the archaeological cultures in a region. The degree of inclusiveness/exclusiveness in ceramics in a regional pattern of archaeological sites should constitute the index of potential if not actual group composition.

3. Is the identification of boundaries among archaeological cultures an impractical or impossible goal, given the apparent mixing of ceramic styles throughout the region?

The feasibility of this goal is measured by the scope of the available data base. Looking as single sites, or even at relatively large areas such as Isle Royale, may be insufficient to disclose patterns of association among artifacts which reflect cultural boundaries. All the usual caveats of sampling bias, differential preservation, collapsed stratigraphy, etc., apply here. However, if one begins with the assumption that the heterogeneity of ceramic styles in the Lake Superior region is chaotic, the outcome of an investigation of boundaries is likely to be strongly predetermined, if not doomed. As an alternative, we can view the consistent association of diverse styles as the very pattern of interaction among these prehistoric groups which is not chaotic at all, but reflects a consistent and stable level of interaction lacking boundaries in the usual sense.

4. Is there more than one type of boundary or territoriality manifest in the archaeological record which is masked by the ceramic mixing but is expressed in some other dimension of material culture?

If we accept the assumption that the heterogeneity of ceramics reflects a situation of diverse group composition, and not simply a function of trade or exchange, or any of the other "explanations," it is still possible to discern differences in cultural behavior indicative of boundaries at a different level. The regional distribution of archaeological copper relative to geological sources strongly suggests that something is operating on cultural behavior which results in a marked difference in its value, use, and availability in the Terminal Woodland substage. The difference in the regional distribution of copper between the Blackduck and Selkirk cultures on the one hand, and the Juntunen on the other may be interpreted as one of differential access to copper in which the Juntunen people exercised some proprietary restriction over the primary sources on Isle Royale and the north shore. Hamilton's (1988:53) use of "passive territoriality" explains differential access to certain subsistence resources in which groups from outside a territory may harvest only certain items without evoking feelings of transgression on the part of the host group. Such may have been the case with copper. Hypothetically, the Blackduck and Selkirk people may have been welcome on Isle Royale to fish and hunt along side of the Juntunen people, so long as access to copper remained in control of the latter. Conversely, the difference in the distribution of archaeological copper may reflect a lack of interest in copper on the part of the Blackduck and Selkirk groups, in which case a cultural difference in the value of copper, but not necessarily a spatial boundary, is indicated.

5. Assuming that certain types of boundaries can be identified among the archaeological cultures of the region, can any conclusions regarding territory and resident versus transient populations be reached?

Exercising hegemony over certain resources, such as copper, reflects a substantive territory. If the Juntunen phase people felt that they had proprietary rights to the copper resources of Isle Royale and the north shore, they would have included it in their own definition of territory. In addition, consistent patterns of movement between areas on a seasonal basis, in which the composite parts of a range formed an integrated whole of subsistence and social related behaviors, might also suggest that the various parts constituted a whole territory for a given archaeological culture.

The NAA of ceramics indicates that pottery was both imported and locally manufactured on Isle Royale, and that the best evidence for long distance movement of pots is found with the Juntunen phase. In the Lake Superior region there is virtually no such thing as a year-round resident population, but the pattern of seasonal residency for the Juntunen phase is quite strong, indicating that Isle Royale was an integral part of the seasonal cycle which was tied both to the north shore and to the Straits of Mackinac. Given that Juntunen phase pottery occurs in numbers equivalent to that of other contemporaneous archaeological cultures, we cannot exclude Isle Royale from the seasonal ranges of these other groups who obviously visited the island for subsistence needs. However, the differences with respect to copper may be taken as a substantive indication of how the island was perceived by Juntunen in contrast to Blackduck and Selkirk peoples.

While it enters into the shady area of direct historic inference, the historical accounts describing the spiritual aspects of copper among the Ojibwa may relate to this difference in the distribution of copper seen archaeologically. Although the copper mining technology and the technological applications for copper tools had almost disappeared by the time observations concerning the aboriginal use of and attitudes regarding copper were made, there is a vestigial remnant of a tradition suggesting that it was an important substance to the Ojibwa who continued to revere it in an unmodified state after it had ceased to serve any technological needs (Halsey 1983, Kohl 1985).

This analysis has grappled with the problems of chronology and site formation processes as they relate to the association of diverse ceramic styles on sites. That the issue requires more dates and more data for clarification is obvious. However, in the context of searching for a workable definition of an archaeological culture which accurately reflects the composition of those groups responsible for the archaeological record anticipates an archaeological situation already manifestly obvious: that sites are not simple reflections of activities nor are artifacts simple reflections of the groups whom they served. A cognate of the finding of complex group composition is the absence of boundaries in the traditional sense, that is, boundaries which are defined by abrupt discontinuities of artifact distributions on the landscape. This analysis has indicated that another type of boundary potentially discernable from archaeological data is one in which access to resources is not an either/or proposition, but is instead contingent upon the type of resources under consideration and the perceived distance between interacting parties.

Finally, the determination of proprietary rights to certain resources as it is inferred from archaeological data is very complex. The correlation of the distribution of primary sources of a specific resource, in this study copper, and that of the potentially competing groups, or archaeological cultures, who made use of that resource is combined with the archaeological distribution of raw and finished items on a regionwide basis. From this it is inferred that certain groups exercised differential access to the resource without compromising the other dimensions of their interactions with their neighboring groups.

APPENDICES

APPENDIX A. TERMINAL WOODLAND SITES ON ISLE ROYALE.

Sites on Isle Royale which have Terminal Woodland components are briefly described below. Artifact content is summarized in tabular form for each site. Detailed artifact data are not presented here but may be found in Clark (n.d.). Artifacts belonging to components other than Terminal Woodland are not included in the tables.

20IR1 CHIPPEWA HARBOR #1: Chippewa Harbor #1 is a major Terminal Woodland occupation site on the south end of the transverse fault that meets McCargoe Cove on the north side of the island. Archaeological investigations began as early as 1928 (West 1929) and have continued to the present (Guthe 1930, Dustin 1957). The site was most recently tested in 1988 by the NPS-MWAC survey which found intact cultural features and artifacts. As can be seen from the tabular data for this site (Table 5) the Terminal Woodland component is complex. In terms of artifact density Chippewa Harbor #1 is second only to the Indian Point site (20IR28), although this is in part a reflection of the amount of excavation that has taken place here. Although some Laurel ceramics are found on the site, most of the material and all of the radiocarbon dates obtain from the Terminal Woodland substage. The intensity of the occupational deposits is believed to be the result of multiple reoccupations of this site, owing to its attraction with respect to logistics, proximity to a wide variety of resources, and its aesthetic appeal. Faunal remains indicate no resources specialization or seasonality of occupation. Virtually all habitats available on the island are represented here: deep water, seasonal spawners, waterfowl, migratory passenger pigeon, caribou, beaver, and riparian amphibian species (Martin and Masulis 1989a).

Table 5. Artifact and raw material summary, 20IR1.

CERAMICS: BLACKDUCK 4, JUNTUNEN 3, SELKIRK 15, HURON 1, ONEOTA (?) 1, HEINS CREEK CORDED (?) 1.

LITHIC TOOLS: JST 3, GFS 2, HBL 8, QTZ 2

LITHIC DEBITAGE: JST 5, GFS 2, HBL 29

COPPER: WASTE 86, BARS 7, TOOLS 10, ORNAMENTS 1

20IR5 FINN POINT: The Finn Point site is located on the north side of Hay Bay opposite the Hay Bay Campground dock. Bastian (1963a) tested the site and found a thin and diffuse scatter of materials mixed with twentieth century fishery deposits on a level shelf of land near the water. The NPS-MWAC survey shovel tested the site and found no prehistoric materials and no further work was done here. Of particular note, however, is the notched projectile point made of Onondaga chert from the Niagara Escarpment of Ontario and New York. This is the only example of this material on Isle Royale.

Table 6. Artifact and raw material summary, 20IR5.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 3

LITHIC TOOLS: HBL 1, ONONDAGA 1

LITHIC DEBITAGE: RSPT 1, HBL 8

COPPER: WASTE 7

20IR14 MASSEE ROCKSHELTER: Isle Royale's only known aboriginal burial site, the Massee Rockshelter (20IR14), near Point Houghton on the south shore of Isle Royale. The name of "rockshelter" is misleading. The site is best described as a small and narrow cleft in a sandstone ridge which is far too small to have ever served as a rockshelter in the sense of its more common usage as a type of occupation site in a shallow cave or overhang.

The Massee Rockshelter was first documented in 1928 when the McDonald-Massee Expedition visited the site. The existence of the site was apparently known to the Isle Royale fishermen and their families, and was first discovered by fisherman E.T. Seglem's children in 1908. According to a communication between Seglem and West who accompanied the McDonald-Massee Expedition one or more skulls were removed as curiosities by local fishermen (West 1929:25). The McDonald-Massee Expedition photographed the removal of skeletal material from the site but did not produce a plan view of the in situ materials. One artifact, a biface, was found in association with the burial feature.

In 1960 the University of Michigan Museum of Anthropology survey of Isle Royale relocated the site and removed the remainder of the skeletal material (Bastian 1963). Bastian (1963a:57) observed that the human bone was in a good state of preservation and concluded that, on this basis, the burial feature likely dated to the Late Woodland or Historic stage. In addition to human remains, a small quantity of animal bone and a second bifacial tool were recovered.

In 1989 the Massee Rockshelter was relocated and examined by archaeologists from the National Park Service's Midwest Archaeological Center. No ground disturbing activities were undertaken in the immediate area of the deposit but it appears that no skeletal materials remain after initial removal in 1928 and final excavation by the University of Michigan. Shovel tests were made in flat areas with soil outside the cleft and along the point of land to the east in an effort to identify associated activity areas but no materials were found.

Analysis of the osteological materials obtained by the McDonald-Massee Expedition was performed by W. C. McKern who estimated that a minimum number of 12 individuals was present at this site (West 1929:38-40). West (1929:24-25) notes that, "as a large number of the small bones were missing it is possible that the remains were gathered up and deposited, after first having been suspended in the trees for some time, as was the custom of the Chippewa and the Sioux." Given the amount of bone recovered by the subsequent UMMA excavation, West's observation concerning the "small bones" is questionable. However, it is evident from the small size of the cleft in the sandstone that the burials were indeed secondary since there is inadequate space for twelve primary internments to have been deposited at one time.

The two bifaces associated with the remains are not stylistically diagnostic. The artifact found in 1928 is lanceolate, approximately 57 mm long and 15 mm wide (West 1929: Plate XVIII:3). The second biface is stemmed with a serrate blade margin (UMMA #62111). The length is approximately 38 mm, the width 16 mm. The raw material is possibly GFS which may indicate a Woodland time/cultural frame for the burials. Since there was no grave furniture, per se, with the burial feature, the relationship between the bifaces and the skeletal material is open to a variety of speculation. Accidental association is considered unlikely, given the context of the deposit in a rock cleft. It is possible that the two artifacts were incidental grave offerings or were in the personal affects with the remains at the time of interment. Or, it may be that the bifaces are in some way related to the manner of death of some of the individuals buried there.

The material associations are insufficient to make a sure determination of cultural or chronological assignation. On the basis of the site's location near the modern water level of Lake Superior it is likely that the site postdates the Archaic stage which, on Isle Royale, conforms to elevated beach features between 40 and 60 feet above modern lake levels.

Sauer's (1990) complete reanalysis of the skeletal material increased the minimum number of individuals from McKern's (1929) estimate of 12 to 15 and identified a number of postmortem modifications of the remains, including cut marks and perforations on long bones, and evidence of scalping on one skull. As the only known burial site on the island, and the only possible instance of violent interaction, it is unfortunate that no linkage can be made to any of the archaeological cultures of the area using either ceramics, raw materials, or epigenetic traits.

Table 7. Artifact and raw material summary, 20IR14.

LITHIC TOOLS: HBL 2

20IR17 GRACE ISLAND: This is an occupation site on the eastern tip of Grace Island. Dustin (1957:19) made some tests but found nothing. The UMMA survey located Terminal Woodland artifacts but no significant features or deposits. Shovel testing by 1989 MWAC survey identified a Terminal Woodland occupation mixed with late nineteenth and twentieth century deposits.

Table 8. Artifact and raw material summary, 20IR17.

CERAMICS: HURON 1, UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC TOOLS: PLS 1

LITHIC DEBITAGE: GFS 1, HBL 3

COPPER: WASTE 16

20IR18 GRACE POINT: This site was known only as a possible location of an American Fur Company fishery in the mid nineteenth century until the UMMA survey team found two flakes in their excavations (Bastian 1963a). In 1989 MWAC survey shovel tested and excavated test units here, finding intact Terminal Woodland deposits but little evidence of the American Fur Company fishery.

Table 9. Artifact and raw material summary, 20IR18.

CERAMICS: JUNTUNEN 1, HURON 2

LITHIC DEBITAGE: JST 19, GFS 12, HBL 13, AGATE 67, PLS 23, QTZT 2

20IR27 BIRCH ISLAND (LINKLATER): The Birch Island site, a small island immediately south of Indian Point at the entrance to Brady Cove, was first reported by the MacDonald-Massee Expedition in 1928 (West 1929:31) and subsequently tested by Guthe in 1930, Spaulding in 1957, Bastian in 1961 (Bastian 1963a), and in 1983 by NPS personnel. While Bastian (1963a:28) states that both Initial and Terminal Woodland components are present on Birch Island, the UMMA survey tests did not recover any ceramics, and the basis of Bastian's statement was the small collection of pottery from the MacDonald-Massee Expedition. To further exacerbate the problem, it is evident from Bastian's analysis of the ceramics that the provenience of sherds from Chippewa Harbor and Birch Island became mixed at some point. We are, therefore, left with uncertain evidence for the nature of the Woodland components at this site, although it seems valid to assume that both Initial and Terminal Woodland stage occupations are represented, given the proximity to Indian Point where both are amply documented.

20IR28 INDIAN POINT: In many respects the Indian Point site is the north shore's counterpart of the Chippewa Harbor #1 site, although a more heavily used location than the latter. Like Chippewa Harbor, Indian Point represents an intensive prehistoric occupation site which has received a commensurate amount of attention by archaeologists. Its logistically advantageous location near the head of McCargoe Cove places it close to the Minong Ridge area of intensive copper mining and the north end of the major natural route across Isle Royale.

The site was first discovered by Fred Dustin in 1929 and first tested by Guthe the following year, although it was earlier identified by Ives (1847) as an historic Indian camp. Guthe and Dustin were rewarded by the recovery of a "gallon can full of sherds, a number of animal bones, two flint chips, one probably a scraper, two hammer stones, and three other stones" (Guthe 1930). A circular depression was also examined with uncertain results. The UMMA survey conducted more extensive excavations here in 1960 and 1962, including "many small test pits" and 16 five foot square units near the west side of the point. The Indian Point site has Initial and Terminal Woodland components, and a strong 18th and early 19th century aboriginal component. The 1988 MWAC survey interest in the Indian Point site was limited to an assessment of the impact of shoreline erosion, and did not include any testing.

Bastian (1963a:31-32) recognized the multicomponent nature of the Indian Point site and sought to define stratigraphic separation between them in his excavations. While his discussion is unclear as to the vertical relations between the various components, it seems safe to conclude that there is no stratigraphic separation and that all cultural materials are found near the surface. No attempt at discerning the horizontal relations among components is discussed in his report.

A rough estimation of the artifacts found at the Indian Point site indicates that both the Initial and Terminal Woodland components are quite substantial. There is a minimum of 25 Initial Woodland vessels, most of which are clearly Laurel. The Terminal Woodland component has a minimum population of 33 vessels, exclusive of eight miniature vessels. The Terminal Woodland ceramics are characteristically variable, with examples of push-pull, stamped, CWS impressed, punctate, plain, and notched rim motifs. There is at least one example of Huron Incised pottery.

Lithic and copper artifacts are not so readily differentiated between Initial and Terminal Woodland. There is a minimum of nine triangular projectile points which are attributable to the Terminal Woodland, and examples of large notched (1) and small notched (3) points. Endscrapers are the most common formal tool on the site. Copper artifacts include an array of the forms of finished items and waste products that are typical of the copper found on later prehistoric sites. Finished products include a hook (1), tanged knives (3), awls (11), discoidal beads (13), tubular beads (7), spiral bead (1), small bars (24), and large bars (13).

Table 10. Artifact and raw material summary, 20IR28.

CERAMICS BLACKDUCK 1, MACKINAC 1, SANDY LAKE 1, SELKIRK 10, HURON 3, UNCLASSIFIED TERMINAL WOODLAND 17

LITHIC TOOLS: Total of 138

LITHIC DEBITAGE: Total of 2049

COPPER: WASTE 242, BARS 62, TOOLS 15, ORNAMENTS 34

20IR29 BELLE ISLE #1: In spite of the long period of historic activity on Belle Isle no records of prehistoric material from this locale exist prior to the UMMA survey in 1961. Roy Drier established a base camp here for his work on the Minong Mine but did not comment on any collecting activity while at Belle Isle in 1953 and 1954 (Drier 1961:1). Neither did the McDonald-Massee Expedition remark on any field work at Belle Isle during their operation in 1928. It seems unlikely that such a site, with extensive and abundant artifacts of all categories would go unnoticed while undergoing development as a resort with a golf course and other facilities located on the prehistoric component. As it stands, however, the first work for which documentation is available is that of the University of Michigan.

Bastian (1963a:34) characterizes the results of the excavation of "several small test pits and one trench" as "relatively unproductive." A total of ten pieces of debitage, 156 sherds, and one piece of worked copper were recovered at this time. Bastian's interpretation of this small assemblage placed it in the Terminal Woodland stage on the basis of his "rectangular impressed" and "thickened lip" ceramic categories being present.

Seven test excavation units were made in 1988 by the NPS-MWAC survey team. The site contains an Initial Woodland Laurel component defined on the basis of its characteristic pseudo-scallop shell stamped ceramics. There is also a Terminal Woodland component with a wide variety of ceramics, including Huron, Blackduck, and Selkirk. The site has a broad area of occupation midden with good preservation of faunal material. Copper-working is documented by the abundant waste and finished copper artifacts and large hammerstones.

Table 11. Artifact and raw material summary, 20IR29.

CERAMICS: BLACKDUCK (Nett Lake Cord Imp.) 1, SELKIRK 3, HURON (Huron Incised) 1, UNCLASSIFIED TERMINAL WOODLAND 3

LITHIC TOOLS: JST 1, RSPT 2, HBL 5

LITHIC DEBITAGE: JST 23, GFS 6, KAK 1, RSPT 54, HBL 104, PLS 1, QTZ 5

COPPER: WASTE 40, BARS 7, TOOLS 6, ORNAMENTS 4

HAMMERSTONES/FLAKES: 7/0

20IR31 GRASS POINT (DUNCAN NARROWS) Now known as Duncan Narrows, the Grass Point site is located on a level point of land on the south side of the entrance to Duncan Bay. Fred Dustin, acting on the report of the finding of a stone pipe, visited the Grass Point site in 1929-30 (1957). His excavations produced equivocal results pertaining to the prehistoric occupation he believed was here. More convincing evidence in the form of Terminal Woodland ceramics (variety unspecified) was found by a NPS employee in 1960, and the site was tested by the UMMA survey team in 1962. Historic materials relating to the 19th century American Fur Company fishery were abundant in the test units. However, one unit contained 34 pieces of stone debitage and one piece of worked copper. The 1988 MWAC survey team made surface collections, excavated two test units, and salvaged a Terminal Woodland feature eroding at the shoreline.

A total of ten flakes were found at the Grass Point site of which seven are diagnostic. All are JST and, with one exception, were recovered from the eroding feature. One episode of flintknapping is indicated by the homogeneity of the JST which is derived from the same parent source. Production of a single tool from a bifacial preform is possibly represented by the debitage from this feature. The feature also yielded a unifacial side scraper made from the same parent raw material as the debitage. A diabase hammerstone was found on the surface near the eroding feature. Given the proximity to documented copper mines above Grass Point on Mount Franklin and Point Lookout, the absence of copper here is likely a function of sampling this low density site.

Table 12. Artifact and raw material summary, 20IR31.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC TOOLS: JST 1

LITHIC DEBITAGE: JST 43, HBL 1

HAMMERSTONES/FLAKES: 1/0

SISKIWIT MINE (20IR41): The Siskiwit Mine site was the location of a prehistoric mine and occupation, an American Fur Company fishing establishment, and a nineteenth century copper mine. The University of Michigan survey (Bastian 1963a) recovered 16 hammerstones from a fissure mine at this locality. In 1986 a sheet midden was located and samples recovered. The midden contained beaver and fish bones, stone tools and debitage, copper waste, and very small amounts of nondiagnostic pottery. In order to clarify the nature of the occupational deposit and its relationship to the mining area above, the Siskiwit Mine site was selected for limited test excavation in the spring of 1987.

A total of 27 pieces of waste copper (Table 13) and two finished tools were found in the 1987 excavation units. Initial stages of fabrication are well represented by raw copper with and without matrix, as well as examples of all flat copper waste types. Two small butterknives were also found in the midden deposits. Fragments of three Terminal Woodland vessels were recovered from the excavation units at the Siskiwit Mine site. All have typological affinities with the Straits of Mackinac sequence.

Table 13. Artifact and raw material summary, 20IR41.

CERAMICS: JUNTUNEN PUSH-PULL 3, UNCLASSIFIED TERMINAL WOODLAND 2

LITHIC TOOLS: HBL 3

LITHIC DEBITAGE: JST 1, GFS 19, HBL 5, PLQ 1

COPPER: WASTE 27, TOOLS 2

20IR42 CEMETERY ISLAND: This small island in the Rock Harbor channel is known and named for the cluster of historic graves on the island's summit. A prehistoric Terminal Woodland occupation was identified here in 1985 when an NPS employee found a rim sherd on the surface near the nineteenth century cemetery. An additional example of Terminal Woodland pottery representing a pot break was found in shovel testing another area of this small island in 1986 (Clark 1987).

Table 14. Artifact and raw material summary, 20IR42.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 2

20IR45 DAISY FARM: The Daisy Farm site is situated at the mouth of Benson Creek This is as desirable a location as can be had anywhere on Isle Royale, and its complex occupational history is reflected in the surface and subsurface deposits distributed over the large area between the shore and first bedrock ridges behind the site. The prehistoric component at the Daisy Farm campground was initially discovered in 1957 by Albert Spaulding of the University of Michigan. In 1987, the Daisy Farm was test excavated by the 1988 survey. Two 1 m units were established in the vicinity of positive shovel test finds made in 1987 by MWAC on the east side of the mouth of Benson Creek. This effort was rewarded by the discovery of Initial Woodland (Laurel) ceramics in one unit, and in the other by a dense Terminal Woodland midden containing ceramics, copper, lithics, bone, and botanical remains.

The variety of lithic raw materials showing a high proportion of HBL, is typical for a Terminal Woodland site. There is one flake which is possibly Bois Blanc or Fossil Hill/Collingwood chert from the eastern Lake Superior or northern Lake Huron basin.

Twenty nine pieces of waste copper were recovered from excavation unit #2 at Daisy Farm. The association is strictly Terminal Woodland and all stages of fabrication are present with a proportionate emphasis on later stages. The co-occurrence of copper waste, ceramics, lithic tools, and abundant food remains argues for a lack of spatial separation between activities at this site. The nearest known prehistoric copper mine is 300 m to the north at the Ransom mine site (20IR43) and it is likely that most of the initial processing took place at or near the site of extraction prior to transporting the raw copper to the occupation site at Daisy Farm.

All ceramic artifacts from the Daisy Farm site have been found in subsurface contexts. Test unit #1 contained the sherds of two Initial Woodland vessels while TU #2 had the remains of at least four distinct Terminal Woodland vessels. Seven bodysherds and 41 indeterminate sherds were not assigned.

Table 15. Artifact and raw material summary, 20IR45.

CERAMICS: BLACKDUCK 1, JUNTUNEN PUSH-PULL 1, HURON (Ontario Oblique) 1

LITHIC TOOLS: HBL 2

LITHIC DEBITAGE: JST 1, GFS 1, HBL 55, QTZ 5, AGATE 1, BBL 1

COPPER: WASTE 30

20IR52 BAKER PT.: The UMMA survey discovered this site in 1960 (Bastian 1963a:38). It is located on a prominent point at the entrance to Moskey Basin. A small prehistoric component was identified by a thin scatter of lithic flakes, a copper awl, and a substantial portion of a Lalonde High Collar (Huron) vessel, dating ca. AD 1450.

Table 16. Artifact and raw material summary, 20IR52.

CERAMICS: HURON (Lalonde High Collar) 1

LITHIC DEBITAGE: GFS 1, HBL 2

COPPER: TOOLS 1

20IR53 CHIPPEWA HARBOR #2: This site is located opposite Chippewa Harbor #1 on a small point on the west side of the entrance to the harbor. Bastian (1963a:22) reports a shallow deposit of prehistoric materials mixed with historic artifacts and tentatively assigns it to the Terminal Woodland on the basis of its proximity to Chippewa Harbor #1. No prehistoric artifacts were found here in the 1987 survey.

Table 17. Artifact and raw material summary, 20IR53.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC TOOLS: JST 1

LITHIC DEBITAGE: HBL 7

COPPER: WASTE 1, BARS 1

20IR56 ROCK HARBOR: The Rock Harbor site was originally found by Spaulding who collected a sherd from the beach here in 1957. The site is located on a small sandy point about one half mile southwest of Daisy Farm. Subsequent tests by the UMMA survey were negative with the exception of "one large unit" which contained Terminal Woodland (Bastian's large punctate and linear punctate categories) and recent historic artifacts (Bastian 1963a:37-38). In May 1987 the site was relocated by the presence of lithic and ceramic artifacts on the beach and in the shallow water off the sandy point upon which the site is situated. The site was again checked in September 1987 and additional collections of ceramics, lithic tools, and debitage were made.

Table 18. Artifact and raw material summary, 20IR56.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 2

LITHIC DEBITAGE: JST, GFS 1, KAK, RSPT 1, HBL, QTZ 1, BBL 1

COPPER: WASTE 2

20IR64 BARNUM ISLAND: The island is located north of Washington Island which protects it from the open waters of Lake Superior to the south and southwest. The UMMA survey excavated several test trenches in which one fragment of worked copper and 15 flakes were found (Bastian 1963a:61). As part of the 1989 NPS-MWAC survey Barnum Island was shovel tested from end to end at 10 m intervals. This effort confirmed the location of a prehistoric site on the northeastern end in the same area occupied by the Johns Hotel and extended the site a short distance to the west. The site was mapped and one excavation unit dug in an attempt to define the prehistoric component. Although intact cultural deposits were encountered, no diagnostic materials were recovered from the excavation.

The site is considered Terminal Woodland on the basis of the lithic raw materials. A total of 221 waste flakes were collected from the shovel test and excavation unit in front of the hotel. One is HBL chert and the rest are JST representing the reduction of only a few parent pieces of material.

Table 19. Artifact and raw material summary, 20IR64.

LITHIC DEBITAGE: JST 223, HBL 4, QTZ 1

COPPER: WASTE 2

20IR65 WASHINGTON ISLAND #1: This site is located on the north side of the extreme northeastern end of the island and combines an Initial Woodland and late nineteenth/early twentieth century fishery in its archAeological remains. The UMMA survey tested the site in 1960 and 1961, finding "rather evenly distributed but sparse occupational debris for about 100 feet along the shore and for 20 to 30 feet back from the beach," (Bastian 1963a:24). Artifacts included 22 sherds with Initial Woodland decorative techniques and coil breaks: pseudo scallop shell and complex push pull. The NPS-MWAC survey confirmed and expanded upon the earlier findings. The site was shovel tested in 5 m intervals and one unit was excavated. Ceramic artifacts indicate both Initial and Terminal Woodland occupations. A total of seven sherds represent two vessels; one Initial Woodland and one Terminal Woodland. An additional two Laurel vessels were identified by the UMMA excavations.

Table 20. Artifact and raw material summary, 20IR65.

CERAMICS: SELKIRK 1

LITHIC DEBITAGE: JST 1, HBL 10

COPPER: WASTE 26, TOOLS 2

HAMMERSTONES/FLAKES: 0/1

<u>20IR73 McCARGOE COVE</u>: The prehistoric component of the McCargoe Cove site was discovered by the UMMA survey in 1960 when a surface collection was made in the area of the exposed rock surfaces just above the NPS dock. Tests of "sodded areas" were made in 1961, resulting in the recovery of nondiagnostic lithic debitage (Bastian 1963a:27). Additional surface collections were made in 1962 by the UMMA survey crew, in 1986 and 1987 by MTU, and in 1988 by NPS-MWAC. The prehistoric site occupies a small rock point which extends into the southern end of McCargoe Cove on the northwest side, just north of where the outlet stream of Chickenbone Lake empties into the cove. It is the nearest known occupation site to the extensive mining complex on the Minong Ridge, but has yielded only scanty evidence of prehistoric activities. No pottery has been found here: artifacts consist of lithic debitage and worked copper. The latter category is somewhat problematic, given the intensive historic mining operations here. Some of the worked copper found in surface collection may, in fact, obtain from the historic period, thus leaving only the waste flakes to attest to the prehistoric occupation.

Table 21. Artifact and raw material summary, 20IR73.

<u>LITHIC DEBITAGE</u>: JST 12, GFS 2, RSPT 1, HBL 20, RHY 1

<u>COPPER</u>: WASTE 15

<u>HAMMERSTONES/FLAKES</u>: 0/1

<u>20IR78 MERRITT LANE</u>: The site's location is "a small shelf along the rocky northwest shore of Merritt Lane north of the channel separating Merritt and Boys islands" (Bastian 1963a:36). Test excavations by the UMMA survey contained Initial and Terminal Woodland ceramics and a large projectile point "of probable Middle Woodland affinity." A grooved axe was found by NPS personnel prior to the UMMA survey (Bastian 1963a:377, Plate 50a). Surface collection of the site in 1987 added 19 pieces of lithic debitage.

Table 22. Artifact and raw material summary, 20IR78.

<u>LITHIC DEBITAGE</u>: JST 1, HBL 16, AGATE 1

<u>COPPER</u>: WASTE 7

20IR79 MERRITT ISLAND: Another site discovered by the UMMA survey, the Merritt Island site is a late prehistoric/early historic occupation, documented by a small projectile point, a blade gunflint, and four tubular copper beads. The site is situated near the center and on the northwest side of the island, just opposite the Merritt Lane site, and may be island #5 mentioned by Ives (1847) where he noted "an old campground of the Indians." In the 1987 survey one flake was found in a shovel test, and a netsinker of PLS was found on the surface of the site.

Table 23. Artifact and raw material summary, 20IR79.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND (?) many small sherds

LITHIC TOOLS: HBL 1, PLS 1

LITHIC DEBITAGE: HBL 43, QTZ 1

COPPER: WASTE 7

20IR107 WEST CARIBOU ISLAND: A prehistoric occupation was discovered in the campground on West Caribou Island in 1986 (Clark 1987). The small ceramic sample from West Caribou suggests, but does not confirm, a placement in the Terminal Woodland substage. One is a neck sherd with portions of two punched through punctuations.

Table 24. Artifact and raw material summary, 20IR107.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC DEBITAGE: JST 8, GFS 2, HBL 4

COPPER: WASTE 5, AWL 1

20IR111 ROCK HARBOR LIGHTHOUSE: The Rock Harbor Lighthouse site is located at one of the major entrances into Rock Harbor. The prehistoric occupation of the site reflects intermittent, short term use during the Terminal Woodland substage. The presence of prehistoric artifacts at Rock Harbor Lighthouse was initially noted by Dustin (1931:9) with the recovery of a flake west of the lighthouse. Surface examination and shovel testing in 1986 (Clark 1987) provided evidence that prehistoric materials were present in subsurface context. The 1987 test excavations at the Rock Harbor Lighthouse produced a total of 85 waste flakes and shatter, ten chipped stone tools and 30 sherds of Terminal Woodland ceramics. Prehistoric materials were distributed from immediately below surface to about 40 cm below surface. Native copper occurs in relatively large quantities at the site. The copper artifacts occur in forms that reflect the intermediate and final stages of tool manufacture, rather than extractive processes.

Table 25. Artifact and raw material summary, 20IR111.

CERAMICS: BLACKDUCK 2

LITHIC TOOLS: HBL 1

LITHIC DEBITAGE: JST 2, GFS 2, HBL 17

COPPER: WASTE 17, BARS 4, ORNAMENTS 1

20IR114 LONE TREE COVE: The Lone Tree Cove site was discovered in 1988 by shovel testing an elevated beach ridge above the Rock Harbor shoreline (Clark 1990). The Lone Tree Cove site was selected for limited testing; two 1 m by 1 m excavation units were placed close to the location of a positive shovel test. One test unit was devoid of cultural material while the other, only five meters distant, contained a sheet midden, ash feature, a dog burial, and numerous artifacts. The midden contained an abundance of pottery and calcined bone with small quantities of lithic debitage and one copper artifact. In addition to the dog burial, faunal remains at the Lone Tree Cove site (T. Martin and Masulis 1989a:26-42) include a minimum of eight beaver and unidentified large mammal in the form of small calcined bone fragments. No plant food remains were recovered from this site.

Table 26. Artifact and raw material summary, 20IR114.

CERAMICS: JUNTUNEN PUSH-PULL 2, HURON 1

LITHIC TOOLS: KAK 1, RSPT 1

LITHIC DEBITAGE: JST 12, GFS 2, HBL 15, PLQ 1

COPPER: TOOLS 1

20IR116 THREEMILE #1: The site sits above and to the northeast of a small cove with a good beach, somewhat analogous to the Lone Tree Cove site although smaller in scope. The lithic artifacts from the Threemile #1 site include 46 waste flakes, one bipolar core/wedge, one projectile point, a pebble core, and two small distal biface fragments. The projectile point is very small; probably a true arrow point of the Terminal Woodland period, and is made of HBL chert. Both biface fragments are the working ends of tools; one a graver or awl, the other likely a projectile point or knife. Both are made of HBL chert. Thirteen sherds, all probably from one Terminal Woodland vessel, were found at the Threemile #1 site. Copper waste and bars are abundant and it is believed that this site is associated with a nearby mine (20IR118).

Table 27. Artifact and raw material summary, 20IR116.

CERAMICS: HURON 1, UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC TOOLS: HBL 3

LITHIC DEBITAGE: JST 2, HBL 44, QTZ 4

COPPER: WASTE 80, BARS 6, TOOLS 2, ORNAMENTS 1

20IR120 CHICKENBONE LK.#1: The presence of prehistoric sites on Chickenbone Lake is alluded to in general terms by West (1929) in the McDonald-Massee Expedition report. However, this site found in 1987 is the first one recorded on Chickenbone Lake. It is located on the only bedrock exposure on the north shore of the east arm of the lake. Debitage, calcined bone, pottery, and burned clay was found on the surface in an area roughly 4 m by 4 m. One shovel test contained a large amount of small calcined bone fragments; all other tests proved negative. Thirteen very small sherds were found on the surface. One has a corded exterior and several exhibit smoothed interior surfaces. Two fired clay lumps lack temper and have the impressions of spruce needles. Martin and Masulis (1989a:42) have identified the bone samples, finding examples of caribou, beaver, and white sucker.

Table 28. Artifact and raw material summary, 20IR120.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC TOOLS: HBL 1, PLS 1

LITHIC DEBITAGE: HBL 3

20IR124 LAKE RITCHIE #1: In 1987 the Lake Ritchie #1 site was found on a bedrock point facing Hastings Island, a little more than half way between the Lake Ritchie/Chippewa portage and the Lake Ritchie/Lake LaSage portage. A sunburned chert scraper was found lying on top of the bedrock 25 m west of the end of the point. Debitage was collected from the surface of a 2 m by 2 m area a short distance to the south of this find. The site was extended 90 m to the west when prehistoric ceramics were found in a shovel test about 10 m from the shoreline. Plans to relocate the Lake Ritchie canoe campsite to the location of a known prehistoric site necessitated the testing of this site in 1988. Three test units were excavated and two contained substantial portions of a single Blackduck vessel. In addition, there was a thin sheet midden containing a burned uniface, and a large piece of unworked copper. A second large piece of unworked copper was found during tentpad construction within 5 m of the excavation. Nineteen pieces of bone include two beaver elements and 17 other small calcined fragments (Martin and Masulis 1989b:2-3).

Table 29. Artifact and raw material summary, 20IR124.

CERAMICS: BLACKDUCK 1

LITHIC TOOLS: GFS 1, HBL 1

LITHIC DEBITAGE: GFS 2, HBL 8

COPPER: UNMODIFIED MASS 2

20IR127 CHIPPEWA HARBOR #3: A ceramic scatter of a single broken pot was found in the shallow water at the back of a small bay at the east end of the west arm of Chippewa Harbor. All sixteen sherds recovered from the Chippewa Harbor #3 site belong to a single vessel. In general the sherds are in a poor state of preservation except where covered by a thick deposit of cooking residue. Although the rim is badly eroded, it is similar to Huron Incised.

Table 30. Artifact and raw material summary, 20IR127.

CERAMICS: HURON (Huron Incised) 1

20IR128 LANE COVE: The Lane Cove site is located within and around the NPS campground on the east end of a sheltered cove. It was discovered through shovel testing by NPS personnel in 1982 when the development of the campground was initiated (Maass 1984). The 1988 survey team surface collected all exposed areas and excavated three units. Substantial portions of a Terminal Woodland vessel were recovered. The rim is straight and thickened in profile with a pinched "pie crust" lip that is smoothed. This style of pottery spans the late Terminal Woodland into the historic period. Similar types are found at the Bell site in Wisconsin (cf, Bell site Type II, Wittry 1963). Mason (1986) has attributed Bell site Type II pottery to the historic Potawatomis. It is a common style at the Michipicoten site (Wright 1966) where it is referred to it as Peninsular Woodland.

Table 31. Artifact and raw material summary, 20IR128.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC DEBITAGE: JST 1, RSPT 1, HBL 6

20IR134 MOTT SAUNA BEACH: In 1987 a water rolled copper awl was found on a gravel beach locally referred to as the "sauna beach" to the east of the Park Service dorms and sauna on Mott Island. Its presence on this beach suggested that an undiscovered prehistoric component was present along the eroding shoreline and developed area immediately adjacent to the beach. A compliance related survey in October 1989 succeeded in detecting such a site. A pot break intersected by a shovel test contained 212 sherds from a single Juntunen drag-jab vessel. Eight additional sherds from the trail to the beach are heavily encrusted with cooking residue under which a smoothed cordmarked surface is discernable. They are not diagnostic but are likely Terminal Woodland as well.

The site as delineated by the survey represents a Juntunen phase (ca. A.D. 1200-1450) occupation. Although copper artifacts were recovered, the absence of copper waste materials indicates that the occupation was functionally marginal to the copperworking activities found elsewhere on the island.

Table 32. Artifact and raw material summary, 20IR134.

CERAMICS: JUNTUNEN 1 (Juntunen Push Pull)

COPPER: BARS 2, TOOLS 2

20IR140 DUNCAN BAY #1: Two waterworn sherds from one Terminal Woodland vessel were found on the beach of the second point 550 m southwest of Grass Point, on the south shore of Duncan Bay. One rim and one bodysherd represent a Terminal Woodland Selkirk pot.

Table 33. Artifact and raw material summary, 20IR140.

CERAMICS: SELKIRK 1

20IR142 BELLE ISLE #2: The Belle Isle #2 site is situated in a setting similar to Belle Isle #1: a broad cove with a long gravel beach almost 100 m long lies at the base of a series of beach terraces that extend 60 m back (west) from the water. Shovel tests were made on the first six beach terraces resulting in the recovery of prehistoric artifacts on the first, second, third, and fifth terraces. A pot break and copper artifacts were found on the open gravel surface on the southern side of the site. Consequently, a grid system was established and eight excavation units were dug at the Belle Isle #2 site. Artifact density was spotty. Shovel testing in an area over 65 m from the beach resulted in the discovery of an additional occupation area. In this part of the site the land is level but drops off steeply into a marsh, or what would be a very small bay or backwater if higher lake levels prevailed. Judged by current conditions, this location is sheltered, if not secreted. Two contiguous excavation units were placed in the area of the positive shovel test. Although no midden soils or features were identified the density of ceramics is high with a minimum of five Terminal Woodland stage vessels. Lithics and copper, by comparison, were sparse. The only bone identified out of a total of 51 pieces is a caribou unciform. The remainder of the faunal material is largely calcined and attributable to medium or large sized mammals (Martin and Masuilis 1989b:3).

Six discrete ceramic vessels and over 300 small sherds which could not be confidently assigned to a specific vessel were recovered from surface and excavated contexts. All are considered representative of the Terminal Woodland substage.

Table 34. Artifact and raw material summary, 20IR142.

CERAMICS: JUNTUNEN PUSH PULL 1, SELKIRK 3, HURON 2

LITHIC TOOLS: HBL 2

LITHIC DEBITAGE: JST 6, GFS 1, HBL 47, AGATE 2, QTZ 3, QTZT 1

COPPER: WASTE 6, BARS 3, TOOLS 1

HAMMERSTONES/FLAKES: 1/1

20IR143 BELLE ISLE #3: This site represents a small activity area, probably related to the Belle Isle #2 site. Its location is on a very small area (scarcely 5 by 10 m) of a level shallow pocket of soil, in a rock cleft above the water. Shovel testing by members of the 1988 survey party found a diffuse shallow hearth containing worked copper. One test unit, incorporated into the Belle Isle #2 grid system, was subsequently opened to collect matrix samples for flotation. Screened matrix contained a relatively large amount of small pieces of copper sheets, fish bone, Terminal Woodland pottery, and a one HBL waste flake. The feature is likely an annealing hearth and conforms to other possible annealing hearths described by Bastian (1963a:30-31) at Indian Point.

Fourteen very small nondiagnostic body and indeterminate sherds were excavated from the shallow hearth in association with the copper and faunal remains. Exterior surfaces are smoothed and without decoration. A nonspecific Terminal Woodland stage placement is suggested. The faunal assemblage at the Belle Isle #3 site includes lake trout, whitefish or cisco, beaver, and unidentified mammal (Martin and Masulis 1989b:3).

Table 35. Artifact and raw material summary, 20IR143.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC DEBITAGE: HBL 1

COPPER: WASTE 50

20IR144 PICKEREL COVE #1: The Pickerel Cove #1 site occupies a natural portage on a narrow neck of land which separates Pickerel Cove from the waters of Herring Bay on Lake Superior. Its small size would have accommodated only a limited number of people at one time. Surface survey of the tent site and fire ring at the Pickerel Cove portage disclosed the presence of a late prehistoric and/or early historic aboriginal site. Surface collections and the excavation of one test unit produced a sample of glass trade beads, lithic waste, copper, and faunal materials, as well as some later historic materials. A total of 71 waste flakes were found at the Pickerel Cove #1 site. Fourteen pieces of copper waste were found. No finished copper items were found and the procurement of copper and copperworking do not appear to have been any more important than the minimal flintknapping that was undertaken here. Martin and Masulis (1989b:3-4) have identified three large unidentified calcined bones from the surface. The test unit contained two unburned humerus shaft fragments from a common loon (unburned), 30 unburned pieces of unidentified large mammal, and 13 calcined pieces of unidentified mammal.

Table 36. Artifact and raw material summary, 20IR144.

LITHIC DEBITAGE: JST 5, GFS 43, RSPT 1, HBL 18, PLS 1

COPPER: WASTE 14

HAMMERSTONES/FLAKES: 0/4

20IR147 BRADY COVE #2: Brady Cove #2 is located on the southeast side of a small terrace at the base of a steeply sided point on the south side of the cove. A single JST flake was found in a shovel test and subsequent investigation of the shoreline was rewarded with the discovery of fragments of a Huron pot and a flake of HBL chert.

Table 37. Artifact and raw material summary, 20IR147.

CERAMICS: HURON 1

LITHIC DEBITAGE: JST 1, HBL 1

20IR148 BRADY COVE #3: The second site in Brady Cove was found by shovel testing a shallow soil pocket on a steep bedrock bank at the northeast end of the cove. A single pot break is represented by the six sherds found in one shovel test. A nonspecific Terminal Woodland placement is suggested.

Table 38. Artifact and raw material summary, 20IR148.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

20IR149 McCARGOE COVE #2: This site is situated on a small point across McCargoe Cove from Birch Island. Shovel tests in an area of soil within a bedrock point revealed a dark midden: one test unit was excavated. Midden contents included a large amount of calcined bone, an aboriginal clay pipe bowl fragment, one body sherd, a small hammerstone, and ten waste flakes. The pipe fragment is untempered clay with smoothed undecorated surfaces. The bodysherd is likewise undecorated. A Terminal Woodland placement is tentatively suggested.

Faunal material from the site are summarized by Martin and Masulis (1989b:4): "Although six unidentified fish bones were recovered from the fine-screened sample, the faunal assemblage is dominated by mammals. A minimum of one individual beaver an one individual caribou are represented."

Table 39. Artifact and raw material summary, 20IR149.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC DEBITAGE: HBL 8, QTZ 2

20IR150 McCARGOE COVE #3: A small occupation site was identified by the 1988 survey on the first point of land on the west side of the entrance to McCargoe Cove. It was discovered by shovel testing a small flat area at the end of the point. A pot break was encountered and a test unit initiated to further define the deposit. All cultural material, mostly sherds from a single Terminal Woodland vessel, were in the upper portion just below the duff layer and interspersed among the large cobbles which constitute the soils here. Three flakes and a small copper bar were also recovered from this unit.

Table 40. Artifact and raw material summary, 20IR150.

CERAMICS: SANDY LAKE 1

LITHIC DEBITAGE: JST 1, HBL 2

COPPER: BARS 1

20IR152 COVE #2: In order to redefine the location of the Cove site (20IR72) intensive shovel testing was undertaken along all parts of the first (unnamed) cove on the east side of the entrance to McCargoe Cove. Three discrete areas were defined on this basis. Time did not permit the formal testing of these locales, but the indications of the shovel test suggest a high potential for significant deposits. A piece of vesicular copper, one HBL bipolar core, and two sherds of Terminal Woodland ceramics were recovered in shovel tests in a small level area between the northern-most end of the cove and a small beach to the north open to Lake Superior. This site is to the west of a narrow rocky isthmus which separates Cove #2 from Cove #3.

Table 41. Artifact and raw material summary, 20IR152.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC DEBITAGE: HBL 1

COPPER: WASTE 1

20IR153 COVE #3: Midden soils containing animal bone, worked copper, three sherds of nondiagnostic Terminal Woodland ceramics, and lithics were found in shovel tests on the east side of the isthmus. The site is situated on an older elevated beach ridge with easy access to water on both sides. Shovel tests contained 35 pieces of mammal bone, all of which were calcined with the exception of one caribou and three beaver elements. One caribou bone exhibits cut marks (Martin and Masulis 1989b:4).

Table 42. Artifact and raw material summary, 20IR153.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC DEBITAGE: HBL 3

COPPER: WASTE 3

20IR154 COVE #1: Cove #1 is located on the point of land at the western entrance to the cove opposite the McCargoe Cove #3 site and extends for about 60 meters to the east along the raised shoreline of the cove. The site contains well developed but discontinuous midden with abundant artifactual and biological remains. Six waste flakes and a long diabase hammerflake were found in shovel tests. A bifacial drill or perforating tool made of HBL, and a basalt celt blank were also recovered from the shovel tests. A total of one rim and eleven body and indeterminate sherds were recovered from shovel tests. Faunal remains consist of eight pieces of clacined medium and/or large sized mammal (Martin and Masulis 1989b:4).

Table 43. Artifact and raw material summary, 20IR154.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1*

LITHIC TOOLS: HBL 1, BASALT 1

LITHIC DEBITAGE: HBL 6

HAMMERSTONES/FLAKES: 0/1

*Approximately 4 Blackduck vessels were recorded for 20IR72, the precise location of which is uncertain, although it is known to have been some where in the Cove area.

20IR160 WASHINGTON ISLAND #2: A short distance from the Singer site (20IR80) is a previously unrecorded Terminal Woodland occupation site. The site is located along the actively eroding shoreline in front of a former cabin site and clearing on the south side of Washington Island. Chert debitage and worked copper were collected from the actively eroding shoreline. Shovel tests revealed intact occupation deposits in a wooded area to the west of the clearing. The site was mapped and two excavation units positioned to further test the cultural deposits.

Five indeterminate sherds were collected from the eroding shoreline. TU #2 contained 23 sherds representing a minimum of three vessels. One sherd bears the impression of a spruce needle. One shoulder, three body, and 15 indeterminate sherds are clearly attributable to the Terminal Woodland. The presence of a possible coil break reflects a tentative Initial Woodland component.

Table 44. Artifact and raw material summary, 20IR160.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC TOOLS: JST 1

LITHIC DEBITAGE: JST 4, HBL 15

COPPER: WASTE 14

20IR174 MALONE BAY CAMPGROUND: A prehistoric site was located in a narrow area of soils between the actively eroding beach and bedrock below the NPS campground at Malone Bay. Midden deposits containing ceramics, lithics, copper, and bone are actively eroding into Lake Superior. The remaining area measures approximately 30 m long and is 4 m wide. The site was mapped, a grid established, and four 1 m square units excavated. Midden deposits were found in each of the units which tended to contain similar kinds of artifacts. These consist of Terminal Woodland ceramics, mostly Blackduck, debitage, worked copper, calcined bone, and a few stone tools.

One notable exception was found in one unit (S3-4, W26-27). Artifacts found from 0 to 20 cm BS conformed to the types of contents described above. Between 20 and 30 cm BS (bedrock) exclusively Laurel ceramics were found with a small number of flakes and three pieces of worked copper. Although the midden deposit is continuous from the surface to bedrock, this is evidently a culturally stratified deposit, unique on Isle Royale.

Table 45. Artifact and raw material summary, 20IR174.

CERAMICS: BLACKDUCK 5, UNCLASSIFIED TERMINAL WOODLAND 2

LITHIC TOOLS: JST 1, RSPT 1, HBL 10

LITHIC DEBITAGE: JST 11, RSPT 2, HBL 133, QTZ 7, PLQ 14, RHY 2

COPPER: WASTE 35, BARS 1, TOOLS 2

HAMMERSTONES/FLAKES: 0/5

20IR175 MALONE ISLAND #2: This site consists of one waterworn Terminal Woodland rim sherd and one bipolar HBL core on a gravel point on the north side of the island. An examination of eroding surfaces and shovel tests on intact surfaces above the point failed to disclose additional remains.

Table 46. Artifact and raw material summary, 20IR175.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 1

LITHIC TOOLS: HBL 1

20IR179 GREENSTONE BEACH: Shovel tests and an examination of actively eroding surfaces by the 1990 MWAC survey crew discovered Terminal Woodland deposits with intact midden. The site is located in a small bay between Malone Bay and Chippewa Harbor on Isle Royale's south shore. Dimensions of the site determined by shovel testing are approximately 40 m N-S by 10 m E-W.

Seven units were excavated along the length of the site, one of which was sterile. Virtually all cultural material is limited to the top 20 cm of the deposits. At the eastern end and center of the site area soils are characterized by dense beach deposited cobbles with little soil. At the western end of the site where TU #6 and #7 were located soils are coarse sands and gravels, also beach deposited. Artifact content is typical for a Terminal Woodland site on the island: units contain debitage, worked copper, ceramics, and bone in a discontinuous sheet midden.

Table 47. Artifact and raw material summary, 20IR179.

CERAMICS: BLACKDUCK 1, HURON 1

LITHIC TOOLS: JST 1, HBL 4

LITHIC DEBITAGE: JST 9, GFS 1, HBL 63, QTZ 5, PLQ 13

COPPER: WASTE 53, BARS 1, ORNAMENTS 1

HAMMERSTONES/FLAKES: 5/3

20IR180 LITTLE GREENSTONE BEACH: In an interview with Tyler Bastian, Chippewa Harbor resident Violet Johnson Miller reported collecting prehistoric sherds from this small cove in 1937 but the area was not visited by UMMA survey (Bastian 1963a:80). The MWAC survey crew visited Little Greenstone in 1990 and found actively eroding cultural deposits with intact midden. The site is located amid the dense beach deposited cobbles approximately 10 m above the modern level of Lake Superior.

Like Greenstone Beach, Little Greenstone is open to the wave action of the lake which accounts for the attrition of the older beach deposits. Three 1m square units were excavated. Most of the cultural material was contained in the top 20 cm. Between 20 and 30 cm BS the sparse amount of soil among the cobbles gave way to pure cobbles: that is, the soil ended and the interstices between the cobbles were filled with air. Some small artifacts (flakes) were lost during the excavation of the third level in one unit by falling into the cobble matrix.

Nine discrete ceramic vessels are identified by rimsherds from the three excavation units. In aggregate, this large number of vessels represented by very small rimsherds is unlike any other assemblage on the island. The group lacks the more typical elements of Juntunen, Huron, or Blackduck ceramics found elsewhere and does not readily conform to the other north shore ware groups (i.e., Selkirk or Sandy Lake). The use of trailing as a decorative technique on one sherd suggests a southern (Wisconsin) relationship.

Table 48. Artifact and raw material summary, 20IR180.

CERAMICS: UNCLASSIFIED TERMINAL WOODLAND 9

FIRED CLAY LUMPS: 12

LITHIC TOOLS: HBL 3

LITHIC DEBITAGE: JST 3, GFS 1, HBL 39, QTZ 3, RHY 1

COPPER: WASTE 180, BARS 1,

HAMMERSTONES/FLAKES: 0/12

20IR181 WRIGHT'S ISLAND: The MWAC survey team found evidence of a late prehistoric mid nineteenth century occupation on Wright's Island in Malone Bay. Shovel testing and the excavation of four units produced a wide array of data showing the mixing of prehistoric and historic materials. Only at the western end of the site did the Terminal Woodland materials seem to be in a relatively isolated context. One Huron potbreak was found in a shovel test where it was associated with cut nails and burned white ware. Another interesting find was that of 17 stone netsinkers, the context of which is uncertain. These could potentially date from both the Terminal Woodland and Historic components.

Table 49. Artifact and raw material summary, 20IR181.

CERAMICS: HURON 1, SELKIRK 1

LITHIC TOOLS: RSPT 1, HBL 1

LITHIC DEBITAGE: RSPT 4, HBL 7, PLQ 1

COPPER: WASTE 1

NETSINKERS: 17

HAMMERSTONES/FLAKES: 0/1

20IR183 MALONE BAY #3: This site is the first and only aboriginal coppermine recorded located on a copper deposit in conglomerate matrix. The site is situated a short distance west of the Malone Bay Campground and immediately west of a small gravel beach. Artifacts, primarily hammerstones and hammerflakes are scattered across the top of a flat conglomerate shelf about 4 m above Lake Superior. A copper-bearing fissure is located immediately to the south and west of the site. Three shallow excavation units and an intensive piece-plotting of surface finds indicate that the site was a single occupation, primarily concerned with exploitation of the copper deposits with some initial fabrication taking place on site. A broken Sandy Lake pot was found near the fissure, along with a small amount of unidentified bone, hammerflakes, worked copper, and FCR.

Table 50. Artifact and raw material summary, 20IR183.

CERAMICS: SANDY LAKE 1

LITHIC DEBITAGE: HBL 2, QTZ 1

COPPER: WASTE 24

HAMMERSTONES/FLAKES: /22

APPENDIX B: FAUNAL REMAINS FROM TERMINAL WOODLAND SITES ON ISLE ROYALE.

The data presented in this appendix are derived from Martin and Masulis (1989), Martin (1989), and Martin (1990). For larger collections additional data, including weight, biomass, and ubiquity index is provided. For smaller collections, only the number of identified specimens (NISP) and minimum number of individuals (MNI) is provided.

Table 51. 20IR1, Chippewa Harbor #1

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					.92
Snowshoe Hare	12	3	2.8	.066	.19
Red Squirrel	2	1	.4	.012	.04
Beaver	100	3	62.1	1.081	.69
cf. Deer Mouse	5	1	.2	.006	.04
Muskrat	7	1	1.3	.033	.19
Canid sp.	9	1	5.2	.116	.15
Caribou	14	1	33.9	.650	.31
Large Mammal	11	-	20.9	.406	.12
Med/Lg Mammal	2416	-	473.0	6.720	.77
Small Mammal	21	-	2.0	.049	.35
BIRDS					.42
Common Loon	91	4	47.3	.683	.35
Duck sp.	4	1	.8	.017	.08
Passenger Pigeon	1	1	.2	.005	.04
Songbird	1	1	.1	.003	.04
Unident. Bird	44	-	3.6	.065	.23
REPTILES					.23
Painted Turtle	2	1	.6	.022	.08
Unident. Turtle	8	-	2.0	.050	.19
FISH					.62
Lake Sturgeon	5	1	1.0	.030	.15
Lake Trout	90	4	8.4	.162	.35
Lake Whitefish	2	1	.2	.008	.04
Whitefish/Cicso	2	1	.2	.008	.04
White Sucker	8	(2)	2.7	.066	.15
Longnose Sucker	3	(2)	.3	.012	.08
White/Longnose Sucker	141	7	10.7	.196	.42
Redhorse(?)	1	(1)	.1	.005	.04
Pike/Muskellunge	48	5	8.4	.162	.31
Burbot	2	1	.2	.008	.08
Walleye	3	3	.4	.013	.12
Unident. Fish	1441	-	42.8	.619	.42
Scales	836	-	3.4	-	.31
Unident. Vertebrate	1949	-	59.8	-	.50
Totals	7279	43	795.0	11.275	
Total Identified	533		187.5	3.366	
Percent Identified	7.6		23.6	29.9	

Table 52. 20IR111, Rock Harbor Lighthouse.

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					
Beaver	1	1	1.0	.026	.17
Large Mammal	2	1	14.5	.292	.33
Med/Large Mammal	44	-	11.9	.259	1.00
FISH					
Lake Sturgeon	7	1	2.4	.060	.17
REPTILES					
Turtle	1	1	.2	.011	.17
GASTROPODS					
Unident.	2	1	.1	-	.17
Totals	57	5	30.1	.648	
Total Identified	8	2	3.4	.086	
Percent Identified	14.0	40.0	11.3	13.3	

Table 53. 20IR41, Siskiwit Mine.

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					
Snowshoe Hare	1	1	.3	.009	.05
Beaver	38	2	20.3	.415	.21
Pig	2	1	.7	.019	.05
cf. Moose	1	1	3.2	.075	.05
Caribou	1	1	1.2	.031	.05
Moose/Caribou	2	-	.9	.024	.05
Cattle	2	1	1.2	.031	.05
Moose/Cattle	3	-	15.7	.320	.11
Large Mammal	58	-	26.4	.841	.26
Med/Lg Mammal	858	-	206.5	3.724	.68
BIRDS					
Common Loon	4	1	.5	.011	.05
Unident. Bird	1	-	.1	.003	.05
FISH					
Lake Trout	198	10	15.5	.570	.37
Lake Whitefish	16	1	1.4	.046	.16
Trout/Whitefish	2	-	.1	.002	.05
Unident. Fish	439	-	20.6	.349	.21
Unident. Vertebrate	23	-	.9	.21	
Totals	1649	19	314.3	6.470	
Total Identified	270	19	59.8	1.553	
Percent Identified	16.4	-	19.0	24.0	

Table 54. 20IR114, Lone Tree Cove.

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					
Beaver	163	8	130.4	2.107	.88
Dog	79	1	123.3	2.004	.38
Large Mammal	13	(1)	19.4	.379	.25
Med/Lg Mammal	220	-	16.4	.326	.63
Medium Mammal	60	-	15.5	.310	.50
Totals	535	10	305.0	5.126	
Total Identified	242	9	253.7	4.111	
Percent Identified	45.2	90	83.2	80.2	

Table 55. 20IR29, Belle Isle #1.

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					
Med/Lg Mammal	79	-	10.3	.087	.83
FISH					
Lake Sturgeon	1	1	.1	.005	.17
Unident. Vertebrate	389	-	6.0	-	.67
Totals	469	1	16.4	.092	
Total Identified	1	-	.1	.092	
Percent Identified	<.1	-	<.7	100.0	

Table 56. 20IR31, Grass Point.

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					
Beaver	3	1	7.6	.163	.67
Med/Lg Mammal	59	-	11.3	.223	1.00
Unident. Vertebrate	168	-	4.5	-	.33
Totals	230	1	23.4	.396	
Total Identified	3	-	7.6	.163	
Percent Identified	17.6	-	54.7	41.2	

Table 57. 20IR45, Daisy Farm.

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					
Red Squirrel	4	1	.4	.012	.11
Beaver	116	3	80.4	1.364	.78
Muskrat	1	1	.1	.003	.11
Caribou	12	2	222.5	3.409	.22
Caribou/Moose	1	-	18.3	-	.11
Large Mammal	44	-	82.8	1.337	.33
Med/Lg Mammal	191	-	43.8	.789	.44
Medium Mammal	2	-	.6	.017	.11
FISH					
Whitefish/Cicso	2	1	.1	.005	.11
Unident. Fish	2	1	.1	.005	.11
Unident. Vertebrate	2146	-	33.5	-	.44
Totals	2521	9	482.6	7.214	
Total Identified	137		344.3	3.350	
Percent Identified	40.8		86.2	74.2	

Table 58. 20IR149, McCargoe Cove #2

Taxon	NISP	MNI	WT(g)	Biomass(kg)	Ubiquity Index
MAMMALS					
Beaver	3	1	2.6	.062	.29
Caribou	11	2	40.8	.741	.43
Large Mammal	49	-	31.1	.580	.57
Med/Lg Mammal	1254	-	381.9	5.543	.86
FISH					
Unident. Fish	6	1	.3	.003.14	
Unident. Vertebrate	c14700	-	223.2	-	.43
Totals	16025	4	679.9	6.929	
Total Identified	5	31.8	.803	-	
Percent Identified	0.7	13.0	11.6		

Table 59. 20IR144, Pickerel Cove #1 (NISP/MNI).

Moose	1/1
Large Mammal	33/-
Med/Lg Mammal	7/-
Common Loon	2/1
Unident. Vertebrate	8/-

Table 60. 20IR124, Lake Ritchie #1 (NISP/MNI).

Beaver	1/1
Med/Large Mammal	17/-

Table 61. 20IR142, Belle Isle #2 (NISP/MNI).

Caribou	1/1
Med/Large Mammal	50/-

Table 62. 20IR143, Belle Isle #3 (NISP/MNI).

Beaver	1/1
Med/Large Mammal	6/-
Lake Trout	1/1
Whitefish/Cicso	17/1
Whitefish family	1/1
Unident. Fish	41/1
Unident. Vertebrate	76/-

Table 63. 20IR153, Cove #3 (NISP/MNI).

Beaver	9/1
Caribou	1/1
Med/Large Mammal	25/-

Table 64. 20IR17, Grace Island (NISP/MNI).

Snowshoe Hare	1/1
Beaver	7/1
Pig	1/1
Med/Large Mammal	104/-

Table 65. 20IR18, Grace Point (NISP/MNI).

Beaver	7/1
Med/Large Mammal	89/-
Common Loon	11/1
?Red-Necked Grebe	1/1
Unident. Large Bird	25/-
Trout family	1/1
Unident Fish	1/-
Unident Vertebrate	49/-

Table 66. 20IR64, Barnum Island (NISP/MNI).

Med/Large Mammal	4/1

Table 67. 20IR65, Washington Island #1 (NISP/MNI).

cf. Snowshoe Hare	1/1
Med/Large Mammal	125/-
Small Mammal	2/-
Unident Vertebrate	711/-

Table 68. 20IR81, Phelps (NISP/MNI).

Med/Large Mammal	2/-

Table 69. 20IR116, Threemile #1 (NISP/MNI).

Canid (wolf?)	3/1

Table 70. 20IR120, Chickenbone Lake #1 (NISP/MNI).

Beaver	4/1
Caribou	1/1
Large Mammal	188/-
White Sucker	1/1

Table 71. 20IR160, Washington Island #2 (NISP/MNI).

Unident Vertebrate	3/-

APPENDIX C: NEUTRON ACTIVATION ANALYSIS OF PREHISTORIC CERAMICS FROM ISLE ROYALE AND THE UPPER GREAT LAKES. Michael D. Glascock and Hector Neff

INTRODUCTION

The following report discusses sample preparation, analytical results and statistical interpretations for a set of 100 ceramics specimens from Isle Royale and the Upper Great Lakes which were submitted to the Missouri University Research Reactor (MURR) for analysis by Instrumental Neutron Activation Analysis (INAA). The analytical procedures used are briefly described below. For more information about the sample preparation and analysis procedures, the reader is referred to Glascock and Elam (1988) and Elam and Glascock (1988).

SAMPLE PREPARATION

Upon receipt of the specimens and a shipping log at MURR, an inventory was conducted to insure that the samples had been marked with the same ID names included on the shipping log. These were found to be in agreement. Because the sample IDs provided by the principal investigators were not acceptable to our system, we modified their IDs by replacing each prefix 89- with the letters IRP (e.g., 89-108 became IRP108). Our IDs were used throughout the entire analysis.

Samples were delivered as powders which had been drilled from sherds using a carbide drill bit. Prior to sample preparation, the powders were dried in an oven at 100 degrees Centigrade for 24 hours to reduce possible water content. After removal from the oven, they were placed in a vacuum desiccator for cooling prior to weighing. Samples were prepared by weighing about 200 mg of each into small polyvials used for short irradiation. After completion of the short irradiations, the samples were transferred into high-purity quartz vials used for long irradiations and reweighed. In addition to these unknown samples, a number of reference standards of SRM-1633a Fly Ash, SRM-688 Basalt Rock and SRM-278 Obsidian Rock were similarly prepared.

IRRADIATION AND ANALYSIS

The first measurements conducted on each sample were by use of the pneumatic tube irradiation system at MURR. In this measurement, samples were sequentially irradiated for five (5) seconds at a neutron flux of 8×10^{13} $n/cm^2/s$. Following irradiation, each sample was allowed to decay for 25 minutes before being counted on a high-resolution germanium detector for 720 seconds. The short-lived elements which were determined by this procedure were Al, Ba, Ca, Dy, K, Mn, Na, Ti and V.

The samples were allowed to decay for two weeks and then all specimens were transferred into quartz vials as mentioned above. The entire batch of samples was subjected to a 24-hour irradiation at a neutron flux of 5 x 10^{13} n/cm^2/s. After the long irradiation, the samples decayed for seven days before a first measurement of 2,000 seconds was conducted on each sample using a germanium detector coupled to an automatic sample changer. This measurement resulted in the determination of several medium halflife elements including: As, La, Lu, Nd, Sm, U and Yb. The samples were then allowed to decay for an additional four (4) weeks before a final measurement of 10,000 seconds each. The latter measurement yielded the following long-lived elements: Ce, Co, Cr, Cs, Eu, Fe, Hf, Ni, Rb, Sb, Sc, Sr, Ta, Tb, Th, Zn and Zr.

Following collection of all element concentration data, a tabulation of the data was assembled using the LOTUS 1-2-3 spreadsheet program. Table 72 provides a complete listing of concentrations determined for all 100 specimens. The data were then transferred into a DBASE file where the descriptive information was attached to the specimens.

STATISTICAL ANALYSIS

In broad terms, the goal of compositional analysis is to identify subgroups that are meaningful from an archaeological viewpoint. Various strategies for identifying patterning in compositional data are discussed by Harbottle (1976), Sayre (n.d.), and Bishop and Neff (1989). Assumptions underlying both the compositional analysis and the subsequent search for subgroups in the data are (1) that chemical variation within sources of ceramic raw materials (clay and temper) is less than variation between sources and (2) that patterns of variation in raw materials carry over into the pottery made from the raw materials, in effect producing a "fingerprint." Assumption #1 carries the qualification that "source" can be conceived on several levels of geographical inclusiveness (Arnold, Neff, and Bishop 1990). Assumption #2 carries the qualification that paste preparation techniques (mixing clays, mixing temper with clays, etc.) affect the composition of the pottery, producing a composite fingerprint that may not match any single raw material source (Arnold, Neff and Bishop 1990; Neff, Bishop and Arnold 1988; Neff, Bishop and Sayre 1988, 1989).

The first step in the analysis of compositional data is to identify elements with too many missing data to be used in group formation and to identify outliers that might have resulted from weighing error, contamination, or other kinds of analytical error. In the case of the northern Great Lakes data, consideration of missing data and precision of the determinations led us to exclude the elements As, U, Co, Cr, Ta, Hf, Ni, Sr, Zn, Zr, Al, Ca, and K. Drill-bit contamination is suspected in the case of IRP025 and possibly some other specimens with high Co, Cr, Ta (W was not determined, so drill bit contamination could not be identified with certainty). Anomalous high values of rare earth elements in the case of IRP105 are thought to reflect inhomogeneity in the paste.

Following preliminary screening, average linkage cluster analysis based on mean euclidean distances derived from log base 10 data was carried out. This analysis suggested divisions along an east-west axis. Cluster analyses of a reduced list of elements and of principal component scores (1-7) showed a similar pattern. However, the tendency for cluster analysis to force data into hyperspherical groups, coupled with the known tendency for pottery and clay compositional groups to be elongated (due to interelemental correlation) demand skepticism regarding any cluster solution.

The results of the cluster analysis combined with provenience and typological information provided a basis for defining preliminary groups that were refined in subsequent analyses. Compositional groups can be thought of as centers of mass in the hyperspace defined by elemental concentrations (Harbottle 1976). The groups represent "sources" at some level, whether each source is a single mine or a large region. Such groups are defined by the centroid (multivariate mean) and variance-covariance structure derived from the elemental concentrations (19 in the present case). The distinctiveness of groups and probability of membership of individual specimens can be evaluated by multivariate techniques that are analogous to t-tests in that both the centroid and the dispersion (variance-covariance structure) of data points are considered. In the present case, the small number of specimens in all the proto-reference groups precluded group evaluation and refinement with multivariate statistics based on the full set of 19 elemental concentrations.

To reduce the dimensionality in the data without arbitrarily excluding elements that might be important in group definition, a principal components analysis of the entire 100-specimen data set was carried out on log base 10 data. Transformation to log concentrations partially counteracts the weighting inherent in the fact that trace, minor, and major elements are used, the concentrations ranging from parts per million up to percent. We conducted a parallel analysis on data standardized across the entire data set, and noted no significant differences in the resulting groups. For both the standardized and logged data, group refinement was based on the first 4-6 principal components, which subsume 78 and 87 percent of the variance in the data set, respectively, as shown in Table 73. Besides effecting a reduction in dimensionality, principal components analysis provides a new set of reference axes on which the data may be plotted, in effect providing a new window through which to explore the elemental concentration space.

Decisions on what specimens to shift between groups and what specimens to exclude from all groups were based on a number of considerations, including relative probabilities of group membership of individual specimens and the potential for a specimen to broaden the group, making it less distinct from other groups. Examination of bivariate plots, both of elemental concentrations data and of principal components scores, were used extensively in this process. The accompanying plots (Figures 18-21) are examples of these bivariate plots.

REFERENCE GROUPS

Table 74 contains the final group assignments along with typological and provenience information and scores for each specimen on the first four principal components. The group names reflect the most common proveniences of member specimens. In the case of Isle Royale, two of the raw clays collected on the island are group members (IRP001 and IRP002) providing yet a stronger tie to geographic space.

Table 75 shows probabilities of group membership obtained by calculating Mahalanobis distances from each specimen to the centroid of each of four reference groups. The first four principal components, which subsume about 78% of the variance in the 19-dimensional elemental concentration data set, formed the basis for these calculations. Probabilities for specimens within a group were "jackknifed" by removing the specimen from the group before calculating probability of membership. This practice counteracts the tendency for inclusion of a specimen in a small group to inflate artificially its own probability of membership, a phenomenon referred to as "stretchability" by Harbottle (1976). Some overlap between the four groups is evident in the near misassignments. This is undoubtedly due to (1) the fact that the groups are rather small and (2) the fact that each group probably represents a fairly extensive source region rather than a localized source.

Another set of probabilities was obtained using only the first 3 principal components, which subsume about 72% of the variance in the 19 dimensional elemental concentration space (Table 76). Further dimensionality reduction made it possible to include a fifth group, centered on the Keweenaw Peninsula. A few misassignments and more near misassignments appear in the Table 76, but that is an artifact of the loss of information with reduction in dimensionality. High probabilities for membership in the Keweenaw group shown by some Thunder Bay/Voyageurs and Juntunen specimens are due mainly to the small size of the Keweenaw group.

The basis for separation of the five reference groups is depicted in Figures 18 and 19, on which the various groups are plotted relative to the first four principal components of the data. All the groups are separable on principal components 1 and 2 (Figure 18) with the exception of Thunder Bay/Voyageurs and Juntunen, which are clearly distinct on components 20 and 21 (Figure 19).

As is common in compositional studies of pottery, a significant proportion of specimens (37) were not included in any of the reference groups. The ungrouped specimens were compared to each of the reference groups by calculating Mahalanobis distances, as discussed above. Probabilities of membership of these outliers in all groups except Keweenaw are given in Table 77. The probabilities for outliers should be regarded skeptically and in light of other information, particularly provenience and typology of the samples. The small sizes of the core groups and the likelihood that each represents a fairly general source zone rather than a localized source means that some non-members may show erroneously high probabilities of membership. To reiterate, decisions as to which specimens to include and which to exclude were based not only on the specimen's probability of membership but also on the effect of including the specimen on the group's distinctiveness from other groups. Further analyses might clarify the compositional affiliations of some of the outlier specimens.

MEANING OF THE REFERENCE GROUPS

The reference groups probably represent source zones rather than localized sources. Source zones consist of the total ceramic environment perceived and utilized by prehistoric potters living in a particular region during the time periods represented in an analyzed sample. Multiple clay and temper sources as well as multiple production locations may be represented in such groups. Thus, for example, the Isle Royale group contains, in addition to pottery from a number of sites on Isle Royale, raw clays from three different collection locations, two separate locations on Isle Royale itself and one on the adjacent mainland. Further subdivision of the identified reference groups and more precise identification of production locations would require a much more intensive program of sampling and analysis.

Above the source zone level (represented by the five compositional reference groups), there is a fundamental dichotomy in the data set between Sand Point and Keweenaw groups on the one hand and the Juntunen, Isle Royale, and Thunder Bay/Voyageurs groups on the other hand. Isle Royale, Thunder Bay/Voyageurs, and Juntunen probably belong to a similar geochemical system in which variations in elemental concentrations tends to occur along parallel hyperplanes of correlation. For example, the Fe-Sc (Figure 20) plot shows the Juntunen and Isle Royale groups lying on basically the same correlation line, though Juntunen specimens tend to be lower in both elements. On La and Eu (Figure 21), Juntunen and Thunder Bay/Voyaguers are completely overlapping. On both the Fe-Sc plot and the La-Eu plot, the Sand Point and Keweenaw groups lie on correlation lines with different slopes, suggesting derivation from a distinct geochemical environment. Principal components #1 and #2 (Figure 18) combine the effect of distinct rare earth and Fe-Sc correlations: through this different "window," the Thunder Bay/Voyageurs, Isle Royale, and Juntunen groups are elongated along a line with neutral or positive slope, while the Keweenaw and Juntunen groups are elongated along lines with negative slope.

As reflected in the probability calculations presented in Tables 75-76, both the Sand Point and Keweenaw groups are "loose" in that specimens in other groups sometimes show high probabilities of membership. This looseness arises from the fact that there is substantial variation in elemental concentrations in the small sample of analyzed specimens, a result not unexpected for groups inferred to represent "zones" rather than localized sources. Identifying Keweenaw and Sand Point as distinct groups depends on analysis of correlation in the data, not just on proximity in Euclidean space. This example provides an elegant demonstration of the fallacy of removing correlation from a data set before attempting to define groups.

Subgroups in the data below the source zone level are suggested by substantial variation in some of the reference groups, particularly the Juntunen group. Principal components analysis of the Juntunen group alone (Table 78) indicates that the largest dimension of variance, which subsumes about 48% of the total variance, is a dimension on which higher scores indicate enrichment of the rare earth (or lanthanide) elements combined with slight dilution of Rb, Ba, and Na. The rare earth elements tend to stay together during the weathering process, making them particularly appropriate for differentiating the end results of weathering, i.e., clays. Rb, Ba, and Na, on the other hand, are associated with rock forming minerals: Na occurs as a major constituent of certain feldspars, whereas Rb and Ba substitute for K and Na in the crystal lattice of feldspars; Rb, Na, and Ba go into solution easily, and tend to be carried away in ground water during weathering. In sum, the major dimension of variance in the Juntunen group seems to reflect differing paste textures, with coarser pastes (containing more rock fragments) scoring lower on the PC1 and finer pastes scoring higher on PC1.

Texture may also explain some of the variation in the Isle Royale group. The group is too small to run a principal components analysis without excluding some of the elements. However, Table 73 indicates that the first principal component of the whole data set in part expresses enrichment of rare earths combined with dilution of the elements carried in rock-forming minerals. Relatively low values for the Huron specimens from Isle Royale (IRP047 - IRP053) on PC1 (see Table 73) may indicate that the makers of Huron pottery, although exploiting basically the same ceramic environment as other potters who worked on Isle Royale, followed a paste recipe calling for slightly greater amounts of crushed rock or sand. With a larger sample of Huron specimens, it might be possible to define a group that represents not just resource procurement in the Isle Royale source zone, but a particular set of paste preparation practices as well.

The Thunder Bay/Voyageurs group is problematic in that it includes specimens from two widely separated regions. Efforts to form two subgroups, one representing Thunder Bay and one representing Voyageurs, were unsuccessful. Whether this overlap indicates widespread geochemically similar ceramic resources or movement of vessels in prehistory is an open question. Specimens in this group also tend to show high probabilities (10 - 20%) of membership in the Juntunen group, a finding related to chemical heterogeneity of the Juntunen group, discussed above. This results suggests a need for further refinement of the Juntunen group.

POSSIBLE ARCHAEOLOGICAL INTERPRETATIONS

Although each of the compositional groups is dominated by specimens from a particular area (giving rise to their interpretation as source zone groups), several groups contain significant proportions of specimens found archaeologically outside the inferred source zones. If the source zone groups were larger and better defined, these anomalies could be taken as evidence of trade or movement of people during prehistory. However, some skepticism regarding such an interpretation is warranted because of the partial overlap between the groups; some of the anomalies may represent chance variation in ceramic pastes derived from chemically heterogeneous source materials.

The Juntunen group provides perhaps the best evidence for movement of vessels, either through trade or movement of people. With only a few exceptions, the members of this group all show below 1% probability of membership in any of the other groups (Table 75). But, as shown in Table 74, Juntunen specimens come not only from Bois Blanc but from Isle Royale (2), Thunder Bay (1), and Keweenaw (3). One of the Juntunen specimens inferred to have been transported (IRP106, from the Keweenaw Peninsula) shows a high probability of belonging to the Isle Royale group, but none of the others shows above 5% probability of belonging to any group other than Juntunen. All specimens inferred to have been transported show above 30% probability of membership in the Juntunen group.

While some Juntunen pottery made in the vicinity of Bois Blanc appears to have been transported to Isle Royale and farther west, typologically similar specimens (designated Juntunen) also appear to have been made locally on Isle Royale (4) and in the Thunder Bay/Voyageurs region (3). Such a pattern could result from movement of people, perhaps through intermarriage. All the Isle Royale specimens show above 50% probability of membership in the Isle Royale group and below 5% probability of membership in the three other groups. Two Juntunen specimens included in the Thunder Bay/Voyageurs compositional group (IRP032 and IRP064) were excavated on Isle Royale, while another (IRP014) was excavated in Thunder Bay. However, as mentioned previously, Thunder Bay/Voyageurs specimens tend to show high probabilities of membership in the Juntunen group; the three specimens typed as Juntunen are no exception, all showing above 10% probability of membership in the Juntunen group.

SUGGESTIONS FOR FURTHER RESEARCH

As stated several times in the foregoing discussion, sample sizes constituted an obstacle to data analysis. The core groups ranged in size from 5 to 22 members, and these core groups themselves represent source zones rather than localized sources or production centers. If further compositional research is undertaken, augmenting the size of the core groups should be a priority.

Because Juntunen pottery seems to present the best evidence for movement of people and movement of pots, it may be the best focus for the next stage of compositional research in the northern Great Lakes. One thrust of the research should be to improve the characterization of compositional patterning in the Bois Blanc region, where the Juntunen compositional group seems to be centered. Further analyses should include 50 to 100 specimens of Juntunen, Mackinac, and other pottery types, and perhaps 20-30 clay samples from the region. In addition, 50-100 specimens of Juntunen pottery from Isle Royale and other parts of the western Lake Superior region should be analyzed in order to provide a further test of the hypothesis that Juntunen pottery was transported over long distances.

Several approaches to clarifying suggested patterning in the western Lake Superior region could be taken. For one thing, the nature of the Thunder Bay/Voyageurs compositional group should be clarified through further sampling of pottery from the two regions combined with sampling of clays. To provide further evidence bearing on the suggestion of movement of vessels between Thunder Bay and Isle Royale, a more secure characterization of the Isle Royale pottery and clays is also desirable. The possibility that Huron pottery falls into a distinct compositional subgroup of the Isle Royale group should also be explored.

A sampling strategy directed at broad regional coverage (as in this study) is a reasonable first step in compositional investigations, but one should anticipate only tentative conclusions from such a study. More secure conclusions will result from subsequent analyses of larger samples from particular locations and particular ceramic types. This is the general approach suggested for further compositional investigations in the Northern Great Lakes region.

ACKNOWLEDGEMENTS

We gratefully acknowledge funding from the National Science Foundation through the Archaeometry program grant (BNS-8801707) and the Department of Energy, through its Reactor Sharing Grant to MURR. We also appreciate the assistance of J. Michael Elam (Research Assistant) who performed the sample preparation. Of course, we are responsible for any errors of fact or interpretation.

Table 72. Element concentrations in ceramic samples from Isle Royale National Park.

Ident.	As(ppm)	La(ppm)	Lu(ppm)	Nd(ppm)	Sm(ppm)	U(ppm)	Yb(ppm)	Ce(ppm)	Co(ppm)	Cr(ppm)	Cs(ppm)
IRP001	4.455	28.70	0.3250	31.02	5.282	3.148	2.176	54.50	20.83	99.5	2.950
IRP002	3.495	28.59	0.3210	28.49	5.905	2.495	2.336	56.55	30.64	153.3	2.333
IRP003	2.184	20.50	0.3066	21.84	4.515	0.833	2.098	44.88	32.46	105.9	1.241
IRP004	4.679	41.57	0.2600	33.37	6.222	5.394	1.777	95.10	20.29	97.7	4.598
IRP005	6.536	31.31	0.2822	31.77	4.961	6.812	1.801	75.92	18.95	128.1	6.976
IRP006	6.602	36.84	0.3248	35.90	6.276	3.419	2.360	81.70	18.99	104.0	5.165
IRP007	7.691	24.31	0.1889	20.01	3.299	2.533	1.258	52.28	12.46	97.7	5.631
IRP008	3.169	31.90	0.2231	28.52	4.401	2.503	1.545	63.57	8.59	62.2	3.389
IRP009	4.927	28.60	0.2213	26.73	4.340	3.010	1.481	61.42	12.52	92.6	4.343
IRP010	5.556	27.45	0.2110	27.08	4.559	3.895	1.523	69.68	16.11	101.6	5.443
IRP011	6.230	22.15	0.2093	19.17	3.583	3.537	1.360	54.16	25.02	93.8	4.857
IRP012	5.372	34.63	0.3212	30.25	6.061	7.304	2.093	73.24	12.62	90.8	6.013
IRP013	3.395	22.99	0.1939	18.77	3.268	1.968	1.365	52.82	13.66	73.2	3.873
IRP014	2.884	41.24	0.2344	52.57	6.085	1.990	1.734	94.31	20.65	113.5	4.055
IRP015	11.548	25.91	0.3522	24.50	4.359	3.698	2.421	66.96	18.90	86.9	3.996
IRP016	5.184	32.73	0.2611	38.52	4.782	2.024	1.965	68.07	23.08	112.5	4.590
IRP017	3.619	16.38	0.1842	21.18	3.012	0.879	1.282	39.12	33.23	105.8	3.683
IRP018	3.171	33.05	0.2164	42.52	5.130	2.086	1.638	74.57	18.62	106.3	4.813
IRP022	22.804	29.94	0.4692	31.17	6.181	15.328	2.288	64.95	19.56	77.9	3.260
IRP023	3.705	36.15	0.2005	46.75	5.045	1.399	1.593	72.18	12.38	108.7	4.871
IRP024	3.399	34.65	0.3729	34.30	5.901	2.134	2.651	72.11	17.41	67.2	2.626
IRP025	0.000	46.51	0.2381	35.99	6.504	0.000	1.744	95.00	302.20	416.4	4.150
IRP026	1.735	20.06	0.1719	19.69	3.321	2.116	1.080	43.87	14.70	106.7	3.618
IRP027	2.246	30.09	0.3373	46.20	5.587	1.906	2.405	67.49	19.87	65.3	3.600
IRP028	3.645	50.94	0.3113	62.24	7.509	1.998	2.149	117.54	28.00	107.9	4.606
IRP029	2.472	35.21	0.2730	47.75	5.926	2.861	2.021	81.75	18.37	87.0	4.172
IRP030	3.149	28.48	0.3129	29.72	4.045	2.722	2.352	57.39	6.92	40.9	3.622
IRP031	2.456	30.67	0.3024	41.99	5.443	2.225	2.186	67.47	27.67	113.8	3.171
IRP032	4.884	42.99	0.2705	54.66	6.106	1.860	1.927	92.69	19.74	94.0	4.509
IRP033	2.367	32.69	0.2870	42.36	5.397	1.380	2.126	67.39	14.96	72.3	4.122

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued).

Ident.	As(ppm)	La(ppm)	Lu(ppm)	Nd(ppm)	Sm(ppm)	U(ppm)	Yb(ppm)	Ce(ppm)	Co(ppm)	Cr(ppm)	Cs(ppm)
IRP034	3.344	30.50	0.2847	30.44	5.585	2.300	1.944	71.12	21.90	61.4	5.563
IRP035	4.731	24.46	0.2994	36.02	4.916	1.596	2.104	55.72	21.97	93.1	3.115
IRP036	3.271	28.93	0.3518	35.03	6.030	2.034	2.609	64.02	24.11	68.3	3.215
IRP037	4.346	29.01	0.3404	41.50	5.458	2.200	2.556	63.41	25.71	98.4	3.394
IRP042	5.491	57.97	0.2908	63.30	7.277	2.953	2.155	120.90	17.34	94.5	6.017
IRP043	3.928	28.08	0.3768	40.96	5.608	2.394	2.669	62.16	23.93	90.5	3.800
IRP044	4.991	25.16	0.3193	27.02	4.898	2.373	2.271	55.86	22.19	106.6	4.473
IRP045	5.156	38.29	0.2483	41.48	5.441	3.099	1.927	79.27	16.57	116.5	4.547
IRP046	0.000	24.10	0.2447	18.80	3.838	1.304	1.815	55.91	19.07	83.2	3.248
IRP047	3.330	26.48	0.2193	25.07	4.355	1.918	1.588	58.52	10.81	49.2	2.592
IRP048	4.302	30.79	0.2135	37.83	4.913	1.687	1.601	69.05	13.39	62.5	2.616
IRP049	3.820	23.85	0.2502	25.19	4.614	2.893	1.815	50.52	18.50	97.8	1.952
IRP050	1.797	23.52	0.2537	31.03	4.512	1.988	1.834	54.34	17.31	64.8	2.492
IRP051	3.958	29.37	0.4220	45.61	5.669	1.791	2.883	70.57	16.55	46.4	2.939
IRP052	0.000	20.41	0.1498	29.17	3.409	0.590	0.923	44.07	13.59	72.0	3.200
IRP053	0.000	19.43	0.2823	21.40	3.466	1.565	2.036	44.26	9.06	51.3	2.945
IRP054	5.023	16.83	0.2906	24.47	3.267	1.687	1.990	36.07	2.95	14.5	1.052
IRP055	3.561	17.79	0.2513	25.48	3.222	1.777	1.831	39.09	10.25	58.5	2.925
IRP056	3.220	43.45	0.2389	45.64	6.691	3.759	1.776	90.45	15.04	79.5	3.270
IRP057	3.026	33.20	0.2437	46.42	5.687	2.019	1.749	74.59	22.04	88.1	4.411
IRP058	5.098	33.37	0.3031	29.61	5.183	2.098	2.055	71.97	18.30	92.4	4.363
IRP059	3.297	24.53	0.3190	24.01	4.897	1.709	2.099	57.58	20.07	80.6	1.994
IRP061	1.367	39.33	0.3538	38.58	6.556	1.183	2.320	98.12	18.41	51.9	3.034
IRP062	2.702	30.06	0.2748	36.03	6.624	1.139	1.914	70.97	40.27	648.1	3.117
IRP063	3.382	31.72	0.3074	28.10	4.908	1.476	1.954	68.70	19.96	76.9	2.229
IRP064	2.585	33.97	0.2010	27.23	4.779	2.004	1.442	72.76	18.80	100.2	5.219
IRP065	2.451	48.52	0.3297	40.96	6.935	1.653	2.267	106.05	12.04	77.8	5.784
IRP066	4.047	44.97	0.3759	41.15	6.963	1.719	2.542	97.98	16.28	89.9	3.930
IRP067	3.297	29.33	0.2670	27.88	4.915	1.646	1.755	65.65	9.79	50.1	2.349
IRP068	10.276	34.33	0.3018	31.65	5.588	2.141	2.075	68.67	18.58	51.3	3.984

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued).

Ident.	As(ppm)	La(ppm)	Lu(ppm)	Nd(ppm)	Sm(ppm)	U(ppm)	Yb(ppm)	Ce(ppm)	Co(ppm)	Cr(ppm)	Cs(ppm)
IRP069	2.663	29.36	0.3428	24.23	4.874	2.627	2.320	70.61	7.2	52.3	3.028
IRP070	2.979	43.14	0.3575	39.70	6.735	2.223	2.491	86.07	11.37	51.3	3.108
IRP071	1.963	41.65	0.3044	34.40	5.918	2.360	2.074	95.15	6.33	43.8	2.917
IRP072	3.077	23.72	0.2338	18.39	3.566	3.131	1.489	61.58	8.73	45.6	2.208
IRP073	2.274	31.26	0.2747	28.11	4.995	3.863	1.718	65.86	13.95	92.8	4.265
IRP074	2.757	34.06	0.2919	31.13	5.355	1.230	2.065	73.48	11.56	72.6	3.218
IRP075	10.653	34.02	0.3175	27.03	5.046	2.943	2.060	75.24	17.84	52.5	3.216
IRP076	10.817	33.99	0.4322	31.70	5.981	3.051	2.968	103.41	15.58	64.0	4.332
IRP077	2.948	32.71	0.3503	31.68	5.542	1.208	2.386	75.67	19.80	88.0	3.561
IRP078	4.693	63.64	0.4164	47.18	7.232	2.789	2.953	131.91	13.93	97.6	4.057
IRP079	3.423	33.09	0.3303	31.76	5.637	1.935	2.216	70.87	15.51	85.2	2.805
IRP080	17.812	47.06	0.4765	41.14	7.667	3.535	3.235	96.69	36.24	65.9	4.837
IRP081	8.690	45.71	0.3997	42.16	7.410	2.662	2.766	91.58	16.08	46.4	3.439
IRP082	9.685	42.33	0.3927	38.50	6.569	2.683	2.698	90.21	16.75	63.7	3.580
IRP083	3.456	25.77	0.2829	24.09	4.382	1.334	1.950	65.40	11.90	71.5	3.196
IRP084	8.513	43.47	0.5324	39.67	7.531	2.441	3.659	91.67	19.77	58.6	4.275
IRP085	15.904	22.98	0.3518	21.66	4.875	3.091	2.436	75.75	24.87	67.4	10.032
IRP086	6.130	19.84	0.2934	20.87	5.188	4.171	1.824	46.01	35.21	74.4	2.829
IRP087	12.650	33.80	0.5596	35.78	9.224	6.011	3.900	69.17	19.95	91.4	6.589
IRP088	8.928	29.82	0.4511	30.21	6.965	4.067	2.896	81.18	29.35	84.3	6.715
IRP089	3.656	13.03	0.1905	13.66	3.052	3.614	1.176	33.57	51.74	78.5	3.625
IRP090	7.918	69.78	0.4600	82.31	15.937	3.558	3.438	77.89	12.33	71.9	8.378
IRP091	4.177	35.39	0.3576	31.38	5.747	3.513	2.392	72.80	10.15	75.2	4.558
IRP092	12.557	32.23	0.3813	27.22	5.648	3.744	2.589	67.36	16.33	76.4	7.193
IRP093	15.567	25.26	0.4036	24.43	5.395	4.864	2.816	61.58	23.56	78.8	8.708
IRP094	10.714	32.63	0.4410	33.96	7.816	3.988	2.998	84.42	26.43	87.1	7.822
IRP095	5.746	23.53	0.2997	24.49	4.601	3.636	1.984	48.13	19.05	86.1	2.067
IRP096	3.199	26.94	0.4059	28.59	5.934	3.602	2.825	63.54	13.47	57.8	5.744
IRP097	4.150	28.53	0.4881	33.99	7.402	3.662	3.371	73.56	11.86	66.1	6.290
IRP098	2.698	44.88	0.5009	61.56	12.279	8.947	3.262	93.24	8.82	61.1	4.142

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued) (continued).

Ident.	As(ppm)	La(ppm)	Lu(ppm)	Nd(ppm)	Sm(ppm)	U(ppm)	Yb(ppm)	Ce(ppm)	Co(ppm)	Cr(ppm)	Cs(ppm)
IRP099	3.396	41.03	0.5414	53.28	10.923	5.012	3.764	96.44	9.83	61.6	7.153
IRP100	5.822	30.12	0.3023	29.48	5.251	3.686	1.998	98.86	12.67	43.5	4.268
IRP101	3.611	37.12	0.5027	40.55	8.697	5.193	3.450	86.85	11.38	63.3	5.892
IRP102	4.188	29.84	0.1768	31.00	4.318	1.555	1.231	68.95	16.33	92.5	4.699
IRP103	3.542	38.49	0.4756	53.38	10.582	8.966	2.964	79.33	9.72	64.6	4.661
IRP104	0.000	38.15	0.4392	51.43	9.905	6.736	2.884	78.57	9.66	61.9	3.879
IRP105	3.319	64.19	0.9840	92.53	20.094	18.786	6.466	135.02	15.83	148.6	6.129
IRP106	1.793	25.03	0.2124	23.27	3.810	1.683	1.466	55.53	10.54	56.3	3.313
IRP107	2.197	30.79	0.2519	27.31	4.852	1.866	1.633	66.71	11.86	61.1	3.170
IRP108	2.812	26.36	0.2112	25.10	4.385	2.081	1.538	58.46	10.72	56.9	3.298

Ident.	Eu(ppm)	Fe(%)	Hf(ppm)	Ni(ppm)	Rb(ppm)	Sb(ppm)	Sc(ppm)	Sr(ppm)	Ta(ppm)	Tb(ppm)	Th(ppm)
IRP001	1.132	3.273	4.182	61.8	68.7	0.4041	14.38	173.5	0.6710	0.6111	7.71
IRP002	1.519	6.008	4.204	100.0	60.5	0.4263	23.04	186.1	0.7520	0.9507	6.36
IRP003	1.241	5.420	4.813	84.7	48.8	0.2474	19.29	199.4	0.7113	0.6132	4.73
IRP004	1.139	3.877	3.411	42.2	112.9	0.3790	11.61	225.0	0.7410	0.5216	13.80
IRP005	0.890	5.066	4.727	48.5	133.4	0.4635	15.70	175.6	1.1015	0.3886	14.20
IRP006	1.224	4.302	5.781	59.7	130.0	0.3008	13.91	143.4	1.0160	0.6538	13.40
IRP007	0.709	3.981	4.385	45.7	123.7	0.3526	12.06	155.7	0.8860	0.2932	12.57
IRP008	0.941	2.955	4.504	31.2	118.7	0.2877	8.89	211.6	0.7326	0.4605	10.81
IRP009	0.856	3.496	4.565	41.3	138.1	0.2754	11.24	254.9	0.8198	0.6132	17.22
IRP010	0.862	4.067	4.541	0.0	118.2	0.3854	13.55	128.8	0.9103	0.3892	13.79
IRP011	0.725	5.582	3.263	60.6	124.9	0.3245	13.65	47.1	0.7433	0.3783	13.55
IRP012	0.921	3.706	4.222	36.8	134.7	0.4324	13.54	144.4	1.2588	0.7509	16.13
IRP013	0.759	3.004	4.947	39.1	115.0	0.2752	9.57	173.9	0.6565	0.2853	13.30
IRP014	1.150	4.782	4.786	53.2	117.8	0.2350	12.69	329.0	0.8943	0.5845	15.58
IRP015	0.754	3.457	8.206	75.9	50.7	0.7163	8.79	22.6	1.3161	0.4976	12.87
IRP016	1.048	5.450	4.212	37.3	140.3	0.2668	16.17	189.7	0.8522	0.4324	18.44

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued).

Ident.	Eu(ppm)	Fe(%)	Hf(ppm)	Ni(ppm)	Rb(ppm)	Sb(ppm)	Sc(ppm)	Sr(ppm)	Ta(ppm)	Tb(ppm)	Th(ppm)
IRP017	0.825	9.114	3.807	65.6	99.3	0.1996	19.12	103.4	0.6947	0.3310	8.87
IRP018	1.062	4.248	5.029	57.3	116.0	0.2992	11.89	193.7	1.0254	0.4866	15.16
IRP022	1.057	4.919	5.016	51.8	82.9	0.3747	13.39	133.5	0.7475	0.6024	9.22
IRP023	1.070	4.425	4.563	50.4	127.0	0.2036	10.73	181.2	1.0309	0.4509	13.98
IRP024	1.170	3.711	5.860	51.3	79.7	0.2786	12.69	101.0	0.8749	0.6577	10.19
IRP025	1.448	4.904	3.788	73.9	101.3	0.2654	22.13	212.7	0.8383	0.5530	13.92
IRP026	0.792	4.219	3.312	67.6	73.2	0.2449	10.93	326.8	0.5921	0.2600	7.99
IRP027	1.157	4.133	5.540	71.9	104.4	0.4049	12.43	159.3	1.0049	0.6316	7.72
IRP028	1.591	5.181	4.545	71.4	115.6	0.2772	14.12	263.0	1.1032	0.6340	15.40
IRP029	1.304	4.767	4.912	35.4	93.4	0.3895	15.31	284.5	0.8327	0.5532	11.52
IRP030	0.766	2.185	5.582	0.0	67.4	0.4579	7.02	42.0	0.9765	0.6303	10.33
IRP031	1.393	5.722	4.293	107.0	80.1	0.3139	18.68	201.4	0.8037	0.8948	8.96
IRP032	1.179	4.531	4.563	108.6	115.4	0.3626	12.08	299.2	0.7947	0.5236	14.64
IRP033	1.081	3.322	4.222	0.0	113.3	0.2393	9.98	187.2	0.7827	0.5616	10.02
IRP034	1.029	3.537	4.531	0.0	133.3	0.3645	11.91	120.6	0.8594	0.6380	12.01
IRP035	1.036	4.931	3.985	69.7	88.4	0.3320	14.59	210.8	0.7148	0.5393	8.88
IRP036	1.366	5.552	5.285	61.8	80.5	0.4748	15.68	306.8	0.9782	0.7256	6.96
IRP037	1.286	5.069	5.210	107.3	87.8	0.6180	17.51	144.2	0.6440	0.6919	7.69
IRP042	1.260	3.926	4.690	0.0	151.2	0.4910	12.87	211.2	0.8651	0.8484	18.37
IRP043	1.197	5.641	4.969	73.3	85.2	0.5644	17.20	88.7	0.7906	0.7067	8.43
IRP044	1.099	5.078	4.675	56.2	92.9	0.5897	16.41	65.6	0.8065	0.5992	8.85
IRP045	1.067	4.955	4.521	0.0	147.5	0.2882	14.33	256.6	0.9620	0.5974	18.39
IRP046	0.926	4.845	5.335	42.1	104.1	0.3896	13.93	291.9	0.7097	0.4707	9.21
IRP047	1.043	2.941	3.014	37.6	90.2	0.1992	7.10	182.8	0.6369	0.4969	8.27
IRP048	1.043	4.238	4.118	61.2	81.6	0.2529	11.08	307.7	0.6160	0.4509	9.67
IRP049	1.101	4.177	4.337	85.5	65.4	0.3031	14.99	239.2	0.7081	0.5015	8.35
IRP050	0.931	3.770	4.933	50.3	106.2	0.3416	11.73	119.9	0.6831	0.4998	12.55
IRP051	1.234	3.647	8.932	0.0	115.9	0.2389	10.57	165.4	0.8539	0.7897	7.49
IRP052	0.841	3.264	3.545	46.6	94.4	0.1116	8.44	526.8	0.5228	0.3161	6.81
IRP053	0.917	3.350	8.258	0.0	97.5	0.0994	9.65	297.1	0.7493	0.4340	6.95

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued).

Ident.	Eu(ppm)	Fe(%)	Hf(ppm)	Ni(ppm)	Rb(ppm)	Sb(ppm)	Sc(ppm)	Sr(ppm)	Ta(ppm)	Tb(ppm)	Th(ppm)
IRP054	0.588	1.238	4.866	0.0	70.4	0.4849	2.79	57.7	0.4378	0.4634	4.52
IRP055	1.166	4.199	4.660	0.0	115.3	0.1439	8.62	252.5	0.6973	0.3613	6.30
IRP056	1.459	3.470	5.169	63.0	97.6	0.2332	11.68	466.2	0.7228	0.5176	10.49
IRP057	1.248	4.782	4.111	0.0	106.1	0.2581	12.65	294.4	0.7831	0.4803	10.45
IRP058	1.076	4.430	4.280	35.0	100.4	0.5773	14.23	88.9	0.6450	0.5110	11.37
IRP059	1.095	4.390	5.582	51.3	74.4	0.4442	13.60	202.3	0.7607	0.5865	7.14
IRP061	1.410	4.001	8.412	26.1	131.4	0.1353	11.15	181.6	0.5971	0.6889	11.76
IRP062	1.690	7.047	5.026	162.0	71.7	0.2239	22.37	348.2	1.0874	0.6206	7.62
IRP063	1.051	4.184	5.099	46.9	77.7	0.4273	12.66	260.3	0.7423	0.5337	9.12
IRP064	1.005	4.096	4.097	39.5	132.8	0.3066	12.68	216.6	0.8007	0.4441	14.32
IRP065	1.267	3.636	5.255	51.4	200.1	0.2518	10.52	203.0	0.8325	0.6459	16.19
IRP066	1.394	4.206	4.911	40.4	116.7	0.6276	12.43	209.4	0.8325	0.9034	13.81
IRP067	0.950	2.210	5.094	25.5	106.4	0.2165	7.03	149.7	0.5471	0.5504	9.74
IRP068	1.095	3.327	4.643	36.6	73.3	0.6025	9.27	136.9	0.8475	0.5935	9.73
IRP069	0.953	2.199	6.466	0.0	88.9	0.5457	9.79	130.4	1.0279	0.6079	12.95
IRP070	1.374	2.423	5.771	42.3	53.2	0.4681	9.44	351.2	0.8674	0.7451	10.32
IRP071	0.908	1.906	5.571	18.2	101.1	0.4087	8.26	146.6	0.8728	0.5494	18.98
IRP072	0.682	2.451	5.151	0.0	103.5	0.1650	7.23	178.8	0.6271	0.4025	18.57
IRP073	1.023	3.555	5.565	43.3	126.8	0.2880	12.45	165.3	0.8503	0.4649	12.26
IRP074	1.115	3.418	5.126	0.0	108.9	0.2830	9.71	155.6	0.6537	0.5896	10.75
IRP075	1.010	3.729	4.558	47.0	78.8	0.6311	9.24	187.6	0.8980	0.4882	10.22
IRP076	1.139	3.209	7.925	38.0	88.5	0.7871	10.56	80.2	1.2693	0.7062	13.14
IRP077	1.201	4.861	5.276	0.0	121.6	0.2429	16.20	101.7	0.6469	0.6631	10.78
IRP078	1.465	3.861	6.285	63.8	62.9	0.6765	14.57	135.5	0.9216	0.8373	11.56
IRP079	1.234	3.671	4.810	0.0	95.9	0.2432	12.95	194.2	0.7287	0.6192	9.17
IRP080	1.525	4.975	6.398	58.6	68.2	1.0368	12.47	140.6	1.2516	0.8661	13.13
IRP081	1.426	2.798	7.057	36.4	78.9	0.5445	8.51	137.9	0.8894	0.7973	13.33
IRP082	1.310	3.719	6.724	67.1	75.0	0.4907	10.57	165.9	1.0384	0.8102	13.27
IRP083	0.884	3.135	5.009	0.0	105.8	0.2638	9.55	170.9	0.6384	0.4693	10.35
IRP084	1.642	5.377	6.855	40.6	70.3	0.7147	17.47	58.7	1.0130	0.9719	9.95
IRP085	0.986	7.496	4.072	0.0	116.1	0.7575	25.97	52.4	0.6701	0.9442	18.45

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued).

Ident.	Eu(ppm)	Fe(%)	Hf(ppm)	Ni(ppm)	Rb(ppm)	Sb(ppm)	Sc(ppm)	Sr(ppm)	Ta(ppm)	Tb(ppm)	Th(ppm)
IRP086	1.116	10.090	2.810	123.0	67.4	1.2034	25.67	0.0	0.5012	1.0106	1.08
IRP087	1.805	8.005	6.879	0.0	113.0	0.8514	24.68	59.6	0.9146	1.1468	24.09
IRP088	1.457	7.209	4.655	55.3	93.0	0.6782	26.75	53.8	0.7250	1.2250	17.60
IRP089	0.583	9.692	2.788	149.8	52.7	0.9699	24.23	66.7	0.5495	0.7281	1.24
IRP090	2.855	3.616	5.202	49.6	105.5	0.4366	19.93	39.2	0.7804	1.6202	21.13
IRP091	0.905	3.417	6.294	0.0	129.6	0.4385	13.26	71.1	0.9359	0.6102	17.91
IRP092	1.204	6.304	5.480	0.0	114.7	0.6395	16.49	156.7	1.1639	0.6218	19.27
IRP093	1.043	6.452	5.503	0.0	123.8	0.8631	21.84	0.0	0.6994	0.6242	20.68
IRP094	1.680	6.551	4.913	76.3	100.2	0.6419	24.20	193.5	0.7289	1.2379	17.98
IRP095	1.154	4.079	4.038	67.6	96.4	0.2414	13.79	228.6	0.5199	0.5274	6.18
IRP096	1.177	3.669	6.801	0.0	125.1	0.4121	15.47	301.2	0.8198	0.7151	17.44
IRP097	1.449	4.925	7.218	0.0	104.4	0.7058	16.32	76.5	0.9725	0.9421	19.94
IRP098	2.176	2.076	6.499	32.6	83.5	0.3126	15.44	210.4	0.6825	1.1815	14.18
IRP099	2.126	1.741	6.370	22.4	106.0	0.3868	15.23	127.8	0.9139	1.4710	17.41
IRP100	0.921	3.597	6.130	0.0	135.9	0.3177	10.28	69.5	0.7852	0.5232	19.54
IRP101	1.656	4.349	7.210	0.0	110.4	0.4102	17.75	112.6	0.9237	1.0585	24.82
IRP102	0.927	3.946	3.452	32.7	111.9	0.1883	11.22	388.3	0.7359	0.4010	12.14
IRP103	1.895	2.563	5.909	0.0	91.3	0.3541	16.71	266.9	0.7474	0.9771	14.26
IRP104	1.844	2.484	5.686	0.0	95.3	0.3032	15.57	335.4	0.7175	0.9813	13.72
IRP105	3.640	3.593	8.535	92.3	91.1	0.7537	22.44	65.0	1.0112	2.3345	26.69
IRP106	0.830	2.757	4.000	34.0	113.1	0.2283	8.27	222.0	0.6529	0.3798	9.17
IRP107	0.956	3.009	3.951	0.0	103.1	0.3531	9.22	207.1	0.6482	0.5150	15.16
IRP108	0.910	2.840	4.408	35.8	117.6	0.1873	8.13	240.0	0.7704	0.4048	10.07

Ident.	Zn(ppm)	Zr(ppm)	Al(%)	Ba(ppm)	Ca(%)	Dy(ppm)	K(%)	Mn(ppm)	Na(%)	Ti(%)	V(ppm)
IRP001	62.42	130.4	6.523	342.0	1.371	3.570	1.735	449.6	1.336	0.4128	150.4
IRP002	88.05	125.1	7.489	258.1	3.896	3.583	1.473	772.3	1.840	0.7859	235.1
IRP003	51.57	109.2	6.546	226.3	5.357	3.095	1.502	872.7	1.790	0.6567	173.0
IRP004	76.00	109.4	9.237	532.1	0.873	2.819	2.323	639.1	1.734	0.2064	145.5

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued).

Ident.	Zn(ppm)	Zr(ppm)	Al(%)	Ba(ppm)	Ca(%)	Dy(ppm)	K(%)	Mn(ppm)	Na(%)	Ti(%)	V(ppm)
IRP005	0.00	146.5	8.648	751.6	0.687	1.949	2.335	493.1	0.995	0.3413	179.8
IRP006	115.52	167.7	8.902	720.4	0.623	3.244	2.183	1294.0	0.964	0.3117	161.0
IRP007	84.52	117.7	8.616	687.4	0.883	1.796	2.368	320.0	1.334	0.3565	147.9
IRP008	56.02	130.5	7.425	641.8	0.944	2.361	2.319	387.7	1.352	0.2355	88.6
IRP009	83.12	118.2	8.784	731.0	1.030	1.888	2.535	652.1	1.712	0.2597	129.2
IRP010	86.58	114.2	8.614	593.6	0.725	2.027	2.186	509.3	1.070	0.2853	145.6
IRP011	81.92	90.4	7.618	705.9	0.902	4.595	2.548	271.1	1.532	0.2439	115.3
IRP012	0.00	129.6	8.451	523.3	1.022	2.287	2.319	446.1	1.209	0.3424	110.6
IRP013	56.87	137.7	7.381	461.8	0.363	1.634	2.124	633.5	1.400	0.2521	99.4
IRP014	84.04	148.4	7.775	664.6	1.508	2.165	2.635	819.1	1.609	0.3259	112.2
IRP015	0.00	212.1	4.945	264.2	0.290	3.635	1.086	351.9	0.357	0.4677	85.9
IRP016	82.37	111.5	8.877	366.0	1.706	3.064	2.832	814.9	1.422	0.4000	123.8
IRP017	72.37	96.9	8.155	274.7	1.633	1.929	1.759	1019.1	1.445	0.3581	183.6
IRP018	0.00	149.3	7.371	539.6	0.748	2.400	2.581	463.0	1.565	0.2853	101.0
IRP022	96.06	200.6	7.090	324.9	0.873	2.399	1.448	1666.1	1.169	0.1944	64.0
IRP023	0.00	113.2	7.845	522.2	0.819	2.545	3.109	430.9	1.709	0.2920	115.8
IRP024	135.86	160.8	7.238	509.2	0.000	2.910	2.094	2079.8	0.700	0.1934	78.4
IRP025	65.98	91.0	7.959	469.9	2.865	3.591	2.163	970.0	1.327	0.3701	123.4
IRP026	44.46	96.9	8.151	357.1	1.561	1.108	1.576	420.2	2.304	0.2709	103.7
IRP027	284.69	124.6	7.535	899.9	0.769	3.004	2.615	1091.7	1.367	0.1944	94.2
IRP028	0.00	132.6	8.818	481.9	1.141	2.774	2.614	881.0	1.632	0.3251	95.9
IRP029	127.49	128.4	7.620	729.8	0.959	3.301	2.470	629.4	1.341	0.2968	107.0
IRP030	85.28	146.7	5.960	333.4	0.411	3.021	1.564	391.9	1.444	0.2812	50.8
IRP031	91.11	113.2	8.083	387.7	2.286	3.440	1.658	964.8	1.610	0.3577	133.1
IRP032	104.47	136.5	7.559	684.1	1.517	2.590	2.873	911.9	1.514	0.2817	103.9
IRP033	70.01	102.7	7.214	708.3	1.345	3.270	2.738	710.2	1.639	0.2448	85.5
IRP034	0.00	145.4	7.033	333.2	1.006	2.781	2.880	706.7	1.608	0.3299	53.1
IRP035	0.00	106.6	8.658	299.0	0.000	3.209	1.994	699.0	1.678	0.3740	126.4
IRP036	0.00	125.0	6.657	370.8	1.617	4.010	1.716	889.9	1.411	0.6924	162.5
IRP037	77.65	133.3	7.797	231.1	2.771	3.385	2.553	945.6	1.428	0.3793	150.9

Table 72. Element concentrations in ceramic samples from Isle Royale National Park (continued).

Ident.	Zn(ppm)	Zr(ppm)	Al(%)	Ba(ppm)	Ca(%)	Dy(ppm)	K(%)	Mn(ppm)	Na(%)	Ti(%)	V(ppm)
IRP042	108.72	136.2	9.685	740.5	0.753	3.083	3.298	760.3	1.259	0.2010	144.2
IRP043	62.48	131.4	7.367	479.2	1.724	3.771	1.673	765.4	1.120	0.5223	148.3
IRP044	74.66	119.5	8.262	466.9	1.430	3.773	2.303	479.4	1.277	0.3847	125.3
IRP045	0.00	112.7	8.507	552.3	1.034	2.999	2.923	615.4	1.319	0.2440	107.7
IRP046	218.71	113.3	7.447	1739.8	1.595	2.775	3.078	739.0	1.356	0.3503	94.6
IRP047	35.41	84.7	7.260	725.8	1.457	2.396	2.661	246.5	1.751	0.2672	57.8
IRP048	0.00	84.2	8.075	324.8	1.532	2.782	1.702	447.7	1.837	0.2960	80.3
IRP049	0.00	120.3	8.053	544.0	1.921	2.829	1.548	603.2	1.974	0.3359	148.6
IRP050	0.00	110.7	6.917	285.9	1.253	2.170	2.490	586.7	1.538	0.3102	69.5
IRP051	73.37	250.5	7.158	602.8	0.996	3.240	2.548	643.1	1.571	0.3666	78.4
IRP052	67.47	86.9	8.175	656.5	1.164	1.343	1.977	441.0	2.559	0.1725	80.2
IRP053	48.14	230.7	8.495	936.8	1.304	2.399	2.211	409.1	1.723	0.4450	66.1
IRP054	15.09	137.2	2.679	373.8	0.587	2.960	2.135	177.6	0.286	0.2192	29.6
IRP055	68.74	110.1	7.661	1312.9	0.797	2.390	3.813	307.6	1.344	0.4629	83.0
IRP056	114.01	138.8	7.351	702.2	1.915	2.475	2.084	486.7	2.278	0.3049	116.1
IRP057	0.00	133.8	8.229	620.4	1.816	2.792	2.550	765.6	1.780	0.3509	124.6
IRP058	104.96	105.2	7.400	698.6	1.320	3.245	2.732	570.9	1.185	0.4102	108.7
IRP059	69.80	132.7	6.609	591.5	1.468	3.313	2.058	702.3	1.493	0.4359	128.8
IRP061	103.55	174.0	7.531	959.8	1.149	3.931	3.609	740.8	1.214	0.3492	74.3
IRP062	184.13	119.1	6.672	719.8	4.201	3.536	1.705	1013.5	1.285	0.8326	197.9
IRP063	80.63	134.1	6.691	470.1	1.777	3.319	1.956	650.2	1.550	0.4018	106.6
IRP064	90.13	93.6	7.509	572.2	1.450	2.421	2.446	425.2	1.655	0.2780	90.5
IRP065	96.00	126.1	7.937	1010.5	1.760	3.890	3.047	301.3	1.227	0.2924	64.5
IRP066	86.17	119.1	8.616	702.5	1.396	4.237	2.934	425.8	1.318	0.2951	84.7
IRP067	68.77	122.4	6.067	512.6	1.229	3.110	2.966	474.7	0.870	0.2500	46.1
IRP068	93.65	119.1	7.890	384.8	3.886	3.354	1.492	442.5	0.954	0.3462	77.2
IRP069	69.78	147.9	7.657	602.8	1.015	4.155	2.133	182.8	0.725	0.3724	64.4
IRP070	75.60	146.9	6.437	456.6	1.759	4.104	1.428	501.2	1.441	0.3049	65.8
IRP071	57.73	117.6	7.413	681.3	1.172	3.363	2.330	184.4	0.827	0.3248	53.5
IRP072	77.80	118.5	6.901	956.6	1.429	2.222	2.747	425.0	0.862	0.2625	54.5

TABLE 73: PRINCIPAL COMPONENTS ANALYSIS FOR LOGGED DATA ON ALL 100 SPECIMENS

Principal Components Analysis Based on the File: llyntot

Analysis Based on Variance-Covariance Matrix

Eigenvalues and Percentage of Variance Explained:

0.1880	36.04
0.1090	20.90
0.07483	14.34
0.04105	7.869
0.02959	5.672
0.02500	4.793
0.01260	2.415
0.00963	1.846
0.007584	1.454
0.005178	0.9925
0.004536	0.8695
0.003734	0.7157
0.003134	0.6008
0.002641	0.5062
0.001917	0.3675
0.001803	0.3456
0.0007256	0.1391
0.0005134	0.09841
0.0001995	0.03824

Principal Component Coefficients (largest to smallest):

	PC01	PC02	PC03	PC04	PC05	PC06	PC07	PC08	PC09	PC10	PC11	PC12	PC13	PC14	PC15	PC16	PC17	PC18	PC19
LA	0.1479	-0.2442	0.0864	0.1035	-0.0455	-0.1991	-0.3432	-0.3143	0.3097	-0.1127	-0.0245	0.0550	0.0480	-0.0598	0.0451	0.0416	0.7051	0.0095	0.1514
LU	0.2622	-0.1061	-0.1055	0.1389	0.0074	-0.0261	0.1625	0.2672	-0.1368	-0.1279	0.0476	0.1799	0.3688	0.2627	0.1111	-0.2769	0.0087	-0.3270	0.5660
SM	0.2585	-0.1879	0.0450	0.2153	-0.0065	-0.0473	-0.1126	-0.2087	-0.0242	0.1720	0.0308	0.0031	-0.0284	0.0688	0.3687	0.1702	-0.2108	-0.6209	-0.3993
YB	0.2589	-0.1163	-0.0842	0.1458	-0.0153	-0.0233	0.1634	0.2535	-0.0935	-0.1464	0.0174	0.2019	0.3721	0.1339	-0.0057	-0.0917	0.2050	0.3464	-0.6334
CE	0.1430	-0.2107	0.0988	0.0230	0.0107	-0.1922	-0.2907	-0.1803	0.3197	-0.2559	-0.1080	0.1165	0.0093	-0.0032	-0.2624	-0.4545	-0.5370	0.1090	-0.0461
CS	0.2022	-0.1161	0.2733	-0.4465	-0.0411	0.1042	-0.0663	-0.3142	-0.4695	0.1943	-0.2371	-0.1298	0.4055	-0.1240	-0.2054	-0.0415	0.0189	-0.0236	0.0088
EU	0.2176	-0.1166	0.0867	0.3225	-0.0410	0.0617	-0.0540	-0.1429	0.0114	0.1436	0.0578	-0.1419	0.1931	0.0467	0.2971	0.3963	-0.3078	0.5431	0.2828
FE	0.1188	0.3244	0.2650	-0.0905	-0.1069	0.1521	-0.0744	-0.0554	0.0760	-0.5860	0.3235	-0.2744	0.1422	0.2757	-0.1694	0.2836	-0.0299	-0.1448	-0.0525
RB	-0.0337	-0.1572	0.2244	-0.2101	0.1055	0.1505	0.0257	-0.0971	-0.2630	-0.3728	0.1949	0.6113	-0.2258	-0.2261	0.3027	0.0957	-0.0522	0.0858	0.0548
SB	0.3497	0.1475	-0.2642	-0.3782	-0.2591	-0.2360	-0.4806	0.4147	-0.0993	-0.0383	-0.1106	-0.0332	-0.1625	-0.0566	0.2011	0.1244	-0.0501	0.0640	0.0224
SC	0.2384	0.2005	0.2565	0.0554	-0.1678	0.1798	0.0538	-0.1183	-0.1301	0.0818	0.1325	-0.2524	-0.3531	0.1513	0.3342	-0.5859	0.1418	0.1686	-0.0288
TB	0.3355	-0.0667	-0.0679	0.2238	0.0374	0.0248	-0.0418	-0.0707	-0.3100	0.1301	0.0322	0.2062	-0.4602	0.3224	-0.5540	0.1812	0.0512	0.0324	0.0622
TH	0.1414	-0.4608	0.3119	-0.3403	-0.0931	-0.2038	0.4845	0.2124	0.2651	-0.0045	-0.1116	-0.1756	-0.2361	0.1719	0.0157	0.1574	-0.0030	0.0098	0.0243
BA	-0.0445	-0.3192	0.1340	-0.0119	0.3029	0.6629	-0.3826	0.3823	0.1319	0.0627	-0.0871	-0.1077	-0.0260	0.0939	-0.0145	-0.0230	0.0492	-0.0289	-0.0201
DY	0.3215	-0.1667	-0.1272	0.2062	-0.0697	0.1281	0.1698	0.1221	-0.0394	-0.1536	0.2256	-0.2843	-0.0757	-0.7311	-0.1947	-0.0321	0.0034	-0.0896	0.0324
MN	0.2599	0.3767	0.3578	0.0973	0.6870	-0.2777	0.0278	0.1608	0.0246	0.0102	-0.2161	-0.0140	-0.0228	-0.1586	0.0335	0.0392	0.0340	-0.0071	0.0148
NA	-0.3443	-0.0910	0.4876	0.4017	-0.3543	-0.2329	-0.1821	0.3121	-0.3253	-0.0937	-0.1856	-0.0456	-0.0148	-0.0793	-0.0564	0.0105	0.0079	-0.0529	-0.0042
TI	0.1547	0.2217	-0.0609	0.1360	-0.2637	0.3544	0.1976	-0.1072	0.1563	-0.2276	-0.7330	0.1459	-0.0718	-0.0644	0.0502	0.0947	0.0079	-0.0539	0.0224
V	0.1567	0.2668	0.3445	-0.0469	-0.3204	0.1289	0.0003	0.1613	0.3677	0.4477	0.2486	0.4125	0.1359	-0.1471	-0.1607	0.0263	-0.0170	-0.0585	0.0156

TABLE 74: FINAL GROUP ASSIGNMENTS AND OTHER DATA FOR ENTIRE ISLE ROYALE AREA DATA SET.

Record#	ANAL. I.D.	TYPE	SITE	ZONE	CHEMICAL GROUP	STANDARDIZED PRINCIPAL COMPONENT SCORES PC1	PC2	PC3	PC4
1	IRP001	Clay sample	Chippewa Harbor	ISLE ROYALE	ISLE ROYAL	-0.1200	0.6000	-0.5200	0.8100
2	IRP002	Clay sample	Moskey Narrows	ISLE ROYALE	ISLE ROYAL	0.4900	1.7300	0.3400	2.1500
3	IRP003	Clay sample	Beaver Island	ISLE ROYALE		-0.3700	2.1800	-0.2000	2.8200
4	IRP004	Blackduck	21SL23	VOYAGEURS	THUN/VOYAG	-0.2100	-0.3600	0.9700	-0.3000
5	IRP005	Blackduck	21SL23	VOYAGEURS		-0.1100	0.1100	0.9100	-2.0200
6	IRP006	Blackduck	21SL23	VOYAGEURS		0.4700	0.0500	1.1400	-0.1800
7	IRP007	Blackduck	21SL23	VOYAGEURS		-1.1500	0.2100	0.5000	-2.0800
8	IRP008	Blackduck	21SL23	VOYAGEURS		-1.0100	-0.4500	-0.1500	-0.4400
9	IRP009	Blackduck	21SL23	VOYAGEURS	THUN/VOYAG	-0.7500	-0.2400	1.1200	-0.8300
10	IRP010	Blackduck	21SL23	VOYAGEURS		-0.5200	0.1500	0.6200	-1.7000
11	IRP011	Blackduck	21SL23	VOYAGEURS	THUN/VOYAG	-0.8700	-0.2200	0.3800	-1.3600
12	IRP012	Blackduck	21SL23	VOYAGEURS	THUN/VOYAG	0.0400	-0.4300	0.3800	-1.0600
13	IRP013	Blackduck	21SL23	VOYAGEURS		-1.3400	0.2900	0.3900	-1.3600
14	IRP014	Juntunen	Dd Ir-1	THUNDER BAY	THUN/VOYAG	-0.3100	-0.2500	1.3200	0.1000
15	IRP015	Blackduck	De Ip-3	THUNDER BAY		0.3100	0.3700	-2.2500	-1.7500
16	IRP016	Blackduck	Dl Iq-15	THUNDER BAY		-0.1300	0.2500	1.2500	-0.5200
17	IRP017	Blackduck	Di Jf-4	THUNDER BAY		-0.9500	2.1100	1.3700	-0.6000
18	IRP018	Blackduck	De Ip-3	THUNDER BAY	THUN/VOYAG	-0.5900	-0.3400	0.7000	-0.6600
19	IRP022	Blackduck	Knudson Collection	THUNDER BAY	ISLE ROYAL	0.1000	0.6800	0.1400	0.4800
20	IRP023	Blackduck	De Ip-3	THUNDER BAY	THUN/VOYAG	-0.8000	-0.3800	0.9400	-0.3300
21	IRP024	Blackduck	De Ik-3	THUNDER BAY		0.2800	0.4100	0.0200	0.6900
22	IRP025	Blackduck	Dk Im-8	THUNDER BAY		0.2600	0.1500	1.2800	0.5200
23	IRP026	Blackduck	Db Jx-1	THUNDER BAY		-1.9100	0.9800	0.4100	-0.6300
24	IRP027	Blackduck	De Ip-2	THUNDER BAY		-0.0600	0.1100	0.3600	0.4200
25	IRP028	Blackduck	De Iu-3	THUNDER BAY	THUN/VOYAG	0.2300	-0.4100	1.2600	0.5900
26	IRP029	Blackduck	De Iu-3	THUNDER BAY		0.0200	-0.1200	0.5300	0.0600
27	IRP030	Juntunen	De Ik-1	THUNDER BAY	JUNTUNEN-1	-0.6800	-0.3600	-1.4200	-0.1000
28	IRP031	Juntunen	20IR142, Belle Isle #2	ISLE ROYALE		0.2300	0.8100	0.6900	1.3000
29	IRP032	Juntunen	20IR134, Mott Sauna Beach	ISLE ROYALE	THUN/VOYAG	-0.0600	-0.2800	1.0400	-0.2300
30	IRP033	Juntunen	20IR114, Lone Tree Cove	ISLE ROYALE	JUNTUNEN-1	-0.5000	-0.4100	0.4200	0.5000
31	IRP034	Juntunen	20IR114, Lone Tree Cove	ISLE ROYALE	JUNTUNEN-1	-0.2500	-0.1600	0.1800	-0.2600
32	IRP035	Juntunen	20IR45, Daisy Farm	ISLE ROYALE	ISLE ROYAL	-0.2800	0.8800	0.2600	0.6300
33	IRP036	Juntunen	20IR18, Card Point	ISLE ROYALE	ISLE ROYAL	0.5300	1.1800	0.1400	1.2500
34	IRP037	Clay sample	GRPO, near Great Hall/Kitchen	MINNESOTA	ISLE ROYAL	0.4700	1.2500	0.1300	0.5700
35	IRP042	Blackduck	20IR111, Rock Hbr. Lighthouse	ISLE ROYALE		0.5500	-0.9100	1.1900	-0.7600
36	IRP043	Blackduck	20IR124, Lake Ritchie #1	ISLE ROYALE	ISLE ROYAL	0.5900	0.8900	0.0300	0.3400
37	IRP044	Blackduck	20IR29, Belle Isle #1	ISLE ROYALE	ISLE ROYAL	0.1500	0.5500	-0.1400	-0.3000
38	IRP045	Blackduck	20IR45, Daisy Farm	ISLE ROYALE	THUN/VOYAG	-0.1500	-0.4500	1.0200	-0.6200
39	IRP046	Blackduck	20IR1, Chippewa Hbr. #1	ISLE ROYALE		-0.5400	0.2000	0.4100	-0.2800
40	IRP047	Huron	20IR127, Chippewa Hbr. #3	ISLE ROYALE		-1.5200	-0.6800	-0.7500	0.6800
41	IRP048	Huron	20IR147, Brady Cove #1	ISLE ROYALE	ISLE ROYAL	-0.9300	0.1900	-0.0500	0.6800
42	IRP049	Huron	20IR142, Belle Isle #2	ISLE ROYALE	ISLE ROYAL	-0.7000	0.7800	0.2300	1.2300
43	IRP050	Huron	20IR45, Daisy Farm	ISLE ROYALE	ISLE ROYAL	-0.7700	0.3700	-0.2000	-0.0200
44	IRP051	Huron	20IR142, Belle Isle #2	ISLE ROYALE		-0.2200	-0.1600	-0.1300	1.5500
45	IRP052	Huron	20IR29, Belle Isle #1	ISLE ROYALE		-2.4200	0.2000	0.6200	0.2700
46	IRP053	Huron	20IR17, Grace Island	ISLE ROYALE	ISLE ROYAL	-1.5400	-0.0800	-0.1000	1.2500
47	IRP054	Clay sample	APIS, Outer Island	ISLE ROYALE		-1.5200	-0.2000	-5.0700	-0.6100
48	IRP055	Lalonde High Collar	20IR52, Baker Point	ISLE ROYALE	ISLE ROYAL	-1.5100	0.0200	-0.3100	0.5500
49	IRP056	Juntunen	20IR1, Chippewa Hbr.	ISLE ROYALE		-0.6400	-0.5200	0.8300	1.1400
50	IRP057	Blackduck	20IR72, Cove	ISLE ROYALE		-0.3800	0.1500	1.0600	0.3700

Record#	ANAL. I.D.	TYPE	SITE	ZONE	CHEMICAL GROUP	PC1	PC2	PC3	PC4
51	IRP058	Blackduck	20IR72, Cove	ISLE ROYALE		0.1100	0.0800	0.0800	-0.5700
52	IRP059	Juntunen	20IR1, Chippewa Hbr.	ISLE ROYALE	ISLE ROYAL	-0.2100	0.8500	-0.2700	1.1100
53	IRP061	Huron	20IR28, Indian Point	ISLE ROYALE		-0.1700	-0.8600	0.5600	1.5100
54	IRP062	Blackduck	20IR72, Cove	ISLE ROYALE		0.3400	1.1500	1.1000	1.7400
55	IRP063	Juntunen	20IR1	ISLE ROYALE	ISLE ROYAL	-0.2600	0.4900	-0.1900	0.8200
56	IRP064	Juntunen	20IR1	ISLE ROYALE	THUN/VOYAG	-0.7400	-0.4000	0.7300	-0.9000
57	IRP065	Juntunen	20MK1	BOIS BLANC		-0.1200	-1.8100	0.3300	-0.3000
58	IRP066	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-2	0.5000	-0.9000	-0.1400	0.1200
59	IRP067	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-1	-0.9100	-0.6400	-1.2500	0.3800
60	IRP068	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-1	-0.0100	-0.0300	-1.0900	-0.3600
61	IRP069	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-1	-0.2200	-1.0000	-1.9600	-0.6300
62	IRP070	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-2	0.0700	-0.6300	-0.9500	1.2100
63	IRP071	Juntunen	20MK1	BOIS BLANC		-0.4600	-1.7300	-1.5100	-0.6700
64	IRP072	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-1	-1.4200	-0.9000	-0.6100	-0.6800
65	IRP073	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-1	-0.7100	-0.4400	0.2300	-0.3600
66	IRP074	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-1	-0.5900	-0.8800	-0.4700	0.4000
67	IRP075	Mackinac	20MK1	BOIS BLANC	JUNTUNEN-1	-0.2700	-0.2600	-1.2700	-0.6900
68	IRP076	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-2	0.7300	-0.4400	-1.3400	-0.7800
69	IRP077	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-1	0.2100	-0.0300	0.2400	0.4700
70	IRP078	Juntunen	20MK1	BOIS BLANC	JUNTUNEN-2	1.0100	-0.5400	-0.8000	0.4900
71	IRP079	Mackinac	20MK1	BOIS BLANC	JUNTUNEN-1	-0.0400	-0.1600	-0.3200	0.9000
72	IRP080	Mackinac	20MK1	BOIS BLANC		1.7000	-0.1300	-1.0600	-0.8700
73	IRP081	Mackinac	20MK1	BOIS BLANC	JUNTUNEN-2	0.8700	-0.7900	-1.2200	0.0100
74	IRP082	Mackinac	20MK1	BOIS BLANC	JUNTUNEN-2	0.7800	-0.2300	-0.8200	0.0700
75	IRP083	Mackinac	20MK1	BOIS BLANC	JUNTUNEN-1	-0.9100	-0.6300	-0.9500	-0.4100
76	IRP084	Mackinac	20MK1	BOIS BLANC	SAND POINT	1.8700	0.9400	-0.8300	0.2900
77	IRP085	Sand Point	20BG14	SAND POINT	SAND POINT	1.4300	0.9600	1.1600	-2.3700
78	IRP086	Sand Point	20BG14	SAND POINT	SAND POINT	1.2500	3.9000	-1.8100	0.5100
79	IRP087	Sand Point	20BG14	SAND POINT	SAND POINT	2.2700	0.1600	0.5300	-0.7700
80	IRP088	Sand Point	20BG14	SAND POINT	SAND POINT	1.9400	0.8500	0.9800	-0.5500
81	IRP089	Sand Point	20BG14	SAND POINT	SAND POINT	0.5700	4.7400	-2.3800	-1.5700
82	IRP090	Sand Point	20BG14	SAND POINT	SAND POINT	2.3000	-1.3700	-0.0900	0.3400
83	IRP091	Sand Point	20BG14	SAND POINT		0.0600	-1.0500	-0.8000	-1.1300
84	IRP092	Sand Point	20BG14	SAND POINT		0.8800	0.0200	0.6600	-1.3900
85	IRP093	Sand Point	20BG14	SAND POINT	SAND POINT	1.5600	1.0600	0.7800	-2.3800
86	IRP094	Sand Point	20BG14	SAND POINT	SAND POINT	1.7900	0.3300	1.1300	-0.3800
87	IRP095	Juntunen	20IR41	ISLE ROYALE	ISLE ROYAL	-0.6200	0.7600	-0.1600	1.5000
88	IRP096	Oneota	20KE15	KEWEENAW		0.7400	-0.2800	0.2100	-0.5800
89	IRP097	Oneota	20KE15	KEWEENAW		1.7100	-0.4000	-0.6800	-1.4600
90	IRP098	Oneota	20KE15	KEWEENAW	KEWEENAW	1.0100	-1.5300	-0.4400	1.8200
91	IRP099	Oneota	20KE15	KEWEENAW	KEWEENAW	1.6700	-1.7700	-0.8500	0.4000
92	IRP100	Oneota	20KE15	KEWEENAW		0.2000	0.0800	1.4500	-0.5400
93	IRP101	Oneota	20KE15	KEWEENAW	KEWEENAW	1.2400	-1.2100	0.6100	0.3300
94	IRP102	Oneota	20KE15	KEWEENAW		-1.2500	-0.1200	1.2700	-0.0700
95	IRP103	Oneota	20KE15	KEWEENAW	KEWEENAW	0.8200	-1.1900	-0.1800	1.2200
96	IRP104	Oneota	20KE15	KEWEENAW	KEWEENAW	0.6100	-1.0300	0.1500	1.6900
97	IRP105	Oneota	20KE15	KEWEENAW		3.2300	-1.9300	-0.5600	1.2800
98	IRP106	Juntunen	20KE15	KEWEENAW	JUNTUNEN-1	-1.4100	-0.4200	-0.4800	-0.2800
99	IRP107	Juntunen	20KE15	KEWEENAW	JUNTUNEN-1	-0.7400	-0.5700	-0.1200	-0.1900
100	IRP108	Sand Point	20KE15	KEWEENAW	JUNTUNEN-1	-1.3400	-0.4500	0.1300	0.2800

TABLE 75: MAHALANOBIS DISTANCE CALCULATION AND POSTERIOR CLASSIFICATION FOR REFERENCE GROUPS, BASED ON FIRST FOUR PRINCIPAL COMPONENTS.

Groups are:
1.000 PCTV (Thunder Bay/Voyageurs)
2.000 PCISR (Isle Royale)
3.000 PCSAND (Sand Point)
4.000 PCJUNT (Juntunen)

Variables used are: pc01 pc02 pc03 pc04

Probabilities are jackknifed for specimens included in each group.

The following specimens are in the file PCTV

ID. NO.	Probabilities: PCTV	PCISR	PCSAND	PCJUNT	From:	Into:
IRP004	99.636	0.004	0.092	14.354	1	1
IRP009	22.249	0.013	0.041	4.969	1	1
IRP011	17.607	0.932	0.043	6.327	1	1
IRP012	14.681	0.048	0.220	7.796	1	1
IRP014	59.565	0.001	0.064	11.719	1	1
IRP018	91.220	0.070	0.053	18.108	1	1
IRP023	32.134	0.017	0.032	19.652	1	1
IRP028	25.587	0.000	0.150	10.242	1	1
IRP032	69.089	0.003	0.125	12.703	1	1
IRP045	25.999	0.002	0.112	5.934	1	1
IRP064	71.041	0.063	0.043	10.317	1	1

The following specimens are in the file PCISR

ID. NO.	Probabilities: PCTV	PCISR	PCSAND	PCJUNT	From:	Into:
IRP001	0.001	14.697	0.141	1.851	2	2
IRP002	0.000	7.294	0.394	0.001	2	2
IRP022	0.002	59.072	0.245	2.572	2	2
IRP035	0.001	54.352	0.107	0.649	2	2
IRP036	0.000	64.624	0.633	0.066	2	2
IRP037	0.000	56.992	0.826	0.075	2	2
IRP043	0.001	51.705	1.139	0.754	2	2
IRP044	0.005	41.579	0.388	4.782	2	2
IRP048	0.013	75.442	0.026	15.221	2	2
IRP049	0.001	58.580	0.038	0.435	2	2
IRP050	0.011	30.399	0.046	11.027	2	2
IRP053	0.007	10.481	0.009	5.243	2	2
IRP055	0.010	37.121	0.011	13.782	2	2
IRP059	0.000	64.955	0.109	0.329	2	2
IRP063	0.003	78.919	0.094	4.506	2	2
IRP095	0.001	69.659	0.042	0.220	2	2

The following specimens are in the file PCSAND

ID. NO.	Probabilities: PCTV	PCISR	PCSAND	PCJUNT	From:	Into:
IRP084	0.000	0.192	91.064	0.186	3	3
IRP085	0.000	0.012	65.846	0.001	3	3
IRP086	0.000	0.000	37.121	0.000	3	3
IRP087	0.013	0.001	25.628	0.233	3	3
IRP088	0.001	0.012	77.958	0.060	3	3
IRP089	0.000	0.000	19.531	0.000	3	3
IRP090	0.024	0.000	16.018	0.133	3	3
IRP093	0.000	0.055	73.666	0.001	3	3
IRP094	0.012	0.000	40.413	0.310	3	3

The following specimens are in the file PCJUNT

	Probabilities:					
ID. NO.	PCTV	PCISR	PCSAND	PCJUNT	From:	Into:
IRP033	1.050	0.038	0.043	59.803	4	4
IRP034	1.605	1.272	0.102	50.869	4	4
IRP072	0.030	5.128	0.013	26.878	4	4
IRP073	4.490	0.642	0.040	54.446	4	4
IRP077	0.164	0.125	0.219	40.360	4	4
IRP083	0.030	2.889	0.030	85.772	4	4
IRP106	0.067	33.340	0.014	62.267	4	4
IRP107	0.431	1.001	0.036	86.173	4	4
IRP108	0.151	3.460	0.013	54.146	4	4
IRP067	0.004	0.348	0.025	37.804	4	4
IRP079	0.020	0.265	0.109	39.408	4	4
IRP066	0.224	0.000	0.348	14.182	4	4
IRP070	0.004	0.004	0.108	10.321	4	4
IRP076	0.032	0.022	1.330	27.176	4	4
IRP078	0.027	0.001	1.672	48.387	4	4
IRP081	0.018	0.001	1.128	42.093	4	4
IRP082	0.025	0.034	1.286	63.866	4	4
IRP069	0.003	0.005	0.092	17.207	4	4
IRP074	0.023	0.034	0.036	59.812	4	4
IRP030	0.005	0.319	0.046	48.034	4	4
IRP068	0.011	1.339	0.217	35.088	4	4
IRP075	0.022	0.590	0.122	51.361	4	4

TABLE 76: MAHALANOBIS DISTANCE CALCULATION AND POSTERIOR CLASSIFICATION FOR 5 REFERENCE GROUPS, BASED ON FIRST THREE PRINCIPAL COMPONENTS.

Groups are:
1.000 PCTV (Thunder Bay/Voyageurs)
2.000 PCISR (Isle Royale)
3.000 PCKEE (Keweenaw)
4.000 PCSAND (Sand Point)
5.000 PCJUNT (Juntunen)

Variables used are: pc01 pc02 pc03

Probabilities are jackknifed for specimens included in each group.

The following specimens are in the file PCTV

	Probabilities:						
ID. NO.	PCTV	PCISR	PCKEW	PCSAND	PCJUNT	From:	Into:
IRP004	98.005	0.001	38.401	0.075	16.189	1	1
IRP009	51.460	0.002	27.515	0.025	13.545	1	1
IRP011	8.695	0.630	20.555	0.018	46.507	1	5
IRP012	7.700	0.015	22.633	0.119	44.710	1	5
IRP014	40.763	0.000	35.596	0.067	7.451	1	1
IRP018	92.850	0.018	30.976	0.031	33.677	1	1
IRP023	38.144	0.004	23.351	0.020	19.678	1	1
IRP028	36.846	0.000	39.340	0.238	4.820	1	3
IRP032	49.130	0.001	28.185	0.118	13.082	1	1
IRP045	60.584	0.001	45.125	0.082	12.476	1	1
IRP064	51.433	0.015	26.999	0.022	30.877	1	1

The following specimens are in the file PCISR

	Probabilities:						
ID. NO.	PCTV	PCISR	PCKEW	PCSAND	PCJUNT	From:	Into:
IRP001	0.001	8.326	1.536	0.149	1.351	2	2
IRP002	0.000	4.344	0.537	4.189	0.001	2	2
IRP022	0.001	42.992	1.607	0.346	1.049	2	2
IRP035	0.000	61.151	1.580	0.145	0.256	2	2
IRP036	0.000	69.519	0.788	2.523	0.033	2	2
IRP037	0.000	71.143	0.760	2.103	0.021	2	2
IRP043	0.000	34.252	0.993	2.133	0.251	2	2
IRP044	0.001	44.116	1.661	0.330	2.429	2	2
IRP048	0.106	62.077	6.110	0.019	13.403	2	2
IRP049	0.001	40.475	2.230	0.048	0.422	2	2
IRP050	0.012	89.263	3.549	0.029	5.164	2	2
IRP053	2.530	23.507	11.711	0.006	20.059	2	2
IRP055	0.622	30.236	9.114	0.006	13.229	2	2
IRP059	0.000	46.076	1.319	0.151	0.272	2	2
IRP063	0.003	85.541	2.211	0.101	3.433	2	2
IRP095	0.001	56.438	1.858	0.053	0.440	2	2

The following specimens are in the file PCKEW

	Probabilities:						
ID. NO.	PCTV	PCISR	PCKEW	PCSAND	PCJUNT	From:	Into:
IRP098	0.001	0.000	14.073	0.483	0.328	3	3
IRP099	0.000	0.000	33.850	2.244	0.039	3	3
IRP101	0.017	0.000	15.434	2.316	0.232	3	3
IRP103	0.015	0.000	87.764	0.434	2.672	3	3
IRP104	0.069	0.000	84.704	0.304	4.868	3	3

The following specimens are in the file PCSAND

ID. NO.	Probabilities: PCTV	PCISR	PCKEW	PCSAND	PCJUNT	From:	Into:
IRP084	0.000	0.103	0.487	78.279	0.054	4	4
IRP085	0.000	0.008	0.894	44.656	0.052	4	4
IRP086	0.000	0.000	0.115	30.883	0.000	4	4
IRP087	0.002	0.000	1.156	50.066	0.585	4	4
IRP088	0.000	0.004	0.775	62.461	0.060	4	4
IRP089	0.000	0.000	0.091	10.613	0.000	4	4
IRP090	0.004	0.000	12.233	6.243	0.043	4	3
IRP093	0.000	0.099	0.711	84.429	0.038	4	4
IRP094	0.002	0.000	1.465	84.435	0.384	4	4

The following specimens are in the file PCJUNT

ID. NO.	Probabilities: PCTV	PCISR	PCKEW	PCSAND	PCJUNT	From:	Into:
IRP033	59.555	0.058	30.474	0.034	45.006	5	1
IRP034	4.414	0.672	10.299	0.068	52.098	5	5
IRP072	0.033	2.157	7.479	0.004	25.211	5	5
IRP073	28.965	0.284	26.203	0.021	61.267	5	5
IRP077	0.356	0.275	5.141	0.251	25.535	5	5
IRP083	0.338	1.263	14.703	0.011	75.141	5	5
IRP106	2.249	20.880	12.729	0.006	44.651	5	5
IRP107	3.857	0.801	23.784	0.017	79.868	5	5
IRP108	6.683	2.126	13.577	0.007	41.085	5	5
IRP067	0.165	0.286	12.141	0.010	56.040	5	5
IRP079	0.597	2.647	5.651	0.101	70.625	5	5
IRP066	0.200	0.002	43.189	0.235	7.998	5	3
IRP070	0.302	0.095	9.563	0.078	91.735	5	5
IRP076	0.042	0.011	2.913	0.455	47.229	5	5
IRP078	0.130	0.009	3.933	1.232	36.117	5	5
IRP081	0.048	0.003	5.547	0.495	26.357	5	5
IRP082	0.053	0.077	2.637	0.828	45.938	5	5
IRP069	0.008	0.002	10.924	0.024	10.368	5	3
IRP074	0.112	0.196	21.987	0.018	52.738	5	5
IRP030	0.150	0.092	5.899	0.017	34.854	5	5
IRP068	0.028	0.446	2.705	0.100	23.084	5	5
IRP075	0.112	0.171	4.284	0.044	49.893	5	5

TABLE 77: PRINCIPAL COMPONENTS ANALYSIS FOR JUNTUNEN REFERENCE GROUP.

Principal Components Analysis Based on the File: ljunt

Analysis Based on Variance-Covariance Matrix

Eigenvalues and Percentage of Variance Explained:

0.1162	48.1122
0.0383	15.8738
0.0286	11.8444
0.0204	8.4469
0.0111	4.5879
0.0082	3.4146
0.0049	2.0393
0.0041	1.6888
0.0034	1.3967
0.0021	0.8493
0.0015	0.6297
0.0012	0.5048
0.0006	0.2419
0.0005	0.1870
0.0002	0.0817
0.0001	0.0595
0.0001	0.0293
0.0000	0.0099
0.0000	0.0021

Principal Components (largest to smallest):

	PC01	PC02	PC03	PC04	PC05	PC06	PC07	PC08	PC09	PC10	PC11	PC12	PC13	PC14	PC15	PC16	PC17	PC18	PC19
LA	0.2575	0.1036	0.0233	0.0526	0.3214	-0.0171	0.1263	-0.0691	-0.3504	-0.0753	-0.2126	0.0597	0.2928	0.5590	0.1720	-0.0612	-0.4283	0.0055	0.0563
LU	0.2494	-0.0059	-0.0664	-0.0465	-0.0034	0.0524	-0.1598	-0.0936	0.1085	0.3139	-0.0086	0.0323	-0.1370	-0.2755	0.2914	-0.1187	-0.4246	-0.3764	-0.5168
SM	0.2266	0.1445	0.0081	0.0386	0.1713	-0.0442	-0.0787	0.1296	-0.1057	-0.2066	-0.0373	0.3831	0.0829	-0.4150	-0.0449	0.0078	-0.0729	0.6441	-0.2617
YB	0.2573	-0.0004	-0.0412	0.0083	0.0372	0.1100	-0.2198	-0.0235	0.2159	0.4321	-0.1295	-0.2137	-0.1151	-0.1330	-0.0627	-0.0390	-0.2918	0.3128	0.5954
CE	0.2416	0.0565	-0.0371	-0.0554	0.1376	-0.1412	-0.0309	-0.1440	-0.4042	0.0082	-0.3313	-0.1811	-0.6140	0.0033	-0.0771	0.3506	0.2345	-0.0238	-0.0780
CS	0.1113	0.0969	0.3716	-0.0286	-0.2413	-0.1742	-0.1202	0.2295	0.1858	0.0016	-0.6322	-0.1963	0.3791	-0.0615	-0.1233	0.1064	0.0897	-0.1040	-0.1344
EU	0.2168	0.1909	0.0018	-0.0169	0.2230	0.0779	-0.0210	0.1533	-0.1041	-0.2632	0.0126	0.2858	0.0544	-0.3684	-0.2074	-0.0232	-0.0039	-0.5679	0.4120
FE	0.1063	-0.3062	0.1424	-0.2900	-0.1786	-0.0039	0.2461	0.1433	-0.3683	0.2788	0.4087	-0.2983	0.1588	-0.0790	-0.3754	0.0602	-0.1352	0.0282	-0.1140
RB	-0.1819	0.2489	0.0625	-0.2950	-0.2402	-0.3606	-0.4766	0.3367	-0.0458	-0.0672	0.0999	0.2504	-0.2773	0.2642	0.0989	-0.0521	-0.1923	-0.0009	0.1019
SB	0.5136	-0.4331	0.2564	-0.0462	0.0038	-0.3334	0.2704	0.3229	0.1525	-0.1180	0.2562	-0.0795	-0.1373	0.0504	0.1962	-0.1060	0.0882	0.0105	0.0637
SC	0.1444	0.2741	0.1459	-0.3521	-0.0991	0.1510	-0.1251	-0.3155	-0.1291	-0.1848	0.0342	-0.2161	0.1090	-0.1284	0.5075	-0.3241	0.3169	0.0714	0.1257
TB	0.2823	0.0793	-0.0022	0.0982	0.1484	-0.0665	-0.4070	-0.1303	0.1236	0.2265	0.3478	0.1264	0.3122	0.1784	0.0737	0.5009	0.3185	-0.0577	-0.0368
TH	0.0255	-0.0289	-0.1283	-0.0713	-0.0437	-0.6917	0.0661	-0.5613	0.0425	0.0781	-0.0237	0.1354	0.1311	-0.0878	-0.2526	-0.2396	-0.0051	-0.0257	0.0597
BA	-0.1775	0.2193	-0.4189	-0.2898	0.4957	-0.2665	0.1391	0.2581	0.2780	-0.0465	-0.0304	-0.3412	0.0945	-0.0913	0.1685	0.1187	0.0092	0.0068	-0.0401
DY	0.2787	0.0865	-0.1673	-0.0479	0.1634	0.1997	-0.2525	0.0589	0.2190	-0.1009	0.0143	-0.1138	-0.1062	0.3165	-0.4744	-0.4901	0.2077	0.0019	-0.2443
MN	0.1153	0.5859	-0.0763	0.6587	-0.2077	-0.1619	0.1985	0.0618	0.1307	-0.0204	0.0825	-0.1035	-0.1469	0.0313	0.1497	-0.0936	0.0444	-0.0103	0.0183
NA	-0.2639	0.1547	0.7179	0.0745	0.4981	-0.0441	-0.0198	-0.1714	0.1836	0.0373	0.1207	-0.0526	-0.1914	-0.0144	-0.0710	-0.0536	-0.0769	0.0032	-0.0511
TI	0.1279	0.0195	-0.0062	-0.0738	-0.2002	0.0681	-0.0689	-0.2962	0.2753	-0.6089	0.1431	-0.2573	-0.0530	0.0157	-0.1362	0.3517	-0.4013	0.0254	-0.0190
V	0.1351	0.2658	0.0385	-0.3825	-0.1094	0.1899	0.4626	-0.1069	0.3904	0.1561	-0.1363	0.4493	-0.1519	0.1940	-0.0025	0.1592	0.0754	0.0297	0.0103

TABLE 78: MAHALANOBIS DISTANCE CALCULATION AND POSTERIOR CLASSIFICATION FOR TWO OR MORE GROUPS.

Reference groups and numbers of specimens:

1	PCTV	11 (Thunder Bay/Voyageurs)
2	PCISR	16 (Isle Royale)
3	PCSAND	9 (Sand Point)
4	PCJUNT	22 (Juntunen)

Variables used:
pc01 pc02 pc03 pc04

The following specimens are in the file PCOUTS (Thirty-seven outliers)

ID. NO.	Probabilities: PCTV	PCISR	PCSAND	PCJUNT	BEST GP.
IRP003	0.000	0.035	0.064	0.000	3
IRP005	0.228	0.035	0.272	0.127	3
IRP006	0.999	0.003	0.488	5.378	4
IRP007	0.711	0.034	0.037	0.282	1
IRP008	0.599	10.481	0.026	77.030	4
IRP010	0.761	0.230	0.104	0.732	1
IRP013	0.338	0.124	0.024	1.726	4
IRP015	0.001	0.000	0.897	0.334	3
IRP016	0.322	0.018	0.145	2.774	4
IRP017	0.000	0.000	0.058	0.000	3
IRP024	0.006	6.143	0.310	10.335	4
IRP025	0.479	0.002	0.208	8.154	4
IRP026	0.002	0.002	0.011	0.097	4
IRP027	0.106	0.782	0.130	36.674	4
IRP029	2.377	0.064	0.155	44.573	4
IRP031	0.002	1.484	0.209	0.615	2
IRP042	0.257	0.000	0.466	0.304	3
IRP046	0.207	6.898	0.065	20.341	4
IRP047	0.004	3.875	0.009	25.432	4
IRP051	0.010	0.065	0.060	12.764	4
IRP052	0.046	0.138	0.004	2.638	4
IRP054	0.000	0.000	0.015	0.001	3
IRP056	0.534	0.002	0.026	21.053	4
IRP057	0.595	0.037	0.063	15.146	4
IRP058	0.237	4.727	0.291	23.220	4
IRP061	0.065	0.000	0.046	7.045	4
IRP062	0.000	0.288	0.216	0.052	2
IRP065	0.001	0.000	0.064	0.118	4
IRP071	0.001	0.001	0.043	1.574	4
IRP080	0.016	0.007	35.558	6.105	3
IRP091	0.080	0.018	0.179	10.868	4
IRP092	0.208	0.021	3.983	0.520	3
IRP096	3.158	0.014	1.374	15.526	4
IRP097	0.150	0.003	31.779	1.039	3
IRP100	0.660	0.002	0.279	1.652	4
IRP102	16.321	0.013	0.016	12.190	1
IRP105	0.001	0.000	11.792	0.003	3

Summary of Probabilities for Specimens in the file PCOUTS

Probability Cutoff Values:

Group: -------	0.01000	0.10000	1.00000	5.00000	10.00000	20.00000	100.00000
PCTV	12	5	17	2	0	1	0
PCISR	15	11	5	3	2	1	0
PCSAND	2	15	15	2	0	1	2
PCJUNT	4	2	8	6	4	6	7

Summary of Best Classification of Projected Specimens:

Classified Into Group:

From Group:	PCTV	PCISR	PCSAND	PCJUNT	Total
PCOUTS	3	2	10	22	37
Total	3	2	10	22	37

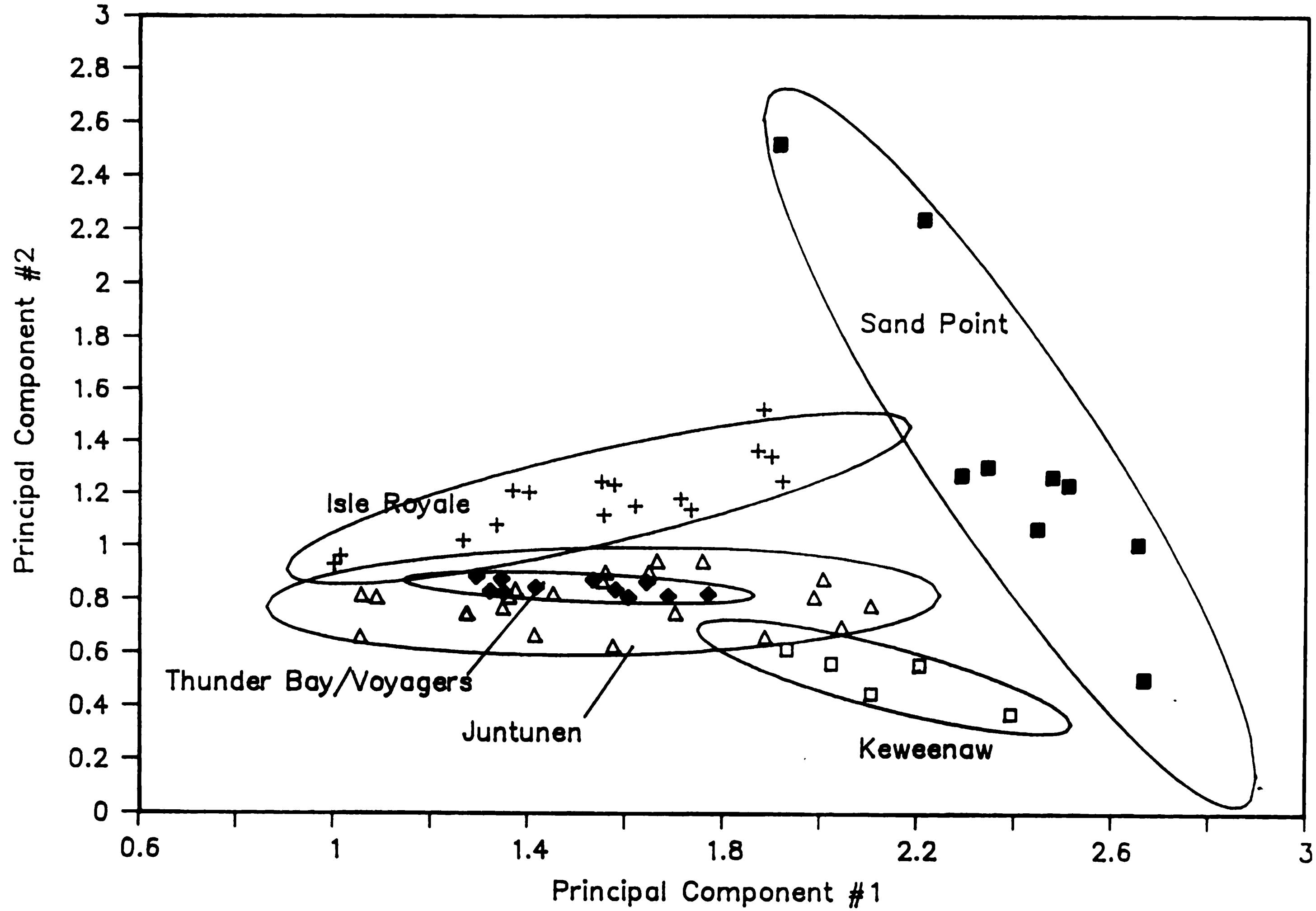

Figure 18. Bivariate Plot: Principal Components #1 and #2.

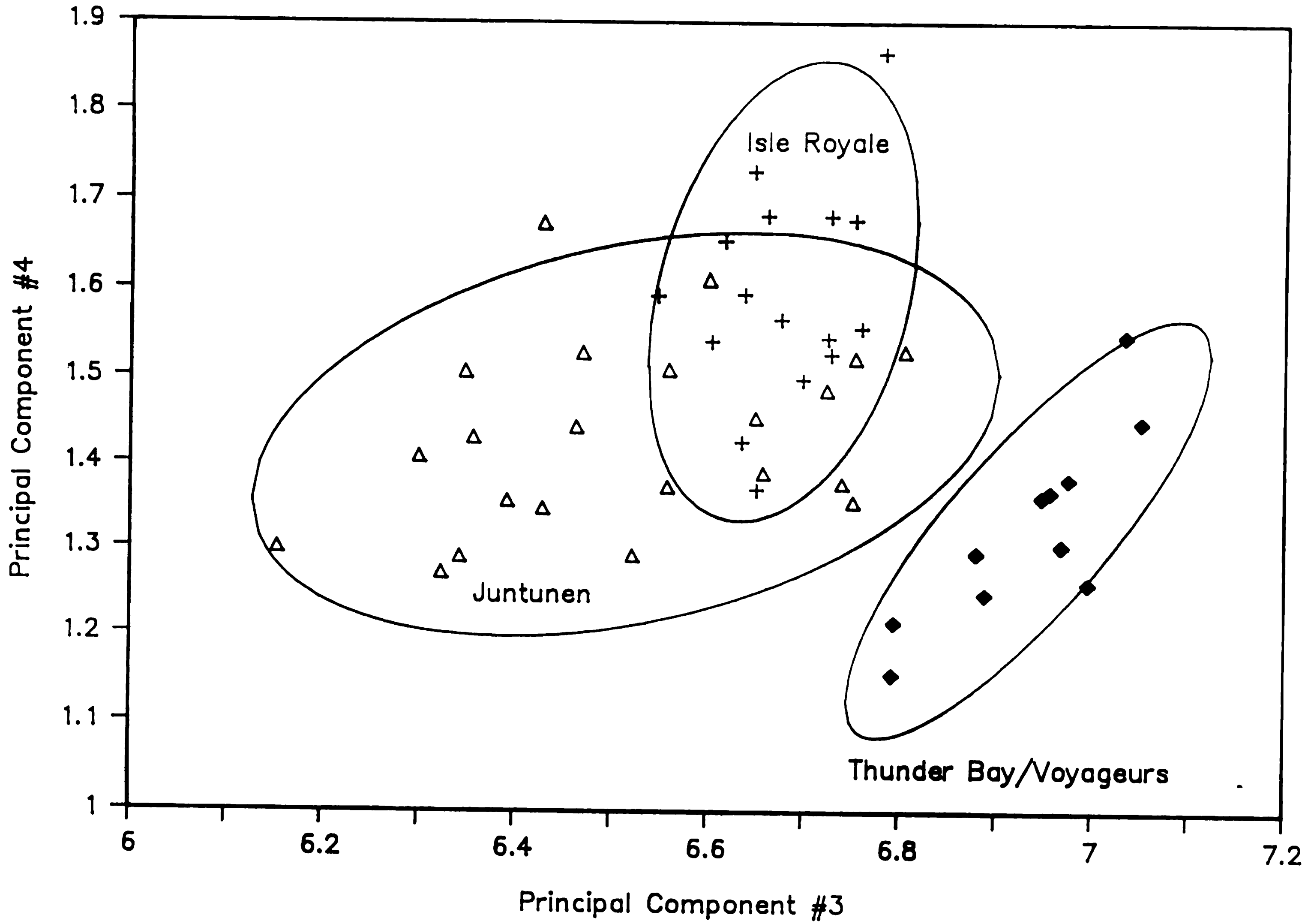

Figure 19. Bivariate Plot: Principal Components #3 and #4.

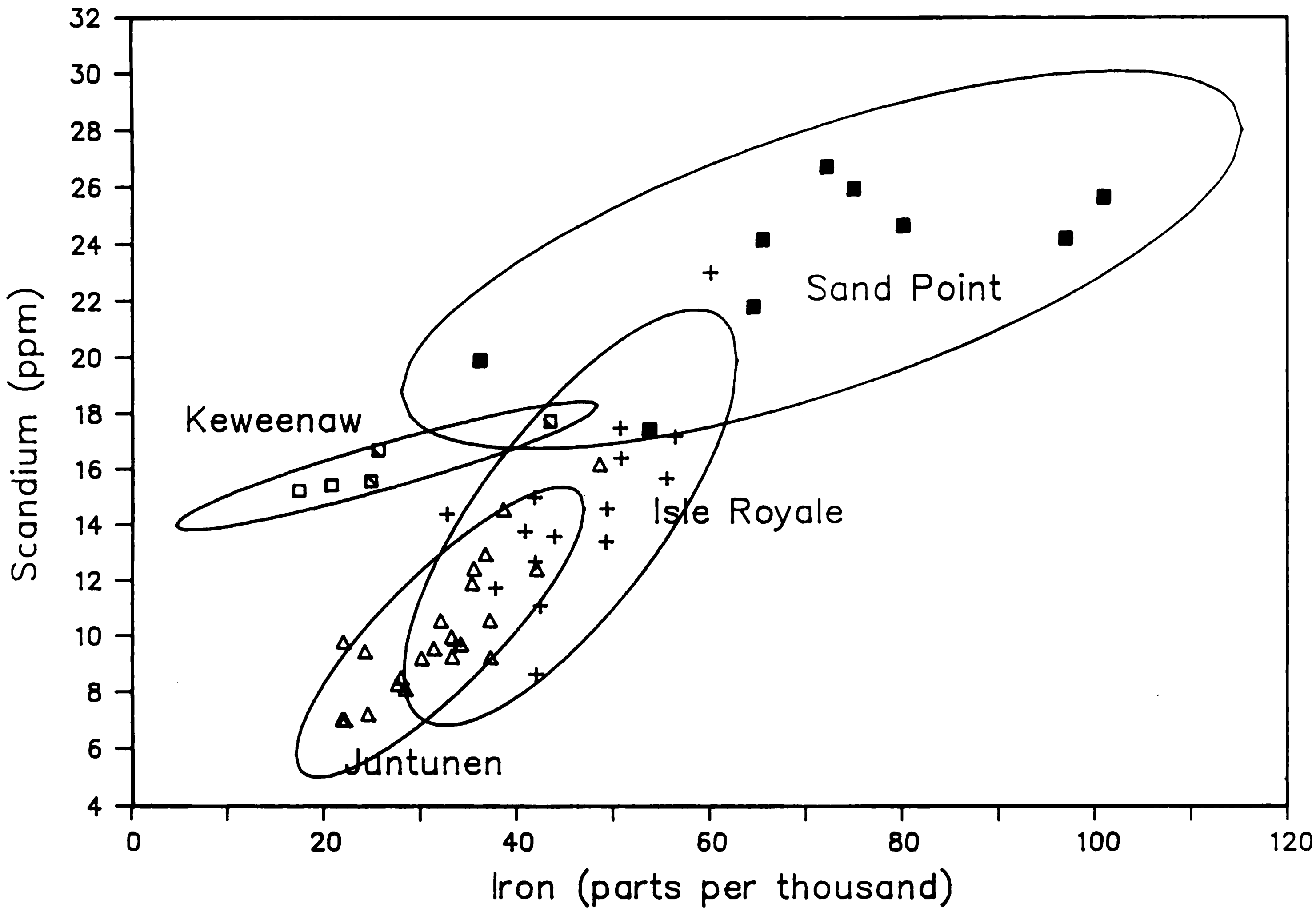

Figure 20. Bivariate Plot: Scandium and Iron.

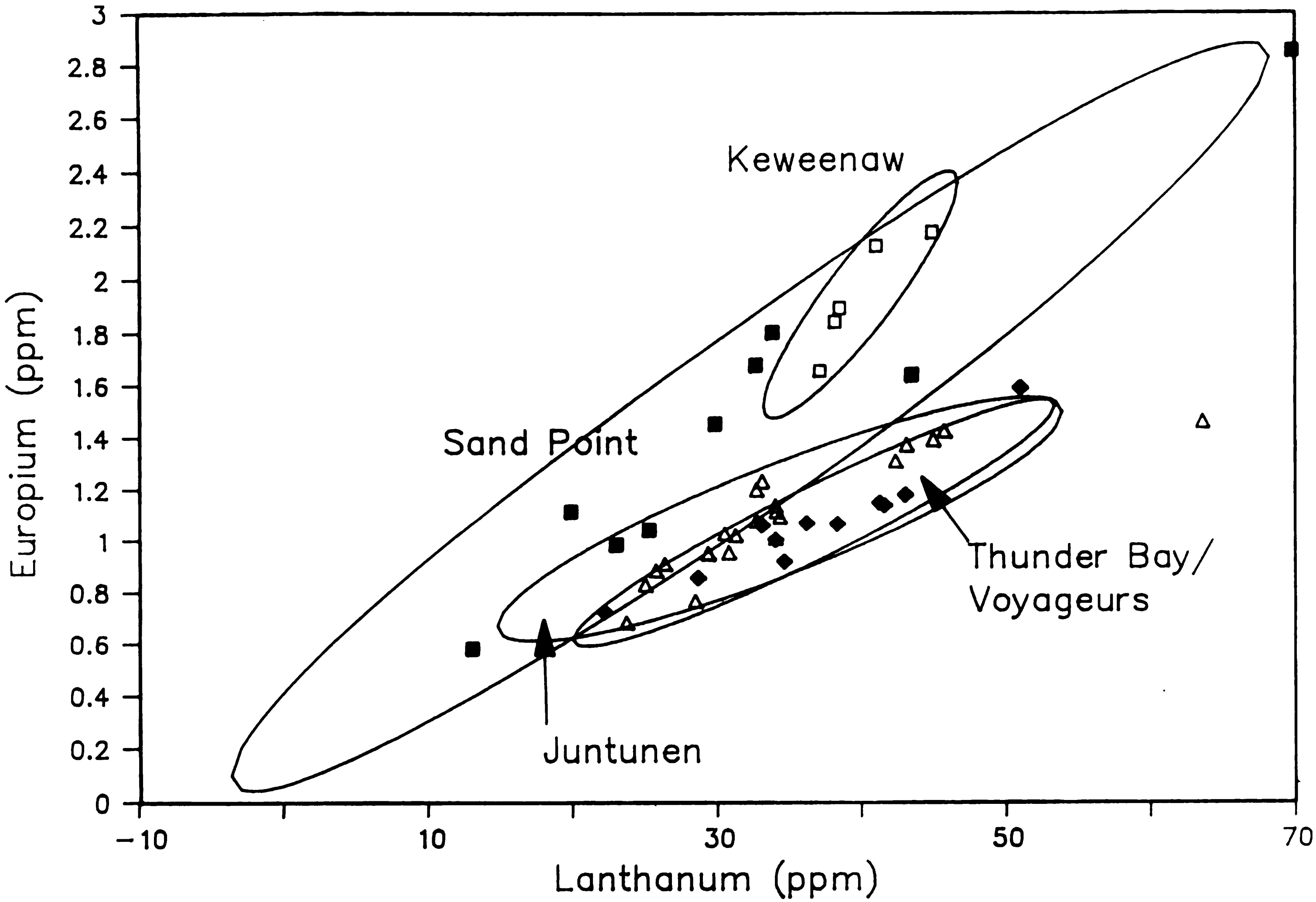

Figure 21. Bivariate Plot: Europeum and Lanthanum.

APPENDIX D: CATALOG OF NAA SAMPLES.

Samples are numbered consecutively with 89 prefix (eg, 89-1).

Abbreviations for source of samples:

APIS	= Apostle Islands National Lakeshore
GRPO	= Grand Portage National Monument
ISRO	= Isle Royale National Park
MCC	= Ministry of Culture and Communications, Thunder Bay
MTU	= Michigan Technological University
MWAC	= Midwest Archeological Center, National Park Service
UMMA	= University of Michigan, Museum of Anthropology
VOYA	= Voyageurs National Park
WMU	= Western Michigan University

NAA#	Source, Site, Ceramic Type, Catalog #, Other
89-1	MWAC, Chippewa Harbor, Clay sample
89-2	MWAC, Moskey Narrows, Clay sample
89-3	MWAC, Beaver Island, Clay sample
89-4	VOYA, 21SL23, Blackduck, MWAC# 605-002
89-5	VOYA, 21SL183, Blackduck, MWAC# 492-001
89-6	VOYA, 21SL183, Blackduck, MWAC# 467-001
89-7	VOYA, 21SL183, Blackduck, MWAC# 534-001
89-8	VOYA, 21SL183, Blackduck, MWAC# 601-001
89-9	VOYA, 21SL183, Blackduck, MWAC# 526-001
89-10	VOYA, 21SL183, Blackduck, MWAC# 603-001
89-11	VOYA, 21SL183, Blackduck, MWAC# 505-001
89-12	VOYA, 21SL183, Blackduck, MWAC# 499-001
89-13	VOYA, 21SL183, Blackduck, MWAC# 001-000
89-14	MCC, Dd Ir-1, Juntunen, MCC# 01
89-15	MCC, De Ip-3, Blackduck, MCC# 05 [alternate]
89-16	MCC, Dl Iq-15, Blackduck, MCC# 14
89-17	MCC, Di Jf-4, Blackduck, MCC# 16
89-18	MCC, De Ip-3, Blackduck, MCC# 06
89-19*	MCC, De Iu-3, Selkirk, MCC# 08
89-20*	MCC, Mason Collection, Selkirk, MCC# 19

89-21*	MCC, Di Jf-5, Selkirk, MCC# 17
89-22	MCC, Knudson Collection, Blackduck, MCC# 18
89-23	MCC, De Ip-3, Blackduck, MCC# 04
89-24	MCC, De Ik-3, Blackduck, MCC# 07
89-25	MCC, Dk Im-8, Blackduck, MCC# 13
89-26	MCC, Db Jx-1, Blackduck, MCC# 15
89-27	MCC, De Ip-2, Blackduck, MCC# 03
89-28	MCC, De Iu-3, Blackduck, MCC# 10
89-29	MCC, De Iu-3, Blackduck, MCC# 12
89-30	MCC, De Ik-1, Juntunen, MCC# 02
89-31	MWAC, 20IR142, Belle Isle #2, Juntunen, MWAC 885-001
89-32	MWAC, 20IR134, Mott Sauna Beach, Juntunen, MWAC 890-005
89-33	MWAC, 20IR114, Lone Tree Cove, Juntunen, MWAC 871-001/003
89-34	MWAC, 20IR114, Lone Tree Cove, Juntunen, MWAC 870-001
89-35	MWAC, 20IR45, Daisy Farm, Juntunen, MWAC 882-002
89-36	MWAC, 20IR18, Card Point, Juntunen, MWAC 891-001
89-37	MWAC, GRPO, clay sample, vicinity of Great Hall/Kitchen
89-38*	MWAC, 20IR140, Duncan Bay #1, Selkirk, MWAC 880-001
89-39*	MWAC, 20IR128, Lane Cove, Selkirk, MWAC 883-001
89-40*	MWAC, 20IR29, Belle Isle #1, Selkirk, MWAC 880-006
89-41*	MWAC, 20IR29, Belle Isle #1, Selkirk, MWAC 880-005
89-42	ISRO, 20IR111, Rock Hbr. Lighthouse, Blackduck, 102
89-43	MWAC, 20IR124, Lake Ritchie #1, Blackduck, MWAC 871-1
89-44	MWAC, 20IR29, Belle Isle #1, Blackduck, MWAC 886-001
89-45	MWAC, 20IR45, Daisy Farm, Blackduck (?), MWAC 882-003
89-46	MWAC, 20IR1, Chippewa Hbr. #1, Blackduck, MWAC 872-2
89-47	MWAC, 20IR127, Chippewa Hbr. #3, Huron, MWAC 870-0
89-48	MWAC, 20IR147, Brady Cove #1, Huron, MWAC 880-001
89-49	MWAC, 20IR142, Belle Isle #2, Huron, MWAC 885-001
89-50	MWAC, 20IR45, Daisy Farm, Huron, MWAC 882-003
89-51	MWAC, 20IR142, Belle Isle #2, Huron, MWAC 885-001
89-52	MWAC, 20IR29, Belle Isle #1, Huron, MWAC 887-001
89-53	MWAC, 20IR17, Grace Island, Huron, UMMA 62136
89-54	MWAC, APIS, Outer Island, Clay sample
89-55	UMMA, 20IR52, Baker Point, Lalonde High Collar, UMMA 62237
89-56	UMMA, 20IR1, Chip. Hbr., Juntunen, UMMA 52477 (20a)
89-57	UMMA, 20IR72, Cove, Blackduck, UMMA 62363 (16b)
89-58	UMMA, 20IR72, Cove, Blackduck, UMMA 62363 (not illust)
89-59	UMMA, 20IR1, Chip. Hbr, Juntunen, UMMA 5329(13c)
89-60	UMMA, 20IR1, Chip. Hbr., Juntunen/Ont.Oblique UMMA 5329 (26b)

89-61	UMMA, 20IR28, Indian Pt., Huron, UMMA 5325 (29b)
89-62	UMMA, 20IR72, Cove, Blackduck, UMMA 39588/89 (17a)
89-63	UMMA, 20IR1,Juntunen, UMMA 52477 (18c)
89-64	UMMA, 20IR1, Huron, UMMA 5329 (30a)
89-65	UMMA, 20MK1, Juntunen, 62947 (McPherron 1967:Plate XXIb)
89-66	UMMA, 20MK1, Juntunen, 41754 (XXd)
89-67	UMMA, 20MK1, Juntunen, 40687 (not illust)
89-68	UMMA, 20MK1, Juntunen, ?????tape #21 (not illust)
89-69	UMMA, 20MK1, Juntunen, 41594 (XXIa)
89-70	UMMA, 20MK1, Juntunen, 41022 (not illust?)
89-71	UMMA, 20MK1, Juntunen, ?????
89-72	UMMA, 20MK1, Juntunen, 41501 (122) (not illust?)
89-73	UMMA, 20MK1, Juntunen, 41531 (not illust?)
89-74	UMMA, 20MK1, Juntunen, 40962 [Fea. 1] McP Vessel 12)
89-75	UMMA, 20MK1, Mackinac, 41580
89-76	UMMA, 20MK1, Mackinac, 41590
89-77	UMMA, 20MK1, Mackinac, 41670 (XIIIa)
89-78	UMMA, 20MK1, Mackinac, 62978
89-79	UMMA, 20MK1, Mackinac, 41071 (XXIg)
89-80	UMMA, 20MK1, Mackinac, 62834
89-81	UMMA, 20MK1, Mackinac, 41588 (XIIa)
89-82	UMMA, 20MK1, Mackinac, ????? (painted #61)
89-83	UMMA, 20MK1, Mackinac, 41795? (XIVa?)
89-84	UMMA, 20MK1, Mackinac, 41582 (XIVb)
89-85	WMU, 20BG14, Sand Point, SP-1254 (VIII:1)
89-86	WMU, 20BG14, Sand Point, SP-2014
89-87	WMU, 20BG14, Sand Point, SP15-754
89-88	WMU, 20BG14, Sand Point, SP1-1749
89-89	WMU, 20BG14, Sand Point, SP1-1004
89-90	WMU, 20BG14, Sand Point, no number
89-91	WMU, 20BG14, Sand Point, SP1-2015
89-92	WMU, 20BG14, Sand Point, SP1-682/1960/1705(VI:1)
89-93	WMU, 20BG14, Sand Point, SP15-817/109
89-94	WMU, 20BG14, Sand Point, SP1-1329 (VI:5)
89-95	ISRO, 20IR41, Juntunen (submerged)
89-96	MTU, 20KE15, Oneota, Williams Collection
89-97	MTU, 20KE15, Oneota, Williams Collection
89-98	MTU, 20KE15, Oneota, Williams Collection
89-99	MTU, 20KE15, Oneota, MTU 80-22-1
89-100	MTU, 20KE15, Oneota, MTU 81-1-1

89-101	MTU, 20KE15, Oneota, MTU 81-1-1
89-102	MTU, 20KE15, Oneota, MTU 81-1-1
89-103	MTU, 20KE15, Oneota, MTU 81-1-1
89-104	MTU, 20KE15, Oneota, Williams Collection
89-105	MTU, 20KE15, Oneota, Williams Collection
89-106	MTU, 20KE15, Juntunen, MTU 80-22-2
89-107	MTU, 20KE15, Juntunen, MTU 80-22-7
89-108	MTU, 20KE15, Sand Point, Williams Collection
89-109	
89-110	

*=sample taken but not submitted

NAA Sample, Listing by Ceramic Type:

BLACKDUCK WARE

Voyageurs National Park, MN

89-4	VOYA, 21SL23, Blackduck, MWAC# 605-002
89-5	VOYA, 21SL23, Blackduck, MWAC# 492-001
89-6	VOYA, 21SL23, Blackduck, MWAC# 467-001
89-7	VOYA, 21SL23, Blackduck, MWAC# 534-001
89-8	VOYA, 21SL23, Blackduck, MWAC# 601-001
89-9	VOYA, 21SL23, Blackduck, MWAC# 526-001
89-10	VOYA, 21SL23, Blackduck, MWAC# 603-001
89-11	VOYA, 21SL23, Blackduck, MWAC# 505-001
89-12	VOYA, 21SL23, Blackduck, MWAC# 499-001
89-13	VOYA, 21SL23, Blackduck, MWAC# 001-000

North Shore Lake Superior and BWCA, ON

89-15	MCC, De Ip-3, Blackduck, MCC# 05 [alternate]
89-16	MCC, Dl Iq-15, Blackduck, MCC# 14
89-17	MCC, Di Jf-4, Blackduck, MCC# 16
89-18	MCC, De Ip-3, Blackduck, MCC# 06
89-22	MCC, Knudson Collection, Blackduck, MCC# 18
89-23	MCC, De Ip-3, Blackduck, MCC# 04
89-24	MCC, De Ik-3, Blackduck, MCC# 07
89-25	MCC, Dk Im-8, Blackduck, MCC# 13
89-26	MCC, Db Jx-1, Blackduck, MCC# 15
89-27	MCC, De Ip-2, Blackduck, MCC# 03
89-28	MCC, De Iu-3, Blackduck, MCC# 10
89-29	MCC, De Iu-3, Blackduck, MCC# 12

Isle Royale National Park, MI

89-42	ISRO, 20IR111, Rock Hbr. Lighthouse, Blackduck, 102
89-43	MWAC, 20IR124, Lake Ritchie #1, Blackduck, MWAC 871-1
89-44	MWAC, 20IR29, Belle Isle #1, Blackduck, MWAC 886-001
89-45	MWAC, 20IR45, Daisy Farm, Blackduck (?), MWAC 882-003
89-46	MWAC, 20IR1, Chippewa Hbr. #1, Blackduck, MWAC 872-2
89-57	UMMA, 20IR72, Cove, Blackduck, UMMA 62363 (16b)
89-58	UMMA, 20IR72, Cove, Blackduck, UMMA 62363 (not illust)
89-62	UMMA, 20IR72, Cove, Blackduck, UMMA 39588/89 (17a)

ONTARIO IROQUOIS TRADITION WARES

Isle Royale National Park, MI

89-47	MWAC, 20IR127, Chippewa Hbr. #3, Huron, MWAC 870-0
89-48	MWAC, 20IR147, Brady Cove #1, Huron, MWAC 880-001
89-49	MWAC, 20IR142, Belle Isle #2, Huron, MWAC 885-001
89-50	MWAC, 20IR45, Daisy Farm, Huron, MWAC 882-003
89-51	MWAC, 20IR142, Belle Isle #2, Huron, MWAC 885-001
89-52	MWAC, 20IR29, Belle Isle #1, Huron, MWAC 887-001
89-53	MWAC, 20IR17, Grace Island, Huron, UMMA 62136
89-55	UMMA, 20IR52, Baker Point, Lalonde High Collar, UMMA 62237
89-61	UMMA, 20IR28, Indian Pt., Huron, UMMA 5325 (29b)
89-64	UMMA, 20IR1, Huron, UMMA 5329 (30a)

JUNTUNEN WARE

North Shore Lake Superior, ON

89-14	MCC, Dd Ir-1, Juntunen, MCC# 01
89-30	MCC, De Ik-1, Juntunen, MCC# 02

Isle Royale National Park, MI

89-31	MWAC, 20IR142, Belle Isle #2, Juntunen, MWAC 885-001
89-32	MWAC, 20IR134, Mott Sauna Beach, Juntunen, MWAC 890-005
89-33	MWAC, 20IR114, Lone Tree Cove, Juntunen, MWAC 871-001/003
89-34	MWAC, 20IR114, Lone Tree Cove, Juntunen, MWAC 870-001
89-35	MWAC, 20IR45, Daisy Farm, Juntunen, MWAC 882-002
89-36	MWAC, 20IR18, Card Point, Juntunen, MWAC 891-001
89-56	UMMA, 20IR1, Juntunen, UMMA 52477 (20a)
89-59	UMMA, 20IR1, Juntunen, UMMA 5329(13c)
89-60	UMMA, 20IR1, Juntunen/Ont.Oblique UMMA 5329 (26b)
89-95	ISRO, 20IR41, Juntunen (submerged)

Straits of Mackinac, MI

89-65	UMMA, 20MK1, Juntunen, 62947 (McPherron 1967:Plate XXIb)
89-66	UMMA, 20MK1, Juntunen, 41754 (XXd)
89-67	UMMA, 20MK1, Juntunen, 40687 (not illust)
89-68	UMMA, 20MK1, Juntunen, ?????tape #21 (not illust)
89-69	UMMA, 20MK1, Juntunen, 41594 (XXIa)
89-70	UMMA, 20MK1, Juntunen, 41022 (not illust?)
89-71	UMMA, 20MK1, Juntunen, ?????
89-72	UMMA, 20MK1, Juntunen, 41501 (122) (not illust?)
89-73	UMMA, 20MK1, Juntunen, 41531 (not illust?)
89-74	UMMA, 20MK1, Juntunen, 40962 [Fea. 1] McP Vessel 12)

Keweenaw Peninsula, MI

89-106	MTU, 20KE15, Juntunen, MTU 80-22-2
89-107	MTU, 20KE15, Juntunen, MTU 80-22-7

MACKINAC WARE

Straits of Mackinac, MI

89-75	UMMA, 20MK1, Mackinac, 41580
89-76	UMMA, 20MK1, Mackinac, 41590
89-77	UMMA, 20MK1, Mackinac, 41670 (XIIIa)
89-78	UMMA, 20MK1, Mackinac, 62978
89-79	UMMA, 20MK1, Mackinac, 41071 (XXIg)
89-80	UMMA, 20MK1, Mackinac, 62834
89-81	UMMA, 20MK1, Mackinac, 41588 (XIIa)
89-82	UMMA, 20MK1, Mackinac, ????? (painted #61)
89-83	UMMA, 20MK1, Mackinac, 41795? (XIVa?)
89-84	UMMA, 20MK1, Mackinac, 41582 (XIVb)

ONEOTA

Keweenaw Peninsula, MI

89-96	MTU, 20KE15, Oneota, Williams Collection
89-97	MTU, 20KE15, Oneota, Williams Collection
89-98	MTU, 20KE15, Oneota, Williams Collection
89-99	MTU, 20KE15, Oneota, MTU 80-22-1
89-100	MTU, 20KE15, Oneota, MTU 81-1-1
89-101	MTU, 20KE15, Oneota, MTU 81-1-1
89-102	MTU, 20KE15, Oneota, MTU 81-1-1
89-103	MTU, 20KE15, Oneota, MTU 81-1-1
89-104	MTU, 20KE15, Oneota, Williams Collection
89-105	MTU, 20KE15, Oneota, Williams Collection

SAND POINT WARE

Keweenaw Peninsula, MI

89-85	WMU, 20BG14, Sand Point, SP-1254 (VIII:1)
89-86	WMU, 20BG14, Sand Point, SP-2014
89-87	WMU, 20BG14, Sand Point, SP15-754
89-88	WMU, 20BG14, Sand Point, SP1-1749
89-89	WMU, 20BG14, Sand Point, SP1-1004
89-90	WMU, 20BG14, Sand Point, no number
89-91	WMU, 20BG14, Sand Point, SP1-2015
89-92	WMU, 20BG14, Sand Point, SP1-682/1960/1705(VI:1)
89-93	WMU, 20BG14, Sand Point, SP15-817/109
89-94	WMU, 20BG14, Sand Point, SP1-1329 (VI:5)
89-108	MTU, 20KE15, Sand Point, Williams Collection

SELKIRK (no samples of Selkerk were submitted for NAA)

North Shore Lake Superior, ON

89-19	MCC, De Iu-3, Selkirk, MCC# 08
89-20	MCC, Mason Collection, Selkirk, MCC# 19
89-21	MCC, Di Jf-5, Selkirk, MCC# 17

Isle Royale National Park, MI

89-38	MWAC, 20IR140, Duncan Bay #1, Selkirk, MWAC 880-001
89-39	MWAC, 20IR128, Lane Cove, Selkirk, MWAC 883-001
89-40	MWAC, 20IR29, Belle Isle #1, Selkirk, MWAC 880-006
89-41	MWAC, 20IR29, Belle Isle #1, Selkirk, MWAC 880-005

CLAY SAMPLES

89-1	Chippewa Harbor, ISRO87
89-2	Moskey Narrows, ISRO88
89-3	Beaver Island, ISRO89
89-37	Depot/kitchen area, GRPO89
89-54	Outer Island APIS88

REFERENCES

REFERENCES

Afinson, Scott F. (editor)
1979 A Handbook of Minnesota Prehistoric Ceramics. Occasional Publications in Minnesota Anthropology, no. 5. St. Paul.

Arima, Eugene Y.
1984 Caribou Eskimo. In Arctic, edited by David Damas, pp. 447-462. Handbook of North American Indians, vol. 5, William G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Arnold, D.E., H. Neff, and R. L. Bishop
1990 Compositional Analysis and "Sources" of Pottery: An Ethnoarchaeological Approach. American Anthropologist (in press).

Aronson, Dan R.
1976 Ethnicity as a Cultural System: an Introductory Essay. In, Ethnicity in the Americas, edited by Frances Henry, pp. 19, Mouton & Company, The Hague.

Arthurs, David
1978 Sandy Lake Ware in Northwestern Ontario: A Distributional Study. Archae-Facts 5(2-3):57-64.

1986 Archaeological Investigations at the Long Sault Site, a Stratified Habitation and Burial Station on the Rainy River in Northwestern Ontario. Conservation Archaeology Report 7, Northwestern Region, Ministry of Citizenship and Culture.

Barth, Fredrik, editor
1969 Ethnic Groups and Boundaries: the Social Organization of Cultural Differences. Little, Brown, and Company, Boston.

Bastian, Tyler J.
1963a Archaeological Sruvey of Isle Royale National Park, Michigan, 1960-1962. Manuscript on file, University of Michigan Museum of Anthropology and Midwest Archeological Center, Lincoln.

1963b Prehistoric Copper Mining in Isle Royale National Park, Michigan. Unpublished MA thesis, Department of Anthropology, University of Utah, Salt Lake City.

Baxter, P.T.W.
1977 Boran Age-sets and Warfare. In Warfare Among East African Herders, edited by Katsuyoshi Fukui and David Turton, pp. 69-95. Senri Ethnological Studies 3, Osaka.

Beaubien, Paul L.
1957 Notes on the Archaeology of Pipestone National Monument. The Minnesota Archaeologist 21(3):1-22.

Biggar, H. P. (ed.)
1925 The Publications of the Champlain Society, Volume 2, The Works of Samuel De Champlain. Toronto.

Binford, Lewis R.
1962 Archaeology as Anthropology. American Antiquity 28:217-225.

Birk, Douglas
1977 The Norway Lake Site: A Multicomponent Woodland Complex in North Central Minnesota. The Minnesota Archaeologist 36:16-45.

Birket-Smith, Kaj
1929 The Caribou Eskimos: Material and Social Life and Their Cultural Position. Report of the Fifth Thule Expedition, 1921-1924, Volume 5, Copenhagen.

Bishop, Ronald L., Veletta Canouts, Patricia Crown, and Suzanne P. De Atley
1990 Sensitivity, Precision, and Accuracy: Their Roles in Ceramic Compositional Data Bases. American Antiquity 55(3):537-546.

Bishop, Ronald L., and Hector Neff
1989 Compositional Data Analysis in Archaeology. In Archaeological Chemistry IV, edited by R.O. Allen, pp. 576-586. Advances in Chemistry Series 220, American Chemical Society, Washington, D.C.

Bray, Martha C., editor
1970 The Journals of Joseph N. Nicollet, A Scientist on the Mississippi Headwaters With Notes on Indian Life. Minnesota Historical Society, St. Paul.

Brizinski, Morris J. and Kenneth T. Buchanan
1977 Ceramics, Chert and Culture: An Analysis of Three Prehistoric Sites Located in the Michipicoten Area. Laurentian University, Sudbury.

Brose, David S.
1970 The Archaeology of Summer Island: Changing Settlement Systems in Northern Lake Michigan. Anthropological Papers No. 41. Museum of Anthropology, University of Michigan, Ann Arbor.

1978 Late Prehistory of the Upper Great Lakes Area. In Northeast, edited by Bruce Trigger, pp. 569-582. Handbook of North American Indians, vol. 15. William G., Sturtevant, general editor. Smithsonian Institution, Washington, D. C.

1990 Toward a Model of Exchange Values for the Eastern Woodlands. Midcontinental Journal of Archaeology 15(1):100-136.

Brumbach, Hetty Jo
1975 "Iroquoian" Ceramics in "Algonkian" Territory. Man In the Northeast 10:17-28.

Brumbach, Hetty Jo, and Susan J. Bender
1986 Winney's Rift: A Late Woodland Village Site in the Upper Hudson River Valley. The Bulletin and Journal of Archaeology for New York State 92:1-8.

Buchner, A. P.
1979 The Shield Archaic: A Review. Manitoba Archaeological Quarterly 3(2):2-11.

Buckmaster, Marla
1979 Woodland and Oneota Settlement and Subsistence Systems in the Menominee River Watershed. Unpublished Ph.D. dissertation, Department of Anthropology, Michigan State University, East Lansing. University Microfilms International, Ann Arbor.

Buckmaster, Marla and James Paquette
1988 The Gorto Site: Preliminary Report on a Late Paleo-Indian Site in Marquette County, Michigan. The Wisconsin Archeologist 65(2):159-168.

Burch, Ernest S.
1972 The Caribou/Reindeer as a Human Resource. American Antiquity 37(3):339-368.

1978 Caribou Eskimo Origins: An Old Problem Reconsidered. Arctic Anthropology 15(1):1-35.

Casagrande, Joseph, Stephen Thompson, and Phillip Young

1964 Colonization as a Research Frontier. In, Process and Pattern in Culture: Essays in Honor of Julian H. Steward, edited by Robert Manners, pp. 281-325. Aldine Press, Chicago.

Christian, Sarah

1932 Winter on Isle Royale, A Narrative of Life on Isle Royale During the Years of 1874 and 1875. University Microfilms International, Ann Arbor.

Clark, Caven P.

1987 Archaeological Survey of the Rock Harbor Area, Isle Royale National Park, 1986. Cultural Resource Management Report 14. Michigan Technological University, Houghton.

1989a Analysis of Copper Waste and North Shore Ties in the Terminal Woodland Substage: The 1988 Isle Royale Archaeological Survey. Journal of the Steward Anthropological Society 18(1-2):151-164.

1989b Plano Tradition Lithics from the Upper Peninsula of Michigan. The Michigan Archaeologist 35(2):88-112.

1990 A Dog Burial from Isle Royale, Lake Superior: An Example of Household Ritual Sacrifice in the Terminal Woodland Period. Midcontinental Journal of Archaeology 15(2):265-278.

n.d. The Isle Royale Archaeological Survey: 1986-1990. Unpublished manuscript on file at Isle Royale National Park, Houghton and the Midwest Archeological Center, Lincoln.

Cleland, Charles E.

1966 Analysis of the Fauna of the Indian Point Site on Isle Royale National Park in Lake Superior. The Michigan Archaeologist 14(3-4):143-146.

1971 The Lasnen Site: An Historic Burial Locality in Mackinac County, Michigan. Anthropological Series 1, The Museum, Michigan State University, East Lansing.

1985 Naub-Cow-Zo-Win Disks and Some Observations on the Origin and Development of Ojibwa Iconography. Arctic Anthropology 22(2):131-140.

Cooper, L. and E. Johnson

1964 Sandy Lake Ware and its Distribution. American Antiquity 29(4):474-479.

Conway, Thor
1977 310-Whitefish Island- A Remarkable Archaeological Site at Sault Ste. Marie, Ontario. Research Manuscript Series, Ministry of Culture and Communications.

Crane, H. R. and James B. Griffin
1965 University of Michigan Radiocarbon Dates X. Radiocarbon 7.

Cremin, William C.
1980 Sand Point (20BG14): A Lakes Phase Site on the Keweenaw Peninsula, Baraga County, Michigan. In The Sand Point Site (20BG14), edited by Margaret Holman and Terrance Martin. The Michigan Archaeologist 26(3-4):7-16.

Dawson, K. C. A.
1974 McCluskey Site. Mercury Series, Archaeological Survey of Canada, Paper 25, National Museum of Man, Ottawa.

1978 The Mound Island Site: A Multi-component Woodland Period Habitation Site in Northwestern Ontario. Ontario Archaeology 30:47-66.

1980 The MacGillivray Site: A Laurel Tradition Site in Northwestern Ontario. Ontario Archaeology 34:45-68.

1983 Cummins Site: A Late Palaeo-Indian (Plano) Site at Thunder Bay, Ontario. Ontario Archaeology 39:3-31.

1987 The Martin-Bird Site. Ontario Archaeology 47:33-57.

Despres, Leo A.
1975 Toward a Theory of Ethnic Phenomena. In, Ethnicity and Resource Competition in Plural Societies, edited by Leo Despres, pp. 187- 207. Mouton & Company, The Hague.

Dorothy, Lawrence G.
1980 The Ceramics of the Sand Point Site (20BG14), Baraga County, Michigan: a Preliminary Description. In, The Sand Point Site (20BG14), edited by Margaret Holman and Terrance Martin. The Michigan Archaeologist 26(3-4):39-86.

Drier, Roy W.
1961 The Michigan College of Mining and Technology Isle Royale Excavations, 1953-1954. In Lake Superior Copper and the Indians, Miscellaneous Studies of Great Lakes Prehistory, edited by James B. Griffin, pp. 1-7. Anthropological Papers 17. Museum of Anthropology, University of Michigan, Ann Arbor.

Drier, Roy W. and Octave DuTemple
1961 Prehistoric Copper Mining in the Lake Superior Region: A Compilation of Reference Articles. Privately published by the authors, Calumet.

Dustin, Fred
1929 Narrative Report of an Archaeological Reconnnaissance of Isle Royale During July and August, 1929. Unpublished manuscript on file, University of Michigan, Museum of Anthropology.

1957 An Archaeological Reconnaissance of Isle Royale. Michigan History 41(1):1-34.

Earle, Timothy K., and Jonathon E. Ericson
1977 Exchange Systems in Prehistory. Academic Press, New York.

Elam, J.M. and M.D. Glascock
1988 A Re-examination of the Provenance of Eastern Sigillata A. In Proceedings of the 26th International Archaeometry Symposium, edited by R.M. Farquar, R.G.V. Hancock, and L.A. Pavlish, pp. 179-183. University of Toronto.

Evans, G. Edward
1961 Ceramic Analysis of the Blackduck Ware and Its General Cultural Relationships. Proceedings of the Minnesota Academy of Science, 29:33-54. St. Paul.

Evans-Pritchard, E.E.
1940 The Nuer. Clarendon Press, Oxford.

Farrand, W. R.
1969 The Quaternary History of Lake Superior. International Association of Great Lakes Research, 12th Conference, Great Lakes Research 1969 Proceedings, pp. 181-197.

Fitting, James E.
1965 Late Woodland Cultures of Southeastern Michigan. Anthropological Papers No.24, Museum of Anthropology, University of Michigan, Ann Arbor.

1975 The Archaeology of Michigan. Second Edition. Cranbrook Institute of Science, Bloomfield Hills.

Fitzhugh, William
1972 The Eastern Archaic: Commentary and Northern Perspective. Pennsylvania Archaeologist 42(4):1-19,

Flannery, Kent V.
1971 Archaeological Systems Theory and Early Mesoamerica. In Man's Imprint from the Past, edited by James Deetz. Little Brown, Boston.

Flannery, Kent V. (editor)
1976 The Early Mesoamerican Village. Academic Press, New York.

Ford, Richard I.
1972 Barter, Gift, or Violence: An Analysis of Tewa Intertribal Exchange. In, Social Exchange and Interaction, edited by Edwin Wilmsen, pp. 21-45. Anthropological Papers 46, The University of Michigan, Museum of Anthropology, Ann Arbor.

Foster, Brian L. and Geoffrey M. White
1982 Ethnic Identity and Perceived Distance Between Ethnic Categories. Human Organization 41(2):121-130.

Foster, J. W., and J. D. Whitney
1850 Report on the Geology and Topography of a Portion of the Lake Superior Land District in the State of Michigan: Copper Lands. House Executive Documents No 69, Part 1. Washington, D.C.

Franzen, John G.
1987 Test Excavation and Locational Analysis of Prehistoric Sites in the Hiawatha National Forest, Michigan. Cultural Resource Management Report No. 5, Hiawatha National Forest, Escanaba.

Fried, Morton
1966 On the Concepts of "Tribe" and "Tribal Society." Transactions of the New York Academy of Science 28:527-540.

Fukui, Katsuyoshi
1977 Cattle Colour Symbolism and Intertribal Homicide Among the Bodi. In Warfare Among East African Herders, edited by Katsuyoshi Fukui and David Turton, pp. 147-177, Senri Ethnological Ethnological Studies 3, Osaka.

Fukui, Katsuyoshi and David Turton
1977 Introduction. In Warfare Among East African Herders, edited by Katsuyoshi Fukui and David Turton, pp. 1-13, Senri Ethnological Ethnological Studies 3, Osaka.

Gibbon, Guy E. and Christy A. H. Caine
1980 The Middle to Late Woodland Transition in Eastern Minnesota. Midcontinental Journal of Archaeology 5(1):57-72.

Gilbert/Commonwealth, Inc. 1987

1986 Cultural Resource Survey, Hiawatha National Forest. Submitted to the U.S.D.A., Forest Service, Milwaukee, Contract No. 53-53B0-5-01018.

Glascock, Michael and J.M. Elam

1988 Differentiation of Obsidian Sources in Mesoamerica. In Proceedings of the 26th International Archaeometry Symposium, edited by R.M. Farquar, R.G.V. Hancock, and L.A. Pavlish, pp. 245-251. University of Toronto.

Gordon, Bryan H.C.

1975 Of Men and Herds in Barrenlands Prehistory. Paper 28, Mercury Series, Archaeological Survey of Canada, National Museum of Man, Ottawa.

Gordon, Diana Lynn

1985 North Caribou Lake Archaeology, Conservation Archaeology Report, Northwestern Region, Report 9.

Gould, R.A.

1980 Living Archaeology. Cambridge University Press, Cambridge.

Griffin, James B., editor

1961 Lake Superior Copper and the Indians, Miscellaneous Studies of Great Lakes Prehistory. Anthropological Papers 17, Museum of Anthropology, University of Michigan, Ann Arbor.

Griffin, James B.

1961 Early Historical Accounts of the Lake Superior Copper District. In Lake Superior Copper and the Indians, Miscellaneous Studies of Great Lakes Prehistory, edited by James B. Griffin, pp. 32-45. Anthropological Papers 17, Museum of Anthropology, University of Michigan, Ann Arbor.

Griffin, James B. and George I. Quimby

1961 Prehistoric Copper Pits on the Eastern Side of Lake Superior. In Lake Superior Copper and the Indians, Miscellaneous Studies of Great Lakes Prehistory, edited by James B. Griffin, pp. 77-82. Anthropological Papers 17, Museum of Anthropology, University of Michigan, Ann Arbor.

Griffin, James B.

1966 The Calumet Ancient Pit. The Michigan Archaeologist 12(3):130-133.

Guthe, Carl

1930 Unpublished field notes on file at the University of Michigan, Museum of Anthropology.

Halsey, John R.

1976 The Bussinger Site: A Multicomponent Site in the Saginaw Valley of Michigan With a Review of Early Late Woodland Mortuary Complexes in the Northeastern Woodlands. Unpublished PhD dissertation, University of Chapel Hill. University Microfilms International, Ann Arbor.

1983 Miswabik-Red Metal: Lake Superior Copper and the Indians of Eastern North America. Michigan History 67(5):32-41.

Halverson, Colleen

1988 An Archaeological Survey of Stephen, Cameron, Flint, and Kakgi Lakes in Northwestern Ontario. Conservation Archaeology Report 12, Minstry of Citizenship and Culture, Northwestern Region.

Hamilton, Scott

1981 The Archaeology of Wenesaga Rapids. Archaeology Research Report 17, Archaeology and Heritage Planning Branch, Ministry of Culture and Recreation, Toronto.

1988 The Concept of Cultural Edge in the Boreal Forest of Manitoba and Northwestern Ontario. In Boreal Forest and Sub-Arctic Archaeology, edited by C.S. Reid, pp. 37-71. Occasional Publications of the London Chapter, Number 6, Ontario Archaeological Society.

Harbottle, Gar

1976 Activation Analysis in Archaeology. In Radiochemistry 3:33-72. The Chemical Society, London.

Hearne, Samuel

1958 A Journey from Prince of Wale's Fort in Hudson's Bay to the Northern Ocean in the Years 1769, 1770, 1771, and 1772. Edited by Richard Glover, MacMillan and Company, Toronto.

Helm, June

1968 The Nature of Dogrib Socioterritorial Groups. In Man the Hunter, edited by Richard B. Lee and Irven DeVore, pp. 118-125, Aldine Press, New York.

Hickerson, Harold

1960 The Feast of the Dead Among the Seventeenth Century Algonkians of the Upper Great Lakes. American Anthropologist 62:81-107.

1970 The Chippewa and Their Neighbors: A Study in Ethnohistory. Studies in Anthropological Method, Holt, Rinehart, and Winston, Inc., New York.

Hlady, Walter M.
1970 Ten Thousand Years: Archaeology in Manitoba, Commemorating Manitoba's Centennial, 1870-1970. Manitoba Archaeological Society, Altona.

1971 An Introduction to the Archaeology of the Woodland Area of Northern Manitoba. Manitoba Archaeological Newsletter 8(2-3).

Hodder, Ian
1979 Economic and Social Stress and Material Cultural Patterning. American Antiquity 44(3):446-454.

Holman, Margaret
1978 The Settlement System of the Mackinac Phase. Unpublished PhD Dissertation, Michigan State University. University Microfilms International, Ann Arbor.

Holmes, William H.
1901 Aboriginal Copper Mines of Isle Royale, Lake Superior. American Anthropologist 3:684-696.

1919 Handbook of Aboriginal American Antiquities, Part I, Introductory, The Lithic Industries. Bulletin 60, Bureau of American Ethnology, Smithsonian Institution. U.S. Government Printing Office, Washington, D.C.

Hoxie, R. David
1980 An Analysis of the Late Woodland Copper Assemblage from the Sand Point Site, Baraga County, Michigan. In The Sand Point Site (20BG14), edited by Margaret Holman and Terrance Martin. The Michigan Archaeologist 26(3-4):25-38.

Hruska, Robert
1967 The Riverside Site: A Late Archaic Manifestation in Michigan. The Wisconsin Archeologist 48(3):145-260.

Huber, N. King
1975 The Geologic Story of Isle Royale National Park. Bulletin No. 1309, U. S. Geological Survey, U.S. Government Printing Office, Washington, D.C.

Innis, Harold A.
1970 The Fur Trade in Canada. University of Toronto Press, Toronto.

Irimoto, Takashi
1981 Chipewyan Ecology: Group Structure and Caribou Hunting System. Senri Ethnological Studies 8, Osaka.

Irving, Roland D.
1883 The Copper-Bearing Rocks of Lake Superior. Monographs of the United States Geological Survey, Volume V, U.S. Government Printing Office, Washington, D.C.

Jacobs, Alan
1977 Maasai Inter-Tribal Relations: Belligerent Herdsmen or Peaceable Pastoralists. In Warfare Among East African Herders, edited by Katsuyoshi Fukui and David Turton, pp. 33-51, Senri Ethnological Ethnological Studies 3.

Janes, Robert R.
1973 Indian and Eskimo Contact in Southern Keewatin: An Ethnohistoric Approach. Ethnohistory 20(1):39-54.

Janzen, Donald E.
1968 The Naomikong Point Site and the Dimensions of Laurel in the Lake Superior Basin. Anthropological Papers No. 36, Museum of Anthropology, The University of Michigan, Ann Arbor.

Jochim, Michael A.
1981 Strategies for Survival: Cultural Behavior in an Ecological Context. Academic Press, Inc., New York.

Julig, Patrick, L.A. Pavlish, and R.G.V. Hancock
1988 INNA of Lithic Materials from the Western Lake Superior Region, North America: Determination of Raw Material Sources. In, Proceedings of the 26th International Symposium of Archaeometry. Toronto.

n.d. Report on INNA Analysis of Lithic Materials from Isle Royale, Lake Superior. Unpublished manuscript in possession of authors.

Justeson, John and Steven Hampson
1985 Closed models of open systems: boundary considerations. In, The Archaeology of Frontiers and Boundaries, edited by Stanton W. Green and Stephen M. Perlman, pp. 15-30. Academic Press, New York.

Karamanski, T., R. Zeitlin, and J. Derose
1988 Narrative History of Isle Royale National Park. Mid-American Research Center, University of Chicago, Loyola.

Kellog, Louise Phelps
1926 The French Regime in Wisconsin and the Northwest. State Historical Society of Wisconsin, Madison.

Kenyon, Walter A.
1986 Mounds of Sacred Earth: Burial Mounds of Ontario. Archaeology Monograph 9, Royal Ontario Museum, Toronto.

Koelz, Walter
1929 A survey of the lakes of Isle Royale with an account of the fishes occuring in them. Typed ms., Institute of Fisheries Research, University of Michigan, Ann Arbor.

Kohl, Johann Georg
1985 Kitchi-Gami: Life Among the Lake Superior Ojibway. Translated by Lacelles Wraxall. Minnesota Historical Society Press, St. Paul.

Kuhn, Robert D.
1986 Interaction Patterns in Eastern New York: A Trace Element Analysis of Iroquoian and Algonkian Ceramics. The Bulletin and Journal of Archaeology for New York State 92:9-21.

Lake Superior Basin Workshop
1988 Desparately Seeking Siouans: The Distribution of Sandy Lake Ware. Wanikan 88-1.

Leach, Edmund R.
1954 Political Systems of Highland Burma. Beacon Press, Boston.

Leacock, Eleanor
1954 The Montagnais "Hunting Territory" and the Fur Trade. American Anthropological Association, Memoir 78.

Lenihan, Danial J., editor
1987 Submerged Cultural Resources Study: Isle Royale National Park. Professional Papers No. 8, Southwest Cultural Resources Center, Santa Fe.

Linton, Ralph (editor)
1940 Acculturation in Seven American Indian Tribes. New York.

Little, Elizabeth A.
1987 Inland Waterways in the Northeast. Midcontinental Journal of Archaeology 12(1):55-76.

Longacre, William A.

1968 Some Aspects of Prehistoric Society in East-Central Arizona. In New Perspectives in Archeology, edited by Sally R. Binford and Lewis R. Binford, pp. 89-102. Aldine Press, New York.

Lovis, Wm. A.

1973 Late Woodland Cultural Dynamics in the Northern Lower Peninsula of Michigan. Unpublished PhD Dissertation, Michigan State University. University Microfilms International, Ann Arbor.

1990 Accelerator Dating of the Ceramic Assemblage from the Fletcher Site: Implications of a Pilot Study for Interpretation of the Wayne Period. Midcontinental Journal of Archaeology 15(1):37-50.

Luedtke, Barbara

1976 Lithic Material Distributions and Interaction Patterns During the Late Woodland Period in Michigan. Unpublished Ph.D. dissertation, Department of Anthroplogy, University of Michigan. University Microfilms International. Ann Arbor.

Lugenbeal, Edward N.

1978 The Blackduck Ceramics from the Smith Site (21KC3) and Their Implications for the History of Blackduck Ceramics and Culture in Northern Minnesota. Midcontinental Journal of Archaeology 3(1):45-68.

Lynott, Mark J., Patrick E. Martin, and Caven P. Clark

1987 Isle Royale Archeology: 1987. Paper presented at the Midwest Archaeological Conference, Milwaukee.

Lynott, Mark J., Jeffrey J. Richner, and Mona Thompson

1986 Archeological Investigations at Voyageurs National Park: 1979 and 1980. Occasional Studies in Anthropology No. 16, National Park Service, Midwest Archeological Center, Lincoln.

Maass, Carol

1984 Interim Cultural Sites Inventory. Unpublished manuscript on file at Isle Royale National Park, Houghton, and Midwest Archeological Center, Lincoln.

MacNeish, R. S.

1952 Iroquois Pottery Types. Bulletin 124, National Museums of Canada, Ottawa.

1958 An Introduction to the Archaeology of Southwest Manitoba. Bulletin 157, Anthropological Series 44, National Museums of Canada, Ottawa.

Martin, Christian J.

1988 An Ecological History of Sharp-tailed Grouse in Isle Royale National Park. Unpublished MS thesis, University of Minnesota, Duluth.

Martin, Patrick E.

1988 Technical Report on Archaeological Survey and Evaluation Isle Royale National Park During 1986. Ms. on file, Archaeology Laboratory, Department of Social Sciences, Michigan Technological University, Houghton.

Martin, Terrance and Mary Masulis

1989a Animal Remains from Archaeological Sites at Isle Royale National Park, Michigan: 1987 Season. Quaternary Studies Program Technical Report 89-389-8, Illinois State Museum Society, Springfield.

1989b Animal Remains from Archaeological Sites at Isle Royale National Park, Michigan: 1988 Season. Quaternary Studies Program Technical Report 89-512-30, Illinois State Museum Society, Springfield.

Mason, Ronald J.

1966 Two Stratified Sites on the Door Peninsula of Wisconsin. Anthropological Papers 26, Museum of Anthropology, University of Michigan, Ann Arbor.

1967 The North Bay Component at Porte Des Morts Site, Door County, Wisconsin. The Wisconsin Archeologist 48(4):267-345.

1969 Laurel and North Bay: Diffusional Networks in the Upper Great Lakes. American Antiquity 34(2):295-302

1976 Ethnicity and Archaeology in the Upper Great Lakes. In, Cultural Change and Continuity: Essays in Honor of James Bennett Griffin, edited by Charles E. Cleland, pp. 349-361. Academic Press, New York.

1981 Great Lakes Archaeology. Academic Press, New York.

1986 Rock Island: Historical Indian Archaeology in the Northern Lake Michigan Basin. Special Paper 6, Midcontinental Journal of Archaeology.

Mathiassen, Therkel

1930 The Question of the Origin of Eskimo Culture. American Anthropologist 32(4):591-607.

McHale Milner, Claire, and John O'Shea

1990 Life After the Juntunen Site? Late Prehistoric Occupation of the Upper Great Lakes. Paper presented at the Midwest Archaeological Conference, October 5-6, Evanston.

McLeod, Mike

1978 The Archaeology of Dog Lake, Thunder Bay: 9000 Years of Prehistory. Report Submitted to the Ontario Heritage Foundation, Lakehead University.

McPherron, Alan

1967 The Juntunen Site and the Late Woodland Prehistory of the Upper Great Lakes Area. Anthropological Papers 30, Museum of Anthropology, University of Michigan, Ann Arbor.

Meech, L. David

1966 The Wolves of Isle Royale. Fauna of the United States National Parks, Fauna Series 7. U.S. Government Printing Office, Washington, D.C.

Michlovic, Michael

1981 Patterns of Social Interaction and the Dynamics of Artifact Style. In, Current Directions in Midwestern Archaeology: Selected Papers from the Mankato Conference, edited by Scott Anfinson, pp. 41-48. Minnesota Historical Society, Occasional Publications in Minnesota Anthropology 9, St. Paul.

Milner, George, Virginia Smith, and Eve Anderson

1988 Conflict, Mortality, and Community Health in an Illinois Oneota Population. Paper presented at the conference entitled: Between Bands and States: Sedentism, Subsistence, and Interaction in Small-Scale Societies. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Moore, James A.

1981 The Effects of Information Networks in Hunter-Gatherer Societies. In, Hunter-Gatherer Foraging Strategies, edited by Bruce Winterhalder and Eric Smith, pp. 194-217. The University of Chicago Press, Chicago.

Munsell Color

1975 Munsell Soil Color Charts. Munsell Color, MacBeth Division of Kollmorgen Corporation, Baltimore.

Neff, Hector

1988 Reconstructing Ceramic Production from Ceramics Compositional Data: A Guatemalan Example. Journal of Field Archaeology 15:339-348.

Neff, H., R.L. Bishop, and E.V. Sayre

1988 A Simulation Approach to the Problem of Tempering in Compositional Studies of Archaeological Cermaics. The Journal of Archaeological Science 15:159-172.

1989 More Observations on the Problem of Tempering in Compositional Studies of Archaeological Ceramics. The Journal of Archaeological Science 16:57-69.

Noble, William C.

1975 Van Beisen (AfHd-2): A Study in Glen Meyer Development. Ontario Archaeology 24.

Packard, R. L.

1893 Pre-Columbian Copper Mining in North America. Annual Report of the Board of Regents of the Smithsonian Institution, July 1892. U.S. Government Printing Office, Washington, D.C.

Parker, John (editor)

1976 The Journals of Jonathan Carver and Related Documents 1766-1770. Minnesota Historical Society Press, St. Paul.

Parker, Kathryn E.

1988 Plant Remains from 1987 Archaeological Testing on Isle Royale. Ms. on file, Midwest Archeological Center, Lincoln.

1989 Plant Remains from 1988 Archaeological Testing on Isle Royale. Ms. on file, Midwest Archeological Center, Lincoln.

1990 Plant Remains from 1989 Archaeological Testing on Isle Royale. Ms. on file, Midwest Archeological Center, Lincoln.

Pelleck, John A.

1983 Forestry Point (Egkl-1): A Woodland site on Red Lake, Northwestern Ontario. Report 3, Northwest Region, Ministry of Culture and Communications.

Penman, John T.

1977 The Old Copper Culture: An Analysis of Old Copper Artifacts. The Wisconsin Archeologist 58(1):3-23.

Perry, Leslie A.

1986a Archeology Along the St. Croix Riverway 1981. Midwest Archeological Center, National Park Service, Lincoln.

1986b Archeological Site Evaluation St. Croix National Scenic Riverway 1982. Midwest Archeological Center, National Park Service, Lincoln.

Peters, Gordon, John Hunn, Karene Motivans, and Walter Okstad
1983 Cultural Resource Management on the Superior National Forest, 1982 Annual Report. Cultural Resource Report No. 1. U.S.D.A. Forest Service, Superior National Forest, Duluth.

Peters, Gordon (editor)
1984 Cultural Resource Management on the Superior National Forest, 1983 Annual Report. Cultural Resource Report No. 2. U.S.D.A. Forest Service, Superior National Forest, Duluth.

Peters, Gordon (editor)
1986 Cultural Resource Management on the Superior National Forest, 1985 Annual Report. Cultural Resource Report No. 4. U.S.D.A. Forest Service, Superior National Forest, Duluth.

Peterson, Lynell
1986 An Attribute Analysis of Sandy Lake Ware from Norman County and North Central Minnesota. Unpublished Master's thesis, University of Nebraska, Lincoln.

Peterson, Rolf O.
1977 Wolf Ecology and Prey Relationships on Isle Royale. National Park Service Scientific Monograph Series 11. U.S. Government Printing Office, Washington, D.C.

Prescott, J. R. V.
1965 The Geography of Frontiers and Boundaries. Aldine Press, Chicago.

Pye, E. G.
1969 Geology and Scenery, North Shore of Lake Superior. Geological Guide Book 2, Ontario Department of Mines, Toronto.

Quimby, George I.
1939 Aboriginal Camp Sites on Isle Royale, Michigan. American Antiquity 4(3):215-223.

1966a The Dumaw Creek Site: A Seventeenth Century Indian Village and Cemetery in Oceana County, Michigan. Fieldiana:Anthropology 56(1):1-91.

1966b Indian Culture and European Trade Goods: The Archaeology of the Historic Period in the Western Great Lakes Region. The University of Wisconsin Press, Madison.

Rajnovich, Grace

1980 Balysadare (DkKp-10): A Laurel-Blackduck Site at the Source of the Winnepeg River. Ontario Archaeology 33:37-58

1983 The Spruce Point Site: A Comparative Study of Selkirk Components in the Boreal Forest. Conservational Archaeology Report No. 1, Northwestern Region, Heritage Branch, Ministry of Citizenship and Culture. Kenora.

Rajnovich, Grace and C.S. Reid

1987 Rescuing Rat River Portage Prehistory: Preliminary Report on the 1986 Excavations of the Ballynacree Site in Kenora. Conservation Archaeology Report 11, Northwestern Region, Ministry of Citizenship and Culture.

Ramsden, Peter G.

1977 Refinement of Some Aspects of Huron Ceramic Analysis. Mercury Series 63, National Museum of Man, Ottawa.

1988 The Huron-Algonkian Boundary: The View from Haliburton and the Kawartha Lakes. Paper presented at the Annual meeting of the Canadian Archaeological Association, Whistler, B.C.

Rapp, George, James Allert, and Eiler Henrickson

1984 Trace Element Discrimination of Discrete Sources of Native Copper. In Archaeological Chemistry III, edited by J.B. Lambert, pp. 273-293. American Chemical Society.

Ray, Arthur J.

1974 Indians in the Fur Trade: Their Role as Hunters, Trappers and Middlemen in the Lands Southwest of Hudson Bay, 1660-1870. University of Toronto Press, Toronto.

Reid, C.S.

1975 The Boys site and the Early Ontario Iroquois Tradition. Mercury Series, Archaeological Survey of Canada, Paper 42, National Museum of Man, Ottawa.

1988 Some Ideas Concerning the Formulation of Research Designs and Excavation Methodologies on Boreal Forest Habitation Sites. Midcontinental Journal of Archaeology 13(2):187-221.

Reid, C.S.(editor)
1980 Studies in West Patricia Archaeology No. 1:1978-1979. Archaeological Research Report 15, Historical Planning and Research Branch, Ministry of Culture and Recreation.

Reid, C.S. and W.A. Ross, (editors)
1981 Studies in West Patricia Archaeology No. 2: 1979-1980. West Patricia Heritage Resource Report 2, Archaeological Research Report 16, Historical Planning and Research Branch, Ontario Ministry of Culture and Recreation.

Renfrew, Colin
1977 Alternative Models for Exchange and Spatial Distribution. In, Exchange Systems in Prehistory, edited by Timothy Earle and Jonathon Ericson, pp. 71-90. Academic Press, New York.

Richards, Bruhy, and Lynne Goldstein
1987 Culture Contact in the Late Prehistoric and Historic Midwest: French and Native American Interactions as a Model for Late Woodland-Mississippian Dynamics. Paper presented at the annual meeting of the Midwest Archaeological Conference, Milwaukee.

Rogers, Edward S.
1967 The Material Culture of the Mistassini. Bulletin 218, National Museum of Canada, Ottawa.

Ross, W.A. (editor)
1982 Studies in West Patricia Archaeology Number Three/1980-1981, Archaeology Research Report No. 2. Ministry of Citizenship and Culture, Toronto.

Sackett James R.
1982 Approaches to Style in Lithic Archaeology. Journal of Anthropological Archaeology 1(1):59-112.

Sahlins, Marshall
1961 The Segmentary Lineage: An Organization of Predatory Expansionism. American Anthropologist 63:322-345.

1972 Stone Age Economics. Aldine Publishing Company, New York.

Salzer, Robert J.
1974 The Wisconsin North Lakes Project: A Preliminary Report. In Aspects of Upper Great Lakes Anthropology, Papers in Honor of Lloyd A. Wilford, edited by Elden Johnson, pp. 40-54. Minnesota Prehistoric Archaeology Series 11, Minnesota Historical Society, St. Paul.

1986 Other Late Woodland Developments. The Wisconsin Archeologist 67(3-4):302-313.

Sampson, C. Garth
1988 Stylistic Boundaries Among Mobile Hunter-Foragers. Smithsonian Institution Press, Washington, D.C.

Sauer, Norman J.
1990 An Analysis of the Human Skeletal Remains from the Massee Rockshelter, Isle Royale National Park. Ms. on file, National Park Service, Midwest Archeological Center, Lincoln, NE.

Sayre, E.V.
n.d. Brookhaven Procedures for Statistical Analyses jof Multivariate Archaeometric Data. Brookhaven National lab, Report BNL-21693.

Schoolcraft, Henry R.
1821 Travels to the Sources of the Mississippi River. E.M. Hosfor, Albany, New York.

Schortman, Edward M.
1989 Interregional Interaction in Prehistory: The Need for a New Perspective. American Antiquity 54(1):52-65.

Service, Elman R.
1962 Primitive Social Organization. Random House, Inc., New York.

1971 Cultural Evolutionism: Theory in Practice. Holt, Rinehart, and Winston, New York.

Sharp, Henry
1977 The Caribou-Eater Chipewyan: Bilaterality, Strategies of Caribou Hunting, and the Fur Trade. Arctic Anthropology 14(2):35-40.

Sharp, Robert W. and Nord
1960 A Fishery Survey of Some of the Lakes of the Isle Royale National Park. Bureau of Sport Fisheries and Wildlife, Minneapolis. Ms. on file, Isle Royale National Park, Houghton.

Sharrock, Susan R.
1974 Crees, Cree-Assiniboines, and Assiniboins: Interethinc Social Organization on the Far Northern Plains. Ethnohistory 21(2):95-122.

Shay, C. Thomas

1971 The Itasca Bison Kill Site: An Ecological Analysis. Minnesota Prehistoric Archaeology Series No 6, St. Paul.

Slavick, Allison D. and Robert A. Janke

1987 The Vascular Flora of Isle Royale National Park. The Michigan Botanist 26(3).

Smith, Beverly

1987 Dog Burials of Late Prehistoric Algonquian Sites in Northeastern Ontario. Paper presented at the 52nd Meeting of the Society for American Archaeology.

Smith, James G.E.

1978 Economic Uncertainty in an "Original Affluent Society:" Caribou and Caribou-Eater Chipewyan Adaptive Strategies. Arctic Anthropology 15(1):68-88.

Smith, James G.E. and Ernest Burch

1979 Chipewyan and Inuit in the Central Canadian Subarctic, 1613-1977. Arctic Anthropology 16(2):76-101.

Spicer, Edward H.

1961 Types of Contact and Processes of Change. In, Perspectives in American Indian Culture Change, edited by Edward H. Spicer, pp. 517-544. University of Chicago Press, Chicago

Stanley, George M.

1932 Abandoned Strands of Isle Royale and Northeastern Lake Superior. Unpublished Ph.D. dissertation, University of Michigan.

Steinbring, Jack

1974 The Preceramic Archaeology of Northern Minnesota. In Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd A. Wilford, edited by Elden Johnson, pp. 64-73. Minnesota Prehistoric Archaeology Series 11, Minnesota Historical Society, St. Paul.

Stoltman, James B.

1973 The Laurel Culture in Minnesota. Minnesota Prehistoric Archaeological Series No. 8, Minnesota Historical Society, St. Paul.

1986 The Archaic Tradition. The Wisconsin Archeologist 67(3-4):207-242.

Stone, Lyle and Donald Chaput
1978 History of the Upper Great Lakes Area. In Northeast, edited by Bruce G. Trigger, pp. 602-609. Handbook of North American Indians, vol. 15, William G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Stuiver, Minz, and B. Becker
1986 High Precision Decadal Calibration of the Radiocarbon Time Scale, A.D. 1950-2500 B.C. Radiocarbon 28:863-910.

Swanton, John R.
1911 Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico. Bulletin 43, Bureau of American Ethnology, Smithsonian Institution. U.S. Government Printing Office, Washington, D.C.

Syms, E. Leigh
1977 Cultural Ecology and Ecological Dynamics of the Ceramic Period in Southwestern Manitoba. Plains Anthropologist 12(2).

Thomas, David Hurst
1975 Non-Site Sampling in Archeology: Up the Creek Without a Site. In Sampling in Archeology, edited by James W. Mueller, pp. 61-81. University of Arizona Press, Tucson.

Thwaites, Rueben Gold
1899-1900 The Jesuit Relations and Allied Documents: Travels and Explorations of the Jesuits and Missionaries in New France, 1610-1791. 73 Volumes. Burrows Brothers Company, Cleveland.

Tornay, Serge
1977 Armed Conflicts in the Lower Omo Valley, 1979-1976: An Analysis From Within Nyangatom Society. In Warfare Among East African Herders, edited by Katsuyoshi Fukui and David Turton, pp. 97-117, Senri Ethnological Ethnological Studies 3, Osaka.

Trigger, Bruce G.
1976 The Children of Aataentsic: A History of the Huron People to 1660. McGill-Queen's University Press, Montreal and London.

1978 Time and Traditions, Essays in Archaeological Interpretations. Columbia University Press, New York.

1984 The Road to Affluence: A Reassessment of Early Huron Responses to European Contact. In Affluence and Cultural Survival: 1981 Proceedings of the American Ethnological Society, edited by Richard F. Salisbury and Elisabeth Tooker, pp. 12-25. American Ethnological Society, Washington, D.C.

Vernon, W. W.

1985 New Perspectives on the Archaeometalurgy of the Old Copper Industry. MASCA Journal Supplement 3(5):154-163.

Walthall, John A.

1981 Galena and Aboriginal Trade in Eastern North America. Scientific Papers, Volume 17, Illinois State Museum, Springfield.

West, George A.

1929 Copper: Its Mining and Use by the Aborigines of the Lake Superior Region. Report of the McDonald-Massee Isle Royale Expedition, 1928. Bulletin of the Public Museum of the City of Milwaukee 10(1):1-182.

Whallon, Robert

1968 Investigations of Late Prehistoric Social Organization in New York State. In New Perspectives in Archeology, edited by Sally R. Binford and Lewis R. Binford, pp. 223-244. Aldine Press, New York.

Whittlesey, Charles

1863 Ancient Mining on the Shores of Lake Superior. Smithsonian Contributions to Knowledge 13(155). Washington, D.C.

Wiessner, Polly

1984 Reconsidering the Behavioral Basis of Style. Journal of Anthropological Archaeology 3(2):190-234.

1985 Style or Isochrestic Variation? A Reply to Sackett. American Antiquity 50(1):160-166.

Wilford, Lloyd A.

1941 A Tentative Classification of the Prehistoric Cultures of Minnesota. American Antiquity 6(3):231-249.

1955 A Revised Classification of the Prehistoric Culture in Minnesota. American Antiquity 21:130-142.

Winchell, N. H.

1881 Ancient Copper-Mines of Isle Royale. Popular Science Monthly 19(5):601-620.

1911 The Aborigines of Minnesota. Minnesota Historical Society, The Poineer Company, St. Paul.

Wittry, Warren

1957 A Preliminary Study of the Old Copper Complex. The Wisconsin Archeologist 38(4):204-221.

1963 The Bell Site, Wn9, An Early Historic Fox Village. The Wisconsin Archeologist 44(1):1-57.

Wright, Gary A.

1974 Archaeology and Trade. Addison-Wesley Module in Anthropology, No. 49. Reading.

Wright, J. V.

1965 A Regional Examination of Ojibwa Culture History. Anthropologica 7:189-227.

1966 The Ontario Iroquois Tradition. Bulletin 210, National Museums of Canada, Ottawa.

1967 The Laurel Tradition and the Middle Woodland Period. Bulletin 217, National Museums of Canada, Ottawa.

1968 The Michipicoten Site. Bulletin 224:1-85, National Museums of Canada, Ottawa.

1972a Ontario Prehistory. National Museum of Man, National Museums of Canada, Ottawa.

1972b The Shield Archaic. National Museums of Canada, Publications in Archaeology 3. Ottawa.

1974 The Nodwell Site. Mercury Series, Archaeological Survey of Canada, Paper 22, National Museums of Canada, Ottawa.

1981 Prehistory of the Canadian Shield. In Subarctic, edited by June Helm, pp. 86-96. Handbook of North American Indians vol. 6. William G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.