PREHISTORIC COPPER MINING IN ISLE ROYALE NATIONAL PARK, MICHIGAN

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PREHISTORIC COPPER MINING
IN ISLE ROYALE NATIONAL PARK, MICHIGAN

by

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TABLE OF CONTENTS

		Page
PREFACE		iv
LIST OF TABLES, FIGURES, AND PLATES		vi
Chapter I.	INTRODUCTION	1
II.	THE NATURAL SETTING	2
III.	PREVIOUS INVESTIGATIONS AND INTERPRETATIONS	9
IV.	THE NATIVE COPPER DEPOSITS	17
V.	THE PREHISTORIC COPPER MINES	20
VI.	ARTIFACTS ASSOCIATED WITH THE MINES	32
VII.	OTHER ARTIFACTS FROM ISLE ROYALE	39
VIII.	HISTORIC ACCOUNTS OF ABORIGINAL COPPER MINING IN THE LAKE SUPERIOR REGION	43
IX.	SUMMARY AND DISCUSSION	49
X.	CONCLUSIONS	60
REFERENCES CITED		62
FIGURES		73
PLATES		76

PREFACE

This is not the thesis which I had intended to write; it is a rather hasty distillation of a portion of the data available on one aspect of Isle Royale archeology. A more comprehensive report is still contemplated, and this thesis may be considered as a preliminary statement about the prehistoric copper mines on Isle Royale.

The field data were collected during a total period of 35 weeks in the summers of 1960, 1961, and 1962. The first two summers were spent surveying and testing reported sites and areas thought most likely to contain occupation sites and prehistoric mines. Because of the heavy vegetation, surface collecting was usually not feasible, and extensive test pitting was conducted. Most of the activity was confined to the outer shores, except where mines were reported in the interior. Efforts to locate previously unreported mine and occupation sites in the interior were unsuccessful, although a few scattered artifacts were found. The final summer was devoted to a more intensive examination of the Minong mine site and the Indian Point camp site. Most of this paper is based on the data collected during the first two summers.

The members of the survey began with no firsthand knowledge of the archeology of the boreal forest or of prehistoric mine or quarry sites. By the end of the third field season we were considerably wiser, so that even if we have not learned a great deal, we are at least better able to appreciate how much we still do not know. Many of the surface observations concerning prehistoric mining which were made during the early part of the survey are now regarded as unreliable, and they will have to be re-examined in the field. In the present paper there is no attempt to present a systematic catalog and critique of all of the survey's observations on prehistoric mines, but I have abstracted what I consider as probably the most reliable.

The archeological survey of Isle Royale National Park, hereafter referred to as "the survey," was conducted by the Museum of Anthropology of the University of Michigan on a contract basis for the National Park Service. Dr. John L. Cotter, Regional Archeologist for the National Park Service, spent several days in the field each summer and has provided much stimulation for the project. Dr. James B. Griffin, Director of the Museum of Anthropology, has been largely responsible for the choice of personnel and for the administration of the survey. I have been almost wholly responsible for planning and conducting the field operations. I am indebted to Drs. Cotter and Griffin for their support and for allowing me to use the data for this thesis.

Dr. Robert M. Linn, formerly Chief Park Naturalist, Isle Royale National Park, shared his experienced knowledge of Isle Royale, made a special effort to smooth our work in the field, and was a welcome source of candid opinion of our efforts.

The members of the first summer's crew were: Thomas F. Nemec, Larry H. Robbins, Paul J. Roper, and Jon C. Staiger; David H. Thompson assisted in 1961; and in 1962 the party included Nemec, Robbins, Thompson, William Deephouse, David Olen, and Gilbert Winer. I am grateful to each of them for their patience and endurance.

I also want to express my thanks to numerous others who have either been partly responsible for the conduct of the survey or have provided some special assistance or information. They include the staff of the Museum of Anthropology, the National Park Service personnel on Isle Royale and in Houghton, the summer residents of Isle Royale, archeologists in the Great Lakes area, and various staff members at the University of Utah.

I am indebted to Dr. David M. Pendergast, chairman of my thesis committee, for his advice and thorough editing of the thesis; and to Dr. Jesse D. Jennings and Dr. Max P. Erickson, for serving on my thesis committee.

LIST OF TABLES

Table		Page
1.	Prehistoric Copper Mines on Isle Royale	31
2.	Attributes of Hammerstones from Isle Royale . .	35
3.	Radiocarbon Dates from a Fissure Mine (Pit 25) at the Minong Site	55

LIST OF FIGURES

Figure		
1.	Map of Prehistoric Copper Mine Sites on Isle Royale	73
2.	Cross Section of a Fissure Mine (Pit 56) at the Lookout Site	74
3.	Cross Section of a Fissure Mine (Pit 4) at the Lookout Site	74
4.	Cross Section of Lode Mines at the Minong Site	74
5.	Map of Lode Mines near Pit 54 at the Minong Site	75

LIST OF PLATES

Plates		
1.	Excavated Fissure and Lode Mines	76
2.	Selected Artifacts from Isle Royale	77

CHAPTER I

INTRODUCTION

This report attempts to summarize what is known about prehistoric copper mining on Isle Royale. The data are derived from publications, museum collections, and field research. There seem to be five major questions that may be asked about the Indian mines on Isle Royale: (1) How large and extensive are the mines? (2) How were they worked? (3) When were they worked? (4) What is the relationship between the mines and the Indian camp sites on the island? (5) What is the relationship of the Isle Royale copper mines to the general archeology of the Lake Superior region, and to the rest of North American prehistory? We will return to these specific questions in Chapter IX.

Another question, which hardly seems to deserve serious consideration, has been the subject of much popular literature: Who were the prehistoric copper miners? The general answer to this has been adequately known for over half a century, and no documented information has come to my attention which would even suggest that anyone might have mined copper on Isle Royale in prehistoric times except the aboriginal inhabitants of North America, the American Indians. The widespread persistence among popular writers and lecturers that the miners may have been Vikings, Aztecs, Egyptians, Phoenicians, or wandering Jews is an interesting phenomenon in itself, but beyond the scope of this paper.

The first two chapters attempt to provide an introduction to the relevant aspects of the geography and natural history of Isle Royale, and to summarize some of the previous efforts to provide some answers to the questions raised above. The main section of the paper will be devoted to the description and comparison of the archeological data on prehistoric copper mining on Isle Royale. Concluding statements will attempt to give an interpretative summary of the prehistoric copper mining on Isle Royale, and to place it in the broad perspective of North American prehistory.

CHAPTER II

THE NATURAL SETTING

Isle Royale lies at 48° north latitude in north central Lake Superior, 15 miles from the nearest mainland to the north, and 43 miles from the Keweenaw Peninsula on the south. Its topography is characterized by youthful drainage of post-Pleistocene age superimposed on a strongly developed pre-Pleistocene ridge and valley system. The main island is nine miles wide and 45 miles long, and is oriented northeast to southwest. The inclusion of the numerous outlying small islands, rocks, and reefs extends the length to 58 miles, but does not increase the width. Shores exposed to the open lake are usually rocky and forbidding, but rare gentle beaches, and a number of protected coves and harbors afford a few inviting shores where Indian camp sites have been discovered. The island, with an area of about 210 square miles, is composed of alternating beds of thick igneous, and thin sedimentary rocks, except for the southwestern corner, where only sedimentary rocks occur.

The large freshwater lake now occupying the Lake Superior basin is a Pleistocene innovation. In late Precambrian times, before the present topographic basin had formed, there were huge outpourings of lava from fissures in a dome near the west central part of the area. Periods of extrusion and intrusion alternated with periods of aerial erosion, building up thick beds of lava and thin beds of sediments. As the lavas and sediments accumulated, the central area began to downwarp, resulting in tilting of the older beds around the edges of the developing synclinal structure. Downwarping and erosion continued after cessation of vulcanism, but a topographic basin did not begin to form until late Paleozoic times. The end of the Precambrian was marked by strong structural deformation, and near the north edge of the syncline, the Isle Royale fault raised a north-facing escarpment over 1500 feet above the surrounding area. Other relatively minor faults cut across the escarpment, which dips from 10 to 30 degrees to the southeast. The copper deposits may have formed about this time, and they will be discussed in Chapter IV.

The Lake Superior basin was eroded out, and the top of the Isle Royale escarpment attained its present form during the 200 million years since the late Paleozoic. In removing the top of the ridge, the erosion exposed the edges of the various beds, and created a strong ridge and valley system because of the varying resistance of alternating beds of massive, poorly jointed igneous rocks, and sedimentary and highly jointed igneous rocks. About half of the total height

of the remaining ridge is exposed above the waters of Lake Superior today.

The effect of the Pleistocene glaciations is seen in the rounded, fluted, and striated bedrock surfaces which parallel the length of the island. These features have led several writers (for example, Holmes, 1901: 687) to assume that the glaciers were responsible for the major topographical configurations on the island. Actually, due to strong structural and lithologic control, the effect of the ice was largely confined to glacial quarrying of the sediments and highly jointed flows in the preglacial valleys. This caused the preglacial subsequent streams to be replaced with a system of aligned bedrock lakes (Zumberge, 1955). The last glacier to cover Isle Royale, the Valders, presumably removed all evidence of life which may have previously existed on the Isle Royale escarpment. As this last glacier retreated about 8500 B.C., glacier-margin Lake Duluth formed in the Lake Superior basin, but Isle Royale was not immediately exposed to aerial erosion. Subsequent isostatic and drainage adjustments caused a relative lowering of Lake Duluth, and about 8000 B.C. the top of Isle Royale emerged above the water. There is no direct evidence available of the earliest forms of life on Isle Royale, and until such time as some evidence may be derived from pollen studies of the highest, and thus the oldest, bogs on the island, we can only assume that the conditions did not differ significantly from those on the adjacent mainland where pollen studies are available. Undoubtedly, plants with airborne spores, such as mosses and lichens, quickly established themselves on the bare rocks. Retreating in a northeasterly direction, the Valders ice still occupied the eastern half of the Lake Superior basin when Isle Royale emerged above the lake, but forests of spruce and birch had become established on the western shore by this time (Jelgersma, 1962: 528).

When the lake level had dropped so that the top of Isle Royale stood about 700 feet above the water (as compared to 792 feet today), the water level temporarily stabilized and formed the Minong beach about 7500 B.C. A spruce and pine dominant forest is recorded from northeastern Minnesota at this time (Jelgersma, 1962: 528). Deer, elk, barren-ground caribou, and mastodons lived in the upper Great Lakes region, and man had been present in the central and lower parts of the region for about 3000 years. The earliest evidence for man in the Lake Superior basin is from the Brohm site (MacNeish, 1952), which is located near the head of Thunder Bay about 35 miles north of Isle Royale. It is thought to have been occupied sometime between 7500 and 6000 B.C. (Quimby, 1959: 424; 1963: 558). The Brohm site is a camp and/or workshop which yielded about 65 stone artifacts--including projectile points, knives, scrapers, choppers, and a drill. Specific evidence about the

environment is lacking at or near the Brohm site, but Farrand (1960: 11) suggests that the glacier ice may have been only a "few tens of miles" away when the site was occupied.

Between the time of the occupation of the Brohm site and the next well-known lake stage, the Nipissing of about 2200 B.C., a number of climatic changes occurred. Around 5500 B.C. the forests of the entire upper Great Lakes region generally show an abrupt decline of spruce and a rise to jack pine dominance. By 4000 B.C. the jack pine had yielded to white pine. The increase of pine, and oak, seems to indicate a gradual warming which culminated in the Xerothermic of 3000 to 1500 B.C. when the temperature is thought to have been warmer than it is today in the Great Lakes area. The fauna were essentially modern during the Xerothermic.

The earliest pollen records from Isle Royale seem to record the changes between the time of the Minong and Nipissing stages. These records were collected from three bogs above the Minong beach, and according to Farrand's (1960) correlations of the Isle Royale beaches, these bogs could have begun to form as early as 7500 or 7200 B.C. As Griffin (1961: 14) points out, however, Potzger interprets the profiles as beginning at the end of the ascent to the pine maximum, which dates between 6000 and 5000 B.C. There are no radiocarbon or other independent dates on the Isle Royale pollen profiles, but Potzger (1954: 206) assumes that the pine initiation occurred at the same time on Isle Royale as on the mainland. Perhaps the bogs did not begin to form as soon as the lake uncovered them, or the samples do not represent the earliest part of the bogs. The later alternative receives some support in that two of the three high bogs were at the ends of lakes. The deepest parts of the valley, and thus the oldest pollen, would be expected near the middle of the lakes.

The lake level fell from the Minong level to several tens of feet below its present level, and it then rose to the Nipissing level (from 45 to over 60 feet on Isle Royale) about 2200 B.C. No archeological remains have been dated from this period on Isle Royale; but, as explained in Chapter IX, it would not be unexpected if some of the copper mines date from the later part of this period. The archeological record for the rest of the Lake Superior basin at this time consists mostly of a few scattered surface finds. Several sites have been found which are thought to be associated with Nipissing deposits in the Lake Superior basin, but it is not clear if they are pre- or post-Nipissing in age. These sites and their alternative interpretations are discussed by Quimby and Griffin (1961).

After the Nipissing stage the water level fell gradually, although somewhat irregularly, to its present level

(Farrand, 1960: 56) with only one prominent stage, the Algoma, of about 1200 B.C. The Algoma is usually around 30 feet or less above the present lake level on Isle Royale (Stanley, 1932). After about 1500 B.C. the climate gradually cooled to the present day, as inferred from increasing fir and spruce pollen and decreasing pine and oak in pollen profiles, and historic evidence (Linn, 1957) from Isle Royale and elsewhere in the Lake Superior region.

The earliest archeological evidence on Isle Royale is a mine with a radiocarbon age of about 1500 B.C., which is about 700 years after the Nipissing stage, and at the end of the Xerothermic. All of the known camp sites on Isle Royale are thought to be less than 3000 years old, during which time the climate has been essentially modern.

At the present time the rate of uplift on the northeast shore of Lake Superior is 20 inches per century, and on the south shore the lake is rising (Powers, 1962: 36-8). This is reflected in archeological sites which are high and horizontally "stratified" on the north shore (Pic River site, James V. Wright, personal communication, 1962), and low and swampy on the south shore (La Pointe on Madeline Island, George I. Quimby, personal communication, 1961). Although there seem to be no specific data on the rate of uplift on Isle Royale, Edwards (1929: 18) states that the mouths of streams on the south and west sides of the island are flooded, and that those on the north and east sides are not--which indicates recent tilting. This is very weakly, if at all, reflected in the elevations of the archeological sites on Isle Royale.

Except where specifically stated, the preceding summary is based on Farrand (1960), Hough (1958, 1963), Lane (1898), Quimby (1960), and Stanley (1932).

The modern climate of Isle Royale is characterized by long winters and short summers. The climate is somewhat moderated by Lake Superior, so that the winters are relatively mild and the summers relatively cool, considering the latitude. Unfortunately, the only summary of the very scanty climatological data for Isle Royale is not published (Linn, 1957), but records for nearby areas suggest the following generalizations: a low monthly mean in January and February of 15° F.; a high monthly mean in July and August of 60° F.; a mean yearly precipitation of 25 to 30 inches; a mean relative humidity of 75; winds of over 40 mph 145 days per year; and an annual mean of about 110 frost-free days (Baker, 1936; Brown, 1933: 9; Butler and Burbank, 1929: 14-5).

There are two major kinds of forests on Isle Royale (Linn, 1962). The most extensive is the type variously referred to as spruce-fir, northern coniferous, or boreal. In the

interior uplands of southwestern Isle Royale is a sugar maple-yellow birch, or northeastern hardwood forest. There are a number of striking micro-environments. The cool shores and outlying islands are covered with dense stands of fir, spruce, and sometimes pine, birch, and aspen. In the warmer interior parts of the island there are hot, sparsely vegetated south-facing slopes, cool spruce-fir-pine forests, dense maple forests, mosquito infested cedar and black spruce swamps, and areas of tangled brush. The poorly developed youthful drainage system is expressed by more than 50 interior lakes and hundreds of swamps and bogs. Historic records suggest filling of some lakes and bogs (Brown, 1933: 25-6), so that there may have been more open lakes in the past than there are now.

The wide variety of vegetation present on the island seems to be due to its large size, varied topography, and latitude, rather than to important isolating mechanisms. The presence of devil's club (Oplopanax horridum), which is otherwise limited in distribution to Korea, Japan, and the Northwest Coast of North America (Fernald, 1925: 256), and at least two other plants (Osmorhiza divaricata and Arevaria macrophylla) which are less far from their distribution centers, is probably not significant because the upper Great Lakes is known for localized colonies of plants which are otherwise known only from western America or around the Gulf of St. Lawrence (Fernald, 1925: 255, 259, 317).

Most of the conspicuous plant items used by the Indians seem to be present. Isle Royale lies near the edge of the wild rice area (Jenks, 1900: 1030, Pl. 66), and there are unconfirmed reports of its presence in Lake Benson. There are records of Indians collecting maple sugar on Isle Royale in the last century (Christian, 1932; Conary, 1939; and Ives, 1847-8). Seeds of hazelnut (Corylus cornuta), bearberry (Arctostaphylos uva-ursi), wild cherry (Prunus sp?), and American lotus (Nelumbo lutea) have been identified from archeological sites (Richard Yarnell, personal communication, 1962), but the circumstances of recovery were such in each case that their association with Indian activities can not be demonstrated.

Since the beginning of commercial fishing in Lake Superior in the 1830's (Nute, 1944: 173-5), the shores of Isle Royale have been famed fishing grounds. The interior lakes contain several fish species unique to Isle Royale, suggesting that they may have been present on the island for some time. In historic times the Indians are known to have fished for whitefish, lake trout, herring, and sturgeon in Lake Superior, but only a very few sturgeon bones have been identified from archeological sites on Isle Royale. Eleven species of small amphibians and reptiles, including the toad, frog, turtle, and snake, are known. Nearly 200 bird species have been identified, including the loon, heron, duck, eagle, hawk, and grouse.

There is a relatively varied population of large and small mammals, including most of those important to the Indian, such as the caribou (until the 1920's), mink, squirrel, hare, beaver, and fox. The major mammals of the region which are absent from Isle Royale are the mole, shrew, bear, deer, racoon, weasel, skunk, and bobcat (Johnsson and Shelton, 1960). The squirrel is considered to be a distinct sub-species (Burt, 1948: 189), but this does not necessarily indicate that this mammal has been isolated on Isle Royale longer than those species which have not differentiated. Perhaps the most striking feature of the mammal population in recent times is its change. Marten, coyote, lynx, and caribou were present in the early 1900's, but their niche seems to have been gradually reoccupied by moose and wolf which either swam or crossed to Isle Royale on the ice. The frequency with which the lake freezes between Isle Royale and the Canadian mainland does not seem to be precisely known, but Park Service personnel estimate that it occurs once every three to five years. If the general post-Pleistocene climatic picture of a post-glacial warming climax between 3000 and 1500 B.C. when it was warmer than today is correct, it seems probable that about 7000 to 3000 B.C. and the past two or three thousand years have been the most favorable periods for winter animal migrations. The migrations of the present century are probably not unique, but archeological specimens do not suggest any change prior to the early 1900's (Griffin, 1961: 14-6). The tarsals and metatarsals of a black bear from one site do not necessarily indicate that the bear was present on Isle Royale, since bear paws commonly served as fetishes for the Indians of the region.

The prehistoric human population of Isle Royale may be inferred by comparison with the rest of the Lake Superior region. Kroeber's estimates of the aboriginal population density of various groups in the Lake Superior region vary from four to eleven square miles per person (Kroeber, 1953: 140-1). A number of contemporary observors in the late eighteenth and early nineteenth centuries (Hickerson, 1962: 15, 30, 92) indicate that the native population density was considerably smaller than Kroeber's minimum estimate, but this may be attributed to reduction from introduced diseases, and to the fact that already in the seventeenth century the beaver in the near interior about the western end of Lake Superior were nearly depleted (Hickerson, 1962: 14). For the greater part of the year the Indians lived in small family groups, a family usually comprising five to seven people. In the spring, and sometimes for part of the summer, the families camped in groups of a few dozen to a hundred people (Coatsworth, 1957: 7; Hickerson, 1962).

Although a systematic investigation has not been made, it appears to me, on the basis of miscellaneous photographs, maps, and descriptions, that the natural environment on Isle

Royale is not particularly different from that in other parts of the Lake Superior region. The exceptions include its insular position, the absence of an extensive system of interconnected inland lakes, and the presence of copper. Early historic documents indicate that Indians were cautious in crossing Lake Superior to Isle Royale in their canoes, but they even made crossings from the comparatively distant south shore (Scull, 1943: 192-3). Recent surveys by the National Museum of Canada indicate that the north shore of Lake Superior was not avoided by the Indians (James V. Wright, personal communication, 1962), so that the insular position and lack of inter-connected inland lakes would not have been a significant disadvantage to at least seasonal occupation.

The island supports a relatively varied biota, and there appears to be no basis for suggesting that living conditions for aborigines on Isle Royale were more severe than they were on the mainland. The ability of the island to support large game under fairly heavy predation is suggested by the fact that the present moose herd seems to be maintaining itself despite the annual loss of about 100 members to wolves (Allen and Mech, 1963: 207).

On the basis of Kroeber's lowest estimate for the Lake Superior region, and considering the seasonal settlement pattern, it seems reasonable to assume that a few families might have lived on Isle Royale during the winter, and that several dozen families comprising over 100 people might have been resident on the island at any one time during the summer. Undoubtedly, the human population fluctuated due to various cultural and ecological factors, including the possibility of depletion of game by over-hunting.

In summary, Isle Royale is a long island in northern Lake Superior, with low rugged relief. Rising from beneath the water of Lake Superior in post-glacial times, forests of pine, spruce, and fir were established by 5000 B.C. during a time of gradual warming, climaxing in the Xerothermic of 3000 to 1500 B.C. when temperatures were warmer than at present, and the forests were dominated by pine. To the present day the lake has continued to lower, and the return of the importance of fir and spruce has accompanied a cooling climate. The modern island consists of alternating ridges and valleys with areas of forest, swamp, and brush. Modern biota do not seem to be markedly different from that of other parts of the Lake Superior basin, and the Indians probably found the island as inviting as most regions near the lake.

CHAPTER III

PREVIOUS INVESTIGATIONS AND INTERPRETATIONS

The earliest notice of prehistoric copper mines on Isle Royale, which may also be the earliest for the entire Lake Superior region, appears in an unpublished diary by C. G. Shaw (1847) who was mining on Isle Royale in the 1840's. His entry for September 21, 1847, reads: "Exploring traced sec lines & found on sec 33 a place where some one had dug for a vein to appearance more than 20 years since as timber growing on the dirt thrown out 6 inches in diameter I intend to examine said place more." Shaw's diary covers only the 1847 season on Isle Royale, and he makes no other mention of old mines. Two years later Shaw accompanied J. W. Foster and J. D. Whitney, government geologists, in part of their explorations on Isle Royale (Foster and Whitney, 1849: 606). Their report of Shaw's observations and interpretations of prehistoric copper mines is so concise and clear that it is quoted in full:

> Mr. C. G. Shaw pointed out to us similar evidences of mining on Isle Royale. They occur on what is known as the Middle Finger, and can be traced lengthwise for the distance of a mile. Mr. Shaw remarks that, on opening one of these pits, which had become filled up with surrounding earth, he found the mine had been worked through the solid rock to the depth of nine feet, the walls being perfectly smooth. At the bottom he found a vein of native copper eighteen inches thick, including a sheet of pure copper lying against the foot-wall.
>
> The workings appear to have been effected simply by stone hammers and wedges, specimens of which were found in great abundance at the bottom of the pits. He found no metallic implements of any description, and is convinced, from the appearance of the wall-rocks, the substances removed, and the multitude of hammers found, that the labor of excavating the rock must have been performed only with the instruments above named, with the aid perhaps of fire. From the appearance of the vein and the extent of the workings, he conjectures that an immense amount of labor had been expended. He endeavored to find some evidences of the antiquity of these workings, but could discover nothing very satisfactory to his own mind, except that they were made at a remote epoch. The vegetable matter had accumulated and filled up the entire opening to a level with the surrounding surface; and, in a region where it accumulates as slowly as it does on the barren and rocky parts of Isle Royale, this filling up would have been the work of centuries. Upon this vegetable

accumulation he found trees growing equal in size to any in the vicinity.

All will admit that the facts above set forth assign to these excavations a high antiquity; but whether they were made by a race distinct from the Indians now inhabiting the region, is a matter of extreme doubt, although all traditions with regard to their origin have perished" (Foster and Whitney, 1850: 162).

The Lake Superior Journal (July 6, 1849) carried a brief description of Shaw's finds, and in 1854 (May 17) it reported the discovery of some prehistoric mines, containing hammerstones, near the Siskowit Mine, Rock Harbor. These are the only very early contemporary accounts of prehistoric mines on Isle Royale which are known.

In some unpublished recollections written in 1892, J. H. Sargent, who spent the summers of 1846-7 on Isle Royale, states: "This lode has the appearance of having been worked by the ancient but all the debris has been swept away by the waves . . ." It is not clear whether Sargent recognized this at the time he was on Isle Royale, or if it is a later interpretation, but since his and Scovill's location was adjacent to that of Shaw's, and Sargent is frequently mentioned in Shaw's dairy, it seems possible that Sargent formed his opinion after Shaw made his discovery in 1847. At any rate, Sargent's observation is important because it describes the presence of a prehistoric mine at the present shoreline. This will be important in suggesting the age of the prehistoric mines on Isle Royale, to be considered in Chapter IX.

(Dustin [1957: 3-6] repeatedly credits C. T. Jackson, a government geologist, for first reporting the prehistoric copper mines on Isle Royale, and Hoy [1886: 101] states that Jackson knew of the mines on the south shore of Lake Superior in 1844. I have not been able to find any substantiation for these statements in Jackson's reports [1849, 1850], or elsewhere. Jackson does mention Shaw, but Jackson left Isle Royale a week before Shaw made his discovery [Jackson, 1849: 422, 429; Shaw, 1847]).

The first active mining period on Isle Royale came to an end in 1855, and the prehistoric mines apparently received little notice until the renewal of intensified mining in the 1870's. During this period of inactivity on Isle Royale, numerous accounts of the prehistoric mines on the south shore of Lake Superior (discovered in early 1848) appeared, and the mines became involved in the controversy over the existence of an early non-Indian race. Some of the accounts received wide scientific and popular notice in the Smithsonian Contributions to Knowledge (Whittlesey, 1863), Appletons' Journal (Gillman, 1873), the Atlantic Monthly (Hagar, 1865), and Harper's Monthly

(Clarke, 1853: 445-6). References to many accounts, and reprintings of some of them, have been published by the Aboriginal Research Club of Detroit (n.d.), Drier and Du Temple (1961), and Griffin (1961).

The renewal of mining activities on Isle Royale in the 1870's seems to coincide with the peak of controversy. The Minong site was discovered in 1871 (Lane, 1898: 16) and in 1873, Henry Gillman, a Detroit antiquarian, made two trips to Isle Royale. The report of his first trip was published in 1873, and a report of his second trip is included in a paper published in 1874. A slight revision of the first account was read to the Detroit Scientific Association in 1874 and published twice in successive volumes of the Michigan Historical Collections in 1880 and 1881. Gillman is not explicit about the extent of his investigations, nor about the provenience of most of the finds which he discusses; but he made surface observations at the Minong and Little Siskiwit river sites, and on Triangle Island (now called North Rock) at the west end of Isle Royale. The mines " . . . are scattered throughout the island, wherever the amygdaloid copper-bearing rock is found . . . " and on "even the rocky islets off the coast . . . where bearing veins of copper are generally worked" (1874: 385). Their number and character are " . . . so extraordinary as to almost exceed belief" (1874: 384). The mines are " . . . generally pits of from ten to thirty feet in diameter, and from twenty to sixty feet in depth" (1881: 207). He states that the mines were "evidently" dug by removing the overlying drift, heating the bedrock with fire, cooling with water, and separating it from the disintegrated rock with hammerstones (1881: 207). He also mentions that copper chisels and knives, and a wooden bowl had been recovered from the mines. On the basis of the age of a large, decayed tree stump on the refuse beside one of the mines, and the mature condition of the forest cover, Gillman estimated 700 or 800 years as a minimal age for the mines. He interprets the depressions at the Little Siskiwit River site as the remains of the town occupied by the miners, who, he suggests, were probably of the mound-builder race who were more intelligent than the Indians.

The year after Gillman's visits to Isle Royale, a copper mass weighing nearly three tons was discovered by miners at the Minong site in the bottom of a prehistoric mine 16½ feet deep. This find is described by A. C. Davis (1875) and by Gillman in 1876 (cited in Griffin, 1961: 20), but there is no evidence that either one was present at the time of discovery, and Gillman's account of the actual discovery seems to be based on Davis' description.

N. H. Winchell, Minnesota State Geologist, visited Isle Royale in 1879 and examined a number of localities on the island, particularly sites of historic mines, but the only mention of prehistoric mines is at the Minong site (Winchell,

1882: 48-54). Winchell provides the first illustrations of prehistoric mines and artifacts found in mines on Isle Royale (Winchell, 1881). Winchell gives no hint as to the number of mines, but he generalizes that they rarely exceed ten feet in depth, although some are up to 20 feet deep. He states that the mines were dug with the hammerstones, " . . . sometimes aided perhaps by the application of heat . . ." (1881: 601), and that the mines were probably not of great antiquity. He gives an extended argument in order to show that the American Indians were the mound-builders and miners.

The archeologist, W. H. Holmes (1901) visited the Minong site in 1892. He was familiar with Winchell's account, and others which he does not specify. He reports: "A long, narrow area amounting to at least half a mile square of the surface has been worked over, pit connecting with pit, the impression given being that hardly a square rod of ground within the particular area has been left unexplored" (p. 688). As one who had seen numerous quarry sites throughout the United States, he remarks: "The extent of this work was a matter of great surprise to me" (p. 688). Nevertheless: "The pits are neither so deep nor so wide as those of the flint quarries. . ." of Ohio, Arkansas, and Oklahoma (p. 684, 688). This is apparently based on surface observations, as he observes that the Isle Royale pits are ". . . seldom more than three or four feet in depth" (p. 689). He sectioned one mine which was about 10 feet deep and probably 20 feet in diameter. He was sure that fire was used to crack the rock. Holmes apparently searched for occupation sites in the Minong area, but was not successful. He attributes the mines to the Indians native to the area, and seems to imply that they are quite recent in time.

A. C. Lane (1898: 1-3, 16), assistant to the Michigan state geologist, spent several months on Isle Royale in 1893 and 1895, but most of his statements about the prehistoric mines seem to be based on the earlier literature. An informant told him that some of the mines were 20 to 30 feet deep, and that in one stope 30 feet deep and 18 to 30 inches wide, boulders had been used for timbering (p. 16). Lane's important deduction that at least some of the mines are relatively recent, because of their relationship to raised beaches, has been ignored by subsequent writers.

George Fox (1911, 1929) visited Isle Royale in 1911, 1914, and 1928. He gives a rather extensive, informative, and illustrated account of his first trip, none of the second trip, and the account of his third trip is supplimentary to a more extended account by West (1929). His investigations during the first trip are summarized here. Fox was confined to surface observations and information from summer residents. Many of his statements about the history and natural history of Isle Royale are naive, erroneous, or undocumented, so that his

archeological observations must be considered with a certain amount of reservation. Only the Minong site, Triangle Island (now North Rock), and Tobin Harbor are specifically cited as having been visited. Fox states that some of the previous estimates of the extent of prehistoric mining had been exaggerated, except for the Minong site. He lists nine localities "as ascertained from various sources" (1911: 84) where mines occur, but he visited only two of these sites. The mines were worked, according to Fox, by heating the rocks with fire, and pounding with hammerstones; but he expresses some doubt that water was used to cool the rocks. He also suggests that "some of the mining was probably done without heating the rock" (1911: 100). He further suggests that the mines at the Minong site were the last worked, or were still " . . . being worked [by the Indians] at the time of the coming of the French" (1911: 92). He was unable to learn of any occupation sites on the island.

W. P. F. Ferguson (1923, 1924) in 1920, after having ". . . spent several summers studying the ancient mines . . ." (1923: 158) began to search for the town of pit-houses vaguely reported by Gillman (1880: 49). Ferguson finally found the site on the Little Siskiwit River in 1922, and received national publicity. He returned in 1923 to conduct extensive excavations. His writings and interpretations are perhaps the most incredible mass of nonsense about Isle Royale archeology to appear in a learned journal (Michigan History). He interprets the Little Siskiwit River site as having scores of pit-houses and a large earthenwork fort. He is disinclined to believe that any known Indians could have been responsible for the "national industrial organization . . ." (1923: 158) represented by the mines. He admits, however, that he was disappointed in not finding any artifacts in any of the pit-houses. He generalizes that mines " . . . are found in all parts of the main island and on the adjacent islets," (1923: 156) and that " . . . it would not be seriously extravagant to say . . ." that several cubic miles of rock had been moved (1923: 157). He states that the mining was accomplished by heating and cooling the rock with water, and then crushing the resulting fragments with hammerstones.

In order to develop a museum diorama on prehistoric copper mining, S. A. Barrett, director of the Milwaukee Public Museum, and a staff of technicians and assistants, including George West, excavated a mine at the Minong site in 1924 (Barrett, 1926). Barrett's observations are confined to the Minong site, and many of his interpretations seem very subjective or questionable. By making " . . . a rather careful walking survey . . . " he found that the pits covered an area one-fourth mile wide by five miles long, and he "very conservatively" estimates that there were 10,000 pits (p.30). The pits

ranged in size from one and a half to six feet deep and from seven to thirty feet across. West states that the mines were dug with fire, water, and hammerstones by the Indians over a long period of time. A copper spear was found on the Minong ridge above the Minong site (Fox, 1929: 317; West, 1929: 37).

The first general archeological reconnaissance of Isle Royale was made by a privately financed, month-long investigation in 1928, known as the McDonald-Massee expedition. Two reports resulted (Fox, 1929; West, 1929), and they are the first to avoid indiscriminate lumping of all the data into one generalized description. Prehistoric mines were examined at the Minong, Ferguson, and Little Siskiwit River sites. At the Minong site no mines were excavated, and West relies largely on Barrett's description and interpretation, but he generalizes that the pits " . . . almost touch each other for miles" and that it is " . . . the most extensive district of prehistoric copper mining . . . in all America" (p. 32). The workings at the Ferguson site were found to be "extremely limited and somewhat disappointing" (p. 26). At the Little Siskiwit River site only about 17 of the pit-dwellings reported by Gillman and Ferguson were located. A few were excavated, and they were interpreted as having been " . . . made solely in search of float copper and not for dwelling places" (p. 28). The embankments of Ferguson's "fort" were found to consist of bedrock ledges and old beaches. Ten pits were found in this area, and partial excavation of one of them showed that the Indians had cleared the beach deposit for 150 feet along the copper bearing face of a bedrock outcrop. Fox (1929: 313-5) states that excavation in both areas of the site revealed mines somewhat similar to those at the Minong site " . . . with the difference that while those at the [Minong site] drifted in toward the rock, getting deeper as the surface of the range was approached, the pits at the [Little Siskiwit River site] were sunk in to the top of an ancient beach where the debris had piled up against a rock ridge." A flint projectile point was found in the sod beneath a small pile of ore near one of the mines. For the first time, definite occupation sites were located on Isle Royale; but "as the village sites discovered were all at a distance of two or more miles from any of the groups of aboriginal mines, and because of their limited size and the scarcity of the material they produced [pottery and chipped stone], it seems safe to conclude that they were merely temporary camping places, occupied for short periods of time by historic Indians . . . " (p. 36). McKern classified the pottery as Effigy Mound (p. 35). A likely place for an occupation site near the Little Siskiwit River mines is mentioned, but apparently it was not investigated (p. 29). Miscellaneous finds of stone and copper artifacts, and some human skeletons from the Point Houghton rock shelter are reported, but their relevance to the prehistoric mining is not suggested. West apparently thought that there were no accounts of Indian mines

from the early historic period, and that copper was used only for ornaments in historic times, so he concludes that the mines are of considerable antiquity. He suggests that the miners were prehistoric Siouan or Algonquian Indians.

Fred Dustin spent four months on Isle Royale in 1929-30 for the University of Michigan's Museum of Anthropology. Carl E. Guthe, director of the Museum of Anthropology, accompanied him for a few weeks, but Guthe's recorded observations are confined to occupation sites. Dustin was familiar with much of the archeological and historical literature on the island, and in attempting to visit all of the reported sites he covered the island more thoroughly than any of his predecessors, although his investigations were almost entirely confined to brief surface examinations. Dustin took many photographs and wrote prolifically (1930, 1932, 1946, 1957, and manuscripts in the Museum of Anthropology, and files of Isle Royale National Park). His reports are written in an informal chatty manner, and they are sometimes contradictory in detail, but his general knowledge of Isle Royale shows a marked improvement over that of his predecessors. Dustin estimates that there are well over 1000 pits at the Minong site, covering an area about 400 feet wide and a mile long. He confirmed the observations of the McDonald-Massee expedition at the Little Siskiwit River site, and located some additional prehistoric mines in various parts of the island: Island Mine, Dustin, Mott Island, Siskowit Mine, Scoville Point, and Mt. Franklin. Perhaps the most significant contribution by Dustin was that he found copper flakes and artifacts, as well as pottery, chipped and ground stone, in three occupation sites, and he concludes that the sites were occupied by the prehistoric miners who were the Indians.

The flurry of archeological exploration on Isle Royale in the 1920's was involved in the movement to make the island a national park, but for over two decades after 1930, during which time the island became a national park, no additional archeological investigations have been recorded in learned journals. Amid the publicity of making the island a national park, the fascination of the prehistoric copper mines played a prominent part, and popular descriptions of the island from this period suggest no lack of imagination. One man even became a member of the New York Explorers' Club for his explorations of the prehistoric copper mines on Isle Royale, but I have not been able to learn what he did.

Realizing the potential of the newly discovered radiocarbon dating method for providing a direct solution to the problem of the age of the mines, R. W. Drier, a metallurgist at the Michigan College of Mining and Technology, spent a few weeks in 1953 and 1954 removing charcoal samples from a mine at the Minong site (Drier, 1961b). He excavated the pit to

a depth of 14 feet without reaching the bottom. He reports ashes, charcoal, and some probable fire-blackened rocks in the fill, but he does not state that the rock was heated by the miners. The average of two radiocarbon dates on a log from near the bottom of his excavation was about 1500 B.C. Drier estimates that there were about 3000 pits at this site.

A. C. Spaulding tested several camp sites in 1957, but he apparently did not investigate any of the mines.

As part of its Mission 66 program, the National Park Service contracted with the University of Michigan to conduct a thorough archeological survey of the Park during the summers of 1960 to 1962. The information collected on the prehistoric copper mines excavated during the first two seasons of this survey provide the basis for much of this paper.

This review conveys some idea of the extent, nature, and reliability of previous investigations and interpretations of the prehistoric copper mines on Isle Royale, and it attempts to illustrate the tendency or set which seems to permeate most archeological investigations of the island. The mines have always been the subject of much uncritical and uninformed speculation, and very few of the archeological reports about Isle Royale have been free from the mystic fascination of the unknown that the relatively remote island locality, and sparsity and nature of the archeological remains seem to evoke. Most of these previous investigations should perhaps be ignored if it were not that the archeological data on the mines are so scarce and relatively difficult to collect that every bit of information is useful, if it can be established as reasonably reliable. The early observations by Shaw, Winchell, and Holmes have been largely confirmed by subsequent investigations. On the other hand, many of Gillman's and Ferguson's interpretations are so incredible, and some of their observations have been shown to be so erroneous, that they must be used with extreme caution.

The reports and interpretations do show an expected trend toward more careful description and broader understanding of archeological and other information relevant to interpreting Isle Royale prehistory. The presentation of more detailed descriptions in the later reports also provides an additional measure of the reliability of the archeological observations. When Fox (1911: 74) belabors the point that there is only one small marsh or swamp on Isle Royale, for example, and makes several other obvious errors, one is justifiably hesitant in accepting his other statements without independent confirmation, even though many of them sound reasonable.

CHAPTER IV

THE NATIVE COPPER DEPOSITS

Previous studies of the prehistoric copper mines on Isle Royale do not explicitly demonstrate any awareness of the various kinds of copper deposits present there, and their influence on the distribution and form of the mines, and, perhaps, on the techniques used in mining. Some of the apparent discrepancies in the archeological literature can be attributed to the fact that different kinds of copper mines are being described.

The terminology used in the basic geological report on Isle Royale (Lane, 1898) is outdated. Since the geology and history of Isle Royale are closely related to that of the Copper Country of the Keweenaw Peninsula and Upper Michigan, Copper Country terminology (Butler and Burbank, 1929) is probably appropriate for Isle Royale (and perhaps for the rest of the Lake Superior copper deposits), at least to the degree to which it is pertinent to archeology. It should be noted, however, that some of the Copper Country terminology differs from standard petrographic and mining usage in other parts of the world.

The gross features of the geology and topography of Isle Royale are summarized in Chapter II, so that only those features specifically relevant to the copper deposits need to be reviewed here. The southwestern part of the island, from Grace Harbor to Malone Bay, consists of a broad belt of sandstones and conglomerates. Copper is not known to occur in this formation on Isle Royale. Most of the bedrock on the island consists of a tilted succession of altered basalt flows with interbedded layers of felsite conglomerates. The basalt flows are composed of a lower, thicker, dense basalt called trap which grades into an upper, thinner, open-textured basalt called amygdaloid. Native copper may occur in the conglomerates and in all parts of the basalt flows.

There are two important kinds of copper deposits on Isle Royale--lode and fissure. Lode deposits occur in conglomerates and amygdaloids, and they are usually a few feet thick. The fissure deposits occur along fractures, and they vary from a fraction of an inch to several inches, or rarely, a few feet in thickness. All of the deposits have a tabular form, but the distribution of metal in them tends to be irregular and unpredictable. Miners classify the fragments of copper into three sizes: mass, barrel, and mineral. Barrel copper ranges in size from about that of an orange to that of a man's head. Mass copper is larger, and mineral is smaller

than barrel copper. Mass and barrel copper ordinarily contain some rock inclusions, so that they are usually about 70% pure copper (Rickard, 1905: 142).

At least one conglomerate lode (Island Mine) was mined historically on Isle Royale, but no prehistoric mines associated with conglomerates have been definitely reported from Isle Royale.

Brecciated amygdaloid lodes have been the most common historic source for copper in the Copper Country, and this seems to be true for both the prehistoric and historic periods on Isle Royale. The most productive historic mine, and the most extensive evidence of prehistoric mining on Isle Royale, occur in the Minong amygdaloid (or Minong breccia) at the Minong site. West (1929: 26) reports a prehistoric mine in amygdaloid at the Ferguson site, although Lane's (1898: Pl.1) general geological map does not indicate any amygdaloids in the area of this site.

In the brecciated amygdaloid lodes the copper occurs in the vesicles, open spaces, and in joints which usually do not extend beyond the bounds of the lode (Butler and Burbank, 1929: 106). Since the copper tends to be widely, though irregularly, distributed through amygdaloid formations, it seems reasonable to expect that where a copper-bearing amygdaloid formation outcrops over a fairly large area miners would have worked the area intensively and extensively. This is the circumstance of both the historic and prehistoric mining at the Minong site. The survey's excavations and experiments on the Minong amygdaloid lode (described in Chapter V) suggest that the rock is generally highly fractured and fracturable.

The other important kind of copper deposit--the fissure deposit--occurs in many places on Isle Royale. These deposits characteristically occur where fissures (or joints or breaks) cross beds of amygdaloids or conglomerates. Although lode and fissure deposits tend to occur in the same beds, productive deposits of both types do not usually occur in the same area (Butler and Burbank, 1929: 101). The fissures may be either parallel or transverse to the beds. The larger fissures are usually compound; that is, several fissures run within a few inches or feet of each other, and these frequently cross or merge. The copper tends to concentrate at the crossings. Consequently, most of the prehistoric mines occurring on fissures are not long trenches, but series of elongated pits situated on crossings. Surface observations and excavations by the survey suggest that most of the fissure mines are separate, and that only a few may be so close together that they are connected. The width of fissure deposits is highly variable (up to ten feet in the Copper Country

according to Butler and Burbank, 1929: 111). There are no verified occurrences of prehistoric copper mines on very wide fissures on Isle Royale, but if they occur it seems reasonable that they might have the form of long, irregular trenches. The copper-bearing fissures usually carry several associated minerals, particularly calcite, so that references to veins of copper several feet wide do not ordinarily refer to a solid mass of copper filling a fissure, but to a wide fissure in which copper is associated with several other minerals. The white calcite makes the fissures easy to spot along exposed shore lines or in bedrock stream beds, but they usually contain little, if any, copper. In rock outcrops away from the shore lines and streams, smaller fissures are difficult to locate because the weathering reduces color and textural contrasts. Fissures are less resistant to weathering than the surrounding rock, so that wide fissures sometimes can be identified in areas of heavy forest cover where they may form distinct trenches or breaks. Historic miners often prospected along these trenches; however, there is no indication that the Indians were familiar with this method of prospecting.

A third type of native copper deposit frequently mentioned in archeological literature is float copper (i.e., pieces of native copper occurring in glacial or beach deposits). A considerable amount of native copper from the Lake Superior region was widely distributed throughout the north-central states by the glaciers, and there is no question that the Indians derived some copper from exposures of this material. On the other hand, float copper seems to be somewhat less than abundant in its occurrence (Knowlton, 1946; Salisbury, 1886). Even on the Keweenaw Peninsula finds of float copper are not exceptionally numerous, as far as I have been able to learn in conversation with several people in that area. If float copper were present in sufficient quantities to make its mining worthwhile to the Indians, it would seem that it could be profitably mined in historic times as a placer deposit, but I have been unable to learn that this was ever done. Consequently, the suggestion that the Indians dug for float copper in glacial deposits and in old beaches in the Little Siskiwit River area on Isle Royale (Dustin, 1957: 8; West, 1929: 26) does not seem very probable. (This method of Indian mining has also been reported near Portage Lake on the Keweenaw Peninsula, by Whittlesey [1863: 14-5]).

CHAPTER V

THE PREHISTORIC COPPER MINES

The prehistoric copper mines on Isle Royale occur in two general forms, depending on the kind of native copper deposit in which they were dug. The first, fissure mines, are relatively deep conico-ovoid shafts occurring on fissure deposits; and the second, lode mines, are relatively shallow, irregular, quarry-like excavations occurring on lode deposits. An example of each of these two types will be described, and comparisons will be made with others which have been investigated by the survey or which are reported in the literature. The locations of the known sites are indicated in Figure 1. Unless otherwise noted, the material discussed in this chapter is based on data collected by the survey. The field notes and specimens are stored at the Museum of Anthropology of the University of Michigan, where they may be consulted by responsible investigators.

The available data suggest that most of the mines occur in small groups, the Minong site being a notable exception. Dustin (1957: 6-7) reports several isolated mines in the Rock Harbor area, but these could not be located by the survey. With the exception of one small mine about one by two feet in diameter and one foot deep (Stoll site), all of the mines tested or excavated by the survey contained hammerstones. All of the known prehistoric mines are nearly filled with debris, and it is sometimes difficult to distinguish them from natural surface irregularities which are abundant on Isle Royale. The ability to identify mines from surface indications markedly improved with experience, but test excavations were undertaken in some doubtful cases. In the following discussion, pit refers to unexcavated depressions thought to be mines, and mine refers to known mines.

Several situations are indicative of the problems which the survey encountered in attempting to locate and identify mines. A brief search for the Dustin and Ferguson sites by the survey in 1960 was unsuccessful, although the availability of photographs (West, 1929: Pl. 10, 1; Dustin's miscellaneous photographs in the Park Naturalist's office, Mott Island) from each site leaves little doubt that they exist. Isle Royale had been rather thoroughly mapped and explored for copper as early as 1848. Even though the historic miners were aware of the usefulness of prehistoric mines as guides to copper deposits, the extensive Minong site was not discovered until 1871. On the other hand, two of the three mines marked by Park Service signs were found not to be mines when excavated by the survey (one was probably an historic prospect,

the other an historic cellar). Only reports of mine sites confirmed by the presence of unquestioned hammerstones or by excavation of one of the suspected pits at the site can be accepted as reliable.

Excluding the unmineralized sandstones and conglomerates in the southwestern corner of Isle Royale, mineralized fissures apparently occur in most of the formations on the island, so that fissure mines may occur wherever bedrock is exposed. Fissure mines are the most widespread type on Isle Royale, but are relatively few in total number. They usually occur in small groups of from two to five mines which may be in one or two nearby fissures, or in fissures several hundred feet apart. Fissure mines are relatively small in lateral extent compared to depth, so that they are shaft-like in appearance (Figs. 2-4, Pl. 1).

The most complete excavation of a fissure mine was conducted in Pit 56 at the Lookout site in 1961. The site is almost certainly the one discovered by Shaw in 1847. It was lost until the early 1950's when it was rediscovered by a former park superintendent (R. F. Gibbs, personal communication, 1960). When the survey first visited the site, a trail had been built to two of the mines. A reconnaissance along the ridge for about three quarters of a mile in both directions from these two mines established the presence of two others, one of which may be the one dug out by Shaw and reported by Foster and Whitney (1850: 162; their description is quoted in Chapter II). Much of the area of the Lookout site is covered with short grass, bedrock ledges, and scattered trees, so that surface conditions for locating mines are fairly good. Additional intensive surface survey in the immediate area of the known mines was not conclusive, so about ten of the most promising depressions and trenches were tested. One of these was a mine, Pit 56.

The surface indications at Pit 56 were a slight depression less than 0.5 feet deep beside a short ledge of bedrock less than 0.8 feet high. The entire area was sodded over, except the vertical face of the low bedrock ledge. An initial narrow trench revealed a wide crevice in the bedrock, and when a hammerstone was found, the excavation was expanded to include what appeared to be about half of the mine. After the half was excavated, a profile drawn, and soil samples taken, the rest of the pit and an area around it were excavated (Fig. 2, Pl. 1a-c). The small ledge which was visible prior to excavation was a high section of one wall of the mine.

The mine proved to be about three by eight feet in diameter at the surface, and 4.1 feet deep. A rectangular area of sod about 8 by 18 feet across was cleared from the bedrock around the mine. The bedrock is glacially smoothed

and fluted, and it was covered with 0.2 to 0.6 feet of soil containing some rocks, decomposed rock, and a hammerstone. The top soil over and near the mine appeared to be a well developed podzolic type. The fill in the mine was found to be generally dark and composed of very compact organic material (Pl. 1a). There were some lenses of fill of slightly different colors and texture, but their significance is not known. The soil samples have not been analyzed for possible pollen, or for data on soil development. The fill in the mine was distinct from the fill in the pits which were tested and found not to be mines. In these latter cases the fill was light brown, and contained many sub-angular and rounded rocks. In the mine, most of the rocks scattered through the fill were angular. Two were over a foot in diameter, but most were small. In the deepest part of the pit was a small deposit of yellow and blue-gray silt or clay less than 0.3 feet thick. This silt or clay directly overlay the bedrock and fissure at the bottom of the pit, and was also present in the lower part of the fissure at the east end of the pit. There was a very compact, thin mat of decayed rootlets tightly adhering to the walls of the mine. Unlike any of the other mines which the survey excavated, Pit 56 was very dry. This seemed to be due to the small size of the mine, its exposed locality, and the fact that is was dug during the driest part of the summer.

The walls of the mine are irregular, fractured, and angular near the top, but deeper in the mine, particularly near the bottom, they are more regular, only slightly fractured, and smooth surfaced (Pl. 1a,c). Five hammerstones, and five scrapers or choppers (Pl. 2f-j) were found in the fill of the mine. The estimated volume of the mine is approximately 30 cubic feet. Six hammerstones were recovered from the mine and the excavated area around it.

Clearing of the sod from the bedrock surface for some distance around the mine showed one major fissure running into the mine from the northeast, and two converging toward the mine from the southwest (Pl. 1b). There are only tiny pieces of copper remaining in the fissure in the mine, but about six feet west of the mine one of the fissures contains a piece of copper up to one half inch wide and 1.2 feet long.

The Pit 56 mine is situated on fissures in the Greenstone basalt or ophite, a major variation of what is more generally referred to as trap rock in this paper. The position of the fissures makes it clear that the mine was dug at a Y-shaped crossing. The presence of a relatively large piece of copper at the surface of the bedrock in a side branch of one of the fissures near the mine is surprising, and it seems to indicate that the area was at least partly covered with soil or debris when the mine was dug by the Indians. Most of the fissures near the mine appear to have been explored because

they are widened and pitted, but the side branch containing the copper is intact. In order for the mine to have been found by the Indians, copper at or near the crossing must have been exposed above the surface.

The effects of weathering are indicated by the rough broken texture of parts of the mine walls near the surface, and many pieces of the bedrock were dislodged during excavation of the mine by the survey. The smooth, curved walls near the bottom do not appear to be weathered, and their form suggests that the only way in which the Indians could remove the very dense trap surrounding the fissure was to break off very small pieces by battering.

The peaty fill of the mine is quite clearly the product of slow accumulation of organic matter, and it indicates that the mine was not filled with debris from nearby mining activities. The silt or clay deposit on the bottom of the mine is probably derived from soil forming processes. The rocks scattered in the fill are at least partly derived from weathering along the top edge of the pit. Hammerstones, and hammerstone fragments, were also scattered throughout the fill, so that they, and probably some of the rocks, had likely been left lying around the edge of the mine and were knocked into it by animals or other weathering processes. Because of the soil accumulation and water storing capacity of the mines, trees and other plants tend to send their roots into them. The roots would be a major factor in fracturing the edges of the mines and knocking rocks into the pits. Some charcoal was collected which may be adequate for radiocarbon dating, but it will represent a minimum date for the Indian activity at the Pit 56 mine.

When compared with other fissure mines excavated by the survey, and those described in the literature (Drier, 1961b; Foster and Whitney, 1850: 162), the Pit 56 mine is typical except for its small size and dryness. The largest known fissure mine was partly excavated by Drier (1961b) in 1953 and 1954. The survey re-opened the excavation, attaining a depth of 16 feet without reaching the bottom of the mine, but the narrowness of the mine at the maximum depth reached suggests that the mine is probably less than 20 feet deep. The fact that this mine was marked by a deep pit and standing water before it was dug suggests that it may be one of the deeper mines on Isle Royale, since most of the mines are more nearly filled and do not hold a pool of water.

All of the fissure mines which have been adequately excavated show distinct copper bearing fissures, a clay or sand deposit on the bottom, a compact organic fill containing rock fragments and hammerstones, smooth sides near the bottom, and the absence of a distinct pile of tailings near the mine.

The fissure mine excavated by Drier, and one excavated by the survey at the Minong site, contained preserved organic remains, including pine cones and needles, leaves, birch bark, pine knots, and sticks and logs. Many of the latter were partly charred.

There was no room for the miner to pile tailings, except temporarily, in worked-over sections of the mine in which he was working. Usually the mines are far enough apart so that the rock removed from adjacent mines would not fall into nearby mines. Consequently, the fill in these mines consists mostly of a peat-like material including some rocks and hammerstones. The fill usually comes to within one or two feet of the top of the mine, but the mines which are nearly filled in may be easily overlooked. The fill is usually wet, and water stands in some pits after rains or in wet seasons. A very few pits at the Minong site maintain a considerable depth of water at all times.

The failure to note a tailing pile near the mines may be due to inadequate investigation in some cases, but this is unlikely for others. In those instances where the area surrounding the mine is fairly level, tailings should be present. Their apparent absence may be due to the relatively small volume of rock removed from these mines, and to the very small size of most of the tailings. The latter assumes that much of the bedrock had been removed by crushing, rather than by fracturing.

The survey did not find any loose pieces of copper in any of the fissure mines which it examined. Shaw found a "sheet of pure copper lying against the foot-wall" of one of the mines at the Lookout site (Foster and Whitney, 1850: 162).

All of the lode mines investigated by the survey are located at the Minong site in the Minong amygdaloid. They occur on the southeast face of the Minong ridge near the central part of the slope. A few fissure mines are located in trap rock on the crest of the Minong ridge. Presumably, this distribution is a reflection of the kind of rock exposed. High on the ridges the amygdaloid has been eroded away leaving only the more resistant trap rock, and near the bottom of the ridges the amygdaloid is covered with alluvium. Hammerstones occur in the tailings of a modern trench at the base of the northwest side of the Minong ridge, but the nature of the aboriginal mine or the copper deposit was not determined.

Since only limited excavations were conducted at the Minong site prior to 1962, some of the following descriptions are more generalized and tentative than desirable, and complete sectional drawings are not available at this time. However, a sectional drawing published by Winchell in 1881 is

reproduced here (Fig. 4), because its general accuracy is confirmed by the survey's excavations, and because Winchell probably had the opportunity to see several prehistoric mines freshly cut by the historic mines.

Pit 54, the pit chosen by the survey for the most intensive excavation, is located in the most extensively mined area of the Minong site, and among one of the heavier concentrations of pits within that area (Fig. 5). The pits in this area are generally less than 30 feet apart, but their form is typical for most of the Minong site. They range from a few feet to 25 feet in diameter, and up to three feet in depth. Pit 54 was fairly symmetrical in shape, and of about average size. Before excavation it was 14 by 17 feet across, and about two feet deep. Other excavations were made in this general locality, but they are not included in the area shown in Figure 5. No bedrock was visible at the surface in the immediate vicinity of Pit 54.

Pit 54 was opened with a two by 16 foot trench situated so that one long wall bisected the center of the depression. The narrowness of the trench and the caving of the walls prevented completion of the trench, so it was expanded at one end to an area of about eight by nine feet (Pl. 1d). Even this expansion was inadequate to reach the bottom of the mine since the walls of the excavation were steeply sloped to prevent cave-ins. The undercut and highly fractured six-foot face of bedrock exposed on one side threatened to, and with some prodding did, collapse. These limited excavations provide some detail about the nature of the mine, but the more extensive excavations undertaken in 1962 amplified these data and provided information about its depth and bottom deposits. The excavation was conducted with picks and shovels, and the fill was not carefully checked for artifacts, because of the large amount of fill to be removed in the time available.

The fill in the exacavated portion of Pit 54 consisted mostly of angular fragments of brecciated amygdaloid rock ranging in size from small particles up to some large pieces which had to be broken before they could be removed from the excavation. Most of the fragments were easily handled with the shovel, or with one hand, however. Mixed in with these amygdaloid fragments was some fine sandy and silty material, a number of glacial cobbles and boulders, and about 125 hammerstones. About 1500 cubic feet of fill were removed. Below the top foot or two, the fill was loose, and there were some open spaces among the rocks. The fill was finer and more compact near the surface, and it was penetrated by more roots than it was deeper in the mine. The finer material was always a minor constituent of the fill, except near the surface where a thin topsoil of sod had developed, but even here rock fragments were near the surface and occasionally projected

above it.

The bedrock underlying the fill appeared to be the same red, brecciated amygdaloid rock as the fragments in the fill. The bedrock was encountered about one and one half feet below the surface on the uphill side and at a slightly greater depth on the downhill side of the pit. The top of the bedrock was smoothed, fluted, and striated, and it directly underlay fill material, except in one area where the bedrock and fill were separated by several inches of fine sand. The deepest part of the mine was over nine feet below the surface of the bedrock. Only the north and south walls of the mine were uncovered, and they were revealed as vertical, often undercut, faces of jaggedly fractured bedrock. On the other two sides of the survey's excavation, one of which was the wall of the first trench which bisected the surface depression, no bedrock was encountered. The total area of bedrock exposed at the bottom of the excavation was about eight by ten feet. The surface of the bedrock at the bottom of the mine varied from deep jagged depressions to areas of flat rock. In some areas, particularly where water stood after hard rains during our excavations, the bedrock was covered with a very thin (usually less than one quarter inch) layer of hard, compact, red clay. In most areas, however, the rock fragments of the fill lay directly on the bedrock.

Copper and bright green malachite stains were occasionally encountered. A few dozen copper amygdalae, either adhering to or completely free of rock, were found in the fill. A number of the fragments of rock fill were stained with malachite, but usually no metallic copper was noted. Very little copper was found in the bedrock itself. Heavy malachite stains occurred in one rough area, but noticeable amounts of copper were confined to a narrow joint in the flat floor and to three small jagged protrusions less than one quarter inch in diameter.

Some very black, greasy, soot-like stains or lumps were occasionally noticed on pieces of rock fill and on the bedrock walls. This substance was noticed in isolated occurrences, but it was usually associated with rootlets which extended to the deepest parts of the excavation. In places there were concentrations of rootlets against vertical bedrock walls. Most of these roots seemed to be in various stages of decay, and black sooty material was often associated with them. The sooty material has been variously interpreted as soot from fires and as decayed organic matter.

All of the charcoal samples found more than two feet below the surface were collected, but the combined samples were insufficient for radiocarbon measurement. The only artifacts recognized in this excavation were about 125 hammerstones. These are described in Chapter VI.

Despite the rather meager indication of the nature of the copper deposit in the mine, there is little doubt that Pit 54 is a prehistoric copper mine. The well developed soil profile indicates that the excavated area had not been disturbed by historic miners, but available studies (summarized by Parsons, 1962: 6-7) do not provide adequate reason to believe that a profile of this type necessarily indicates any great antiquity. The absence of soil zones in the rock fill seems to indicate that the fill in this mine did not accumulate over a long period of time, and that it represents tailings from adjacent mines. Some lensing and sorting of the fill was apparent, and this may be attributed to variations in the size of the tailings removed from nearby mines, and to the sorting effect of gravity as the tailings were deposited.

The smoothed, fluted, and striated surface of the bedrock around the mine is undoubtedly the product of glaciation, and the sand deposit on this surface in one area is probably a glacial or lake deposit which covered parts of the bedrock. The excavations were not extensive enough to reveal the entire extent of the mine, but the test was sufficient to indicate that the shapes of the mines on the Minong lode are very irregular, perhaps tending to be elongated along the strike of the lode. Clearly, the depression present on the surface did not accurately reflect the shape of the mine below it. This same incongruity was also reflected in some three by three foot tests dug in the area. The pits now visible on the surface are probably the product of underlying depressions combined with relatively small amounts of tailings from other mines.

The almost complete absence of charcoal in the fill or lying on the floor of the mine, and the complete absence of anything recognized as ash, would seem to indicate that the rock was not heated in order to facilitate its removal. On the other hand, the small, black, very greasy deposits of material on the walls of the mine were tentatively identified by John L. Cotter, when he visited the site in 1962, as soot from fires used in heating the rock. Unfortunately, the particular specimens which he saw were not collected, but several samples of similar material were collected in a nearby test, and were examined by Richard Yarnell, formerly research assistant in the Ethnobotanical Laboratory, University of Michigan Museum of Anthropology. According to Yarnell (personal communications, 1962), the samples contained pebbles, copper salts, charcoal, and dead rootlets and other decayed organic matter. He saw "no evidence of soot, but it is possible that there was some." In view of the frequent association of the black, greasy substance with decayed roots, as noted above, it seems reasonable to choose the simpler, more obvious explanation that the substance is decayed organic matter, rather than soot produced by fires in the mines.

Several three by three foot test pits dug in the general area of Pit 54 showed conditions similar to those at Pit 54. One of these tests yielded a considerable amount of charcoal in one area. The test was not large enough to determine satisfactorily the content of the charcoal, but it seemed to be associated with what may have been an old soil line. The "soil line" might also be interpreted, however, as the charred debris from a fire used to heat the rock in an adjacent mine, but no ashes were recognized. Another test just above the uphill limits of the area of the pits revealed four feet of compact, stratified sand and silt overlying glaciated bedrock. Another test just below the uphill side of the mined-over area revealed a very deep deposit of unstratified sand and silt containing a few mine tailings and hammerstones. Expansion of this test revealed a relatively complex situation which is interpreted as an area with a deep overburden of sand and silt which had been removed by the miners in order to reach bedrock at least five feet below the original ground surface. Outlined in the wall of the test was a clear distinction between the compact, stratified, undisturbed sand and silt overlying undisturbed bedrock, and the loose, unstratified fill overlying mined-over amygdaloid bedrock. Both kinds of fill contained pebbles, cobbles, and boulders weighing up to several hundred pounds, but tailings and hammerstones were confined to the disturbed fill. The survey's excavations suggest that the prehistoric miners followed lodes under deep overburdens whenever they thought it useful to do so. The diffuse form of the lode mines, as contrasted with the more symmetrical shape of the pits visible on the surface, suggests that the miners did not dig down through the overburden in hopes of finding metal-bearing rock, but that they removed the overburden in the process of following known copper-rich bedrock.

Some unusual features were found in a lode mine, Pit 77, which was partly excavated at the end of the 1962 season. It is in the Minong amygdaloid lode over a mile from Pit 54, and is situated at the top of a steep slope along the shore of McCargo Cove. The fill resembled that of Pit 54, except that charcoal was sparsely scattered throughout. Near the bottom of the small section excavated, some fine granule-sized, horizontally stratified pieces of tailings were found. The deposit was truncated against a sloping ledge of bedrock on the uphill side of the pit, and extended beyond the survey's trench in other directions. The deposit appeared to be water-laid, and since it was about 55 feet above Lake Superior, it seems possible that it might have been deposited by the Nipissing Lake stage which stood at about this level in McCargo Cove. If the deposit is a result of surface wash, its horizontality would not be expected. Unfortunately, there was insufficient time to expand the excavation. Charcoal samples were collected from both above the below the deposit, and they

have been submitted for radiocarbon dating. In addition to its possible chronological significance, the Pit 77 excavation yielded some unusually large hammerstones which are discussed in Chapter VI.

Excavations of two other lode mines at the Minong site have been previously reported. One was excavated by Holmes (1901) in 1892, a little over a decade after the historic mining at this site was abandoned. The only significant difference between this mine and those excavated by the survey seems to be the presence of " . . . considerable quantities of charcoal scattered through the mass . . . " (p. 690). The pit excavated by Barrett (1926) in 1924 seems also to be similar to Pit 54. Barrett does not mention the discovery of any charcoal in the fill, but he interprets a malachite stain in the bottom as indicating that a large nugget of copper had been removed. His photographs show an irregular pocketing of the bedrock. An unknown number of prehistoric mines at the Minong site were encountered by historic mining operations, but no detailed descriptions are available.

Some of the mines in the Little Siskiwit River area are reported to be in amygdaloid rock, but the reports on these mines provide an inadequate basis for comparisons (Ferguson, 1924; West, 1929: 26).

Reliable information on lode mines is available only for the Minong site. The data suggest that the pits visible on the surface do not accurately indicate the size, shape, or number of mines in that area, but it is reasonable to suppose that they form a rough guide. Some of the pits are very shallow, and hence have probably been overlooked in brushy areas. The Minong site extends from the shore of McCargo Cove for 1.6 miles along the Minong ridge. The width is highly variable, but most of the pits occur in a belt about 400 feet wide. Only the southwestern 1.1 miles of the site was recognized in 1961 when a systematic attempt to count the pits was made. A rather careful surface survey was made of this area, and each mine was marked as it was counted in order to prevent recounting of the same pits. In the area covered, 1015 pits suggestive of lode mines, and 26 pits suggestive of fissure mines were counted. The area near McCargo Cove not included in this count has not been carefully investigated, but several traverses of the area suggest that there are no more than a few hundred pits. It is difficult to estimate the number of prehistoric pits destroyed by the historic mines. Judging from the extent of the prehistoric pits on either side and between the large historic open-cut mines, a relatively small number may have been destroyed. There were probably no more than 1500 prehistoric pits at the Minong site, and almost certainly not over 2000.

Pit 54 is the largest lode mine of which there is adequate record from Isle Royale. It is about 15 feet wide and over 30 feet long. Although the maximum depth of our excavation was over 12 feet, three feet of this was fill above the bedrock surface, and on the downhill side the actual depth of the mine was less than five feet. Holmes (1901: 690) states that the pit he excavated was "some ten feet" deep. In 1875, a large copper mass was removed from a prehistoric mine 16.5 feet deep at the Minong site, but it is not entirely clear from the descriptions (Davis, 1875; Gillman, cited by Griffin, 1961: 20) whether it was a lode or fissure mine.

In summary, all of the excavated mines on Isle Royale, with the possible exception of the inadequately known Little Siskiwit River area, are of two mutually exclusive types reflecting the kind of copper deposit in which they occur--fissure or lode. The fissure mines tend to be deep, oval pits only large enough to allow the miners to remove the narrow tabular copper deposit. The fill in the fissure mines appears to be due to gradual accumulation, so that evidence of fire found in them is probably indicative of forest fires, and does not have any implication for reconstructing the method used in mining.

The largest and most extensive mines are lode mines. The only completely excavated lode mine (Barrett, 1926: 28) was five by ten feet across, but surface features suggest that the one dug by the survey, which was over 15 feet wide, is more typical at this site. The copper was scattered through the rock in vesicles, crevices, and openings. The fill in the lode mines usually consists of tailings, but it may include other debris, particularly sand and silt from overburden moved in the process of mining. The possible soil zone revealed by one test at the Minong site suggests that the site was mined over a considerable period of time, but the usual absence of soil zones or peaty deposits in lode mines suggests that the debris in the mines was deposited as tailings from nearby mines and not by natural accumulation. Charcoal or other organic matter, except for roots, is scarce in the fill. Although none have been certainly identified, it is expectable that some prehistoric mines may occur in cliff faces or in lake shore exposures where the excavation would not have become filled with debris, in which case the preceding descriptions are too simplified.

The mine sites and number of mines located at each site are listed in Table 1. The figures are conservative, and it is impossible to estimate how many mines have not been included in this table. A number of other sites have been reported in the literature (Dustin, 1957; Fox, 1911: 84-5), but could not be located by the survey. It is beyond the scope of this paper to consider the probable status of each of these unlocated sites.

TABLE 1

PREHISTORIC COPPER MINES ON ISLE ROYALE

Sites (for Locations see Fig. 1)	Fissure Mines		Lode Mines		Total Number of Mines at Each Site
	Number of Mines Recorded	Number of Mines Excavated	Number of Mines Recorded	Number of Mines Excavated	
Minong[a]	25 +	2	1015 +	5	1040 +
Lookout[a]	5	3	. .	. .	5
Stoll[a]	3	3	. .	. .	3
Siskowit[a]	3	1	. .	. .	3
Little Siskiwit River[b]	?	?	?	?	11
Ferguson[c]	?	?	?	?	?
Dustin[d]	?	. .	?	. .	27
Total Number of Kinds of Mines	36 +	9	1015 +	5	1089 +

[a] Survey's observations. Includes three previously excavated pits (Barrett, 1926: 25-8; Drier, 1961b; and Foster and Whitney, 1850: 162).

[b] West, 1929: 28-9.

[c] Ferguson, 1924: 451-2; and West, 1929: 26.

[d] Dustin, 1957: 10.

CHAPTER VI

ARTIFACTS ASSOCIATED WITH THE MINES

Very few artifacts, besides hammerstones, have been reported from the prehistoric copper mines on Isle Royale, and many of these specimens are no longer available for study or are of a doubtful nature. The most specific reference to copper artifacts from the mines is by Gillman (1873: 173): "Tools made of copper, and consisting principally of chisels and knives, have also been taken from such of the pits as have been explored." These specimens are neither described nor illustrated. All other known statements about copper artifacts from the mines are even more vague. Gillman also reports a "large portion" of a wooden bowl-like object about three feet in diameter from the bottom of a mine. Winchell (1881: 602) refers to Gillman's description and adds that it "had probably been used for boiling water . . . ." It is very doubtful if such an object would be useful for boiling or bailing water, and it seems more probable that it was a rotted-out stump or burl preserved in a wet fissure mine. Fortunately, descriptions and illustrations (Winchell, 1881: 603, Figs. 2-3) and independent confirmation (Fox, 1911: 91) are available for two other objects: a wooden paddle and a knotted piece of rawhide. The paddle was discovered by miners in 1879 near a large mass of copper which the Indians had abandoned. The handle was broken and the blade worn so that the remaining section had a blade about four and three quarters inches wide, three quarters of an inch thick, and a foot long. It resembles ethnographic specimens of Chippewa canoe paddles (Jenks, 1900: Pl. 70; Densmore, 1929: 171, Pl. 53a). The piece of rawhide was found during the same summer under a mass of copper.

Fragments of birch bark recovered from the mines have been interpreted as the remains of baskets or buckets (Fox, 1911: 91). This seems plausible, but lacking more specific description of the objects and the circumstances in which they were found, there is a very good possibility that the birch bark fragments were part of the forest debris which is commonly preserved in the wet deposits of deep fissure mines. The survey found some excellently preserved, large pieces of birch bark, as well as pine cones and needles, and other organic material, in a fissure mine. The birch bark was carefully examined, but there was no indication that it was part of an artifact.

Du Temple (Drier and Du Temple, 1961: 15-6) states that Drier recovered some pottery in his excavation of Pit 25 at the Minong site. According to Drier (personal communication,

1961), however, this is incorrect. No other occurrences of pottery found in the mines are known to have been reported.

A narrow-notched, straight based, triangular, "chalcedony" projectile point about 40 mm. long was found in the soil beneath ". . . a small dump of copper-bearing rock, probably on the spot where the copper was separated from chunks of rock," near some mines at the Little Siskiwit River site by the McDonald-Massee expedition in 1928 (West, 1929: 29, 37, Pl. 18, 2). The present location of the specimens collected by the McDonald-Massee expedition is not known, and West's descriptions and illustration do not allow a precise identification of the material of which the point is made. The form of this point is unique to Isle Royale, and it is not known if it occurs elsewhere in the Lake Superior basin. This type, Washita, is widespread in most of the Great Plains and Mississippi Valley from about A.D. 1100 to 1600 (Bell, 1958: 98). West (1929: 29, 37) seems to imply that the conditions in which the point was found indicate that is was contemporary with the mines. While this may be so, it was found within an area extensively explored, and called the "Old Fort," by Ferguson in 1923 and 1924. It is possible that many piles of rock in this area may be a result of Ferguson's explorations.

From his excavation of a lode mine at the Minong site in 1892, Holmes (1901: 694-5) reports:

> Among the stone implements found are a few forms that may properly be classed with the flaking hammers of the flint quarries. All are small and somewhat discoidal, and are flaked and battered more or less completely all around the periphery. They could have been used in grooving sledges and in shaping or repairing other stone tools.

It is not clear exactly what he is describing, and a search of some of the literature on flint quarries provided no insight. The survey recovered a flaked and battered discoidal of schistose trap 1.9 feet feet below the surface of a fissure mine (Pit 56) at the Lookout site (Pl.2f). It varies in diameter from 93 to 100 mm. and is 17 to 19 mm. thick. It appears to have been made from a large flake, and there is a broad, flat, unmodified 50 mm. long section of the edge which may be the striking platform. Four other similar artifacts, but less modified and more irregular in shape, were also found in and just below the sod covering the same mine. One of these, which may actually be a small, unusually shaped hammerstone, is an irregularly oval cobble of weathered ophite 145 mm. long, 80 mm. wide, and 50 mm. thick (Pl. 2g). The thinnest edge has been heavily battered and flaked. The three other objects are flakes or spalls, probably unintentionally broken from hammerstones, which have been battered and flaked along three sides (Pl. 2 h-j). Their maximum diameters range

from 80 to 110 mm., and their thicknesses range from 22 to 35 mm. One is made of weathered ophite, and the other two are of basalt. These latter two objects, and the schistose discoidal, have a scattered, glassy polish on one or both surfaces. None of the several dozen unmodified hammerstone flakes and fragments from the mine shows any polish, and the absence of polish on the two weathered ophite artifacts may be due to their composition or weathered condition. The amount and kind of wear (moderate flaking, battering, smoothing, and polishing) suggest that these objects were not used as pecking tools for shaping other artifacts. Perhaps they were used to scrape debris from the mines, to cut roots, and/or to remove sod from the bedrock surface. The crude objects from Pit 56 at the Lookout site have not been reported from other copper mines in the Lake Superior region, as far as is known. Pit 56 was excavated with considerable care, and all hammerstones and recognizable fragments therefrom were preserved, as well as a few miscellaneous rock samples from the fill and bedrock. However, only the discoidal-shaped specimen was recognized in the field. When all of the specimens from Pit 56 were examined in the laboratory, two artifacts had been cataloged as hammerstone flakes, and two others as miscellaneous rock samples. Since only a few of the rocks found in the mine were saved, it is probable that additional artifacts were discarded during excavation.

The hammerstones are slightly elongated or roughly oval cobbles and boulders modified through use on one or both ends by battering and/or spalling. They are illustrated in most of the published archeological reports on Isle Royale (for example, Griffin, 1961). A few of these crude artifacts have very shallow, usually incomplete, grooves around their girth. Most of the hammerstones encountered by the survey were in excavations of prehistoric copper mines, but several dozen were seen on the surfaces of mine sites, and a few were found at occupation sites. It is sometimes difficult to distinguish slightly modified, or heavily weathered, hammerstones from ordinary cobbles and boulders which occur nearly everywhere on Isle Royale, so that some specimens of this class may have been overlooked during the survey.

Since hammerstones are relatively numerous, some valid generalizations about them can probably be drawn. Observations were made on hammerstones collected by Holmes (Chicago Natural History Museum collections); Fox and Barrett (Milwaukee Public Museum collections); Dustin (University of Michigan, Museum of Anthropology collections); and the survey; and on those in the Isle Royale National Park museum collection. The attributes of these 193 hammerstones from Isle Royale are summarized in Table 2. One grooved hammerstone is from Pit 77 at the Minong site, and the other three were collected by Holmes from an unspecified locality on Isle Royale. A number

of other grooved hammerstones were collected by the survey in 1962, but they are not included in this sample. One was found in Pit 54 at the Minong site, and about five others were found at the Siskowit and Stoll sites. This suggests that about five per cent of the hammerstones on Isle Royale are grooved. About two thirds of a collection of hammerstones from near Rockland, Michigan, on the south shore of Lake Superior are grooved (Straw, 1962). When the 1962 data from Isle Royale are analyzed, it may be possible to demonstrate that grooved hammerstones are significantly more frequent in some mines than in others. Holmes (1901: 694, Pl. 24) states that there is a polished band around many of the ungrooved hammerstones which indicates that they were hafted. I have been unable to see any indication of this, however,

TABLE 2

ATTRIBUTES OF HAMMERSTONES FROM ISLE ROYALE

Attributes	Range	Mean
Girth	200 - 690 mm.	330 mm.
Length	100 - 290 mm.	164 mm.
Maximum Width	70 - 255 mm.	125 mm.
Minimum Width	40 - 185 mm.	95 mm.
Weight	1½ - 26 lbs.	6 lbs.
	Per Cent	
Battered on One End	3	
Battered on Both Ends	5	
Spalled on One End	31	
Spalled on One End, Battered on Other End	28	
Spalled on Both Ends	33	
	Number of Specimens	
Grooved	4	

Sample size: 193

Several observors state that some hammerstones on Isle Royale weigh up to 60 or 75 pounds (Dustin, 1957: 29; Holmes, 1901: 692). Although I have seen grooved hammerstones weighing about 40 pounds from the south shore of Lake Superior, the heaviest hammerstones found by the survey on Isle Royale weigh 26 pounds. Since many glacial and lake boulders occur on Isle Royale, it is possible that some of them may have been erroneously identified as hammerstones.

The frequency distributions of the metrical attributes are flattened, usually bimodal, curves skewed toward the smaller sizes. The bimodality is especially marked in the girth measurement, and there is a clear division between large and small hammerstones at 295 mm. There does not seem to be any test to see if this bimodality is significant, but its persistence when the total collection is separated into provenience units suggests that it may be significant. There seem to be two kinds of explanations for the bimodality: (1) it reflects the size of the material available to the manufacturers, or (2) the cobbles to be used as hammerstones were deliberately selected in two general sizes. The possibility of being able to prove or disprove the first alternative seems remote, since the source of the hammerstones is not known; and it appears to me to be an improbable explanation. Assuming that some cultural explanation is required, there are at least three possibilities: (1) the hammerstones were not hafted and the smaller ones were held with one hand and the larger ones were held with two hands, (2) they were employed for different uses, such as breaking chunks off the bedrock and crushing the chunks, or (3) a combination of (1) and (2). Although this is a very subjective sort of observation, most of the hammerstones less than 295 mm. in girth are easily handled with one hand, but most of those with a girth greater than 295 mm. are too large to grip securely with one hand. If the girth of the ungrooved hammerstones from Isle Royale is a result of selection for one- and two-handed use, grooved hammerstones might be expected to show no bimodality in girth. The frequency distribution of the girths of 54 grooved hammerstones from the south shore of Lake Superior (collection of William Marjamaa, Calumet, Michigan) forms a low, flat curve only slightly skewed to the smaller sizes. The curve does not seem to be bimodal, but the evidence is not conclusive. Perhaps this would be clarified by a larger sample size. A number of other functional explanations might be made for the two size classes of ungrooved hammerstones from Isle Royale, but supporting lines of evidence are not apparent.

Except for a general correlation between girth and the various other attributes of size, only one other attribute cluster was discovered: the hammerstones from Pit 77 at the Minong site are exceptionally large. Eight of the 14 hammerstones from this lode mine are larger than any of the other

hammerstones included in this study. The difference does not seem to be due to sampling error because a median test comparing the girths of specimens from Pit 77 with all of the hammerstones from Isle Royale indicates a probability of more than .98 that there is a significant difference. There is no apparent explanation for this situation, but it may be due to available rock supply or to personal or cultural preference.

The composition of the hammerstones is not listed as a formal attribute in Table 2 because it did not appear to be significant when tabulated. The source of the hammerstones requires some comment, however. Winchell (1881: 604; 1882: 48-54), a leading local geologist and petrographer of his time, collected rock specimens from various places on Isle Royale, but principally along the shores. He also collected some hammerstones at the Minong site. He concluded from thin section studies of hammerstones that they were not derived from Isle Royale, but from beaches along the Canadian mainland opposite Isle Royale. Dustin (1957: 29-30) states, however, that " . . . this was based upon insufficient observation, as it is possible to duplicate any hammerstone with a pebble from either the present or ancient lake beaches . . . . The rocks are relics of the Ice Age, brought from the northern mainland and dropped on the isle . . . ." A number of other writers have commented on the source of the hammerstones, but without providing any specific data in support of their assertions (for example, Barrett, 1926: 29; West, 1929: 34). This problem can not be finally resolved on the basis of present data, but a few pertinent observations can be made. The shingle on the modern beaches of Isle Royale is largely composed of conglomerate, sandstone, and mainly a greenish diabase (variously called ophite, porphyritic basalt, greenstone basalt, or varioloid greenstone). Hard, fine-grained, dark rocks, such as are typical of the hammerstones, are extremely rare on the modern beaches; the survey collected only three. Reference to the gross geology of the island (Lane, 1898: Pl. 1) shows that, as the beaches imply, greenish diabase, sandstone, and conglomerate comprise the major formations on both sides of the island, although dense, dark trap formations occur in the interior of the island. Megascopically, a sample from the wall of a fissure mine (Pit 77) in the Minong trap is indistinguishable from the material comprising many of the hammerstones found in a lode mine (Pit 54) in the Minong amygdaloid. An abandoned shingle beach, probably of Nipissing age, crossing the Little Siskiwit River a few hundred feet below the Little Siskiwit River site is composed of dark, dense trap. While these data need confirmation, they suggest that the Indians could have collected hammerstones from abandoned beaches, from active beaches which are now abandoned, or from unknown modern beaches on Isle Royale. An experiment conducted by the survey suggests the plausibility of Winchell's contention that the hammerstones were brought

from the Canadian mainland. Two hammerstones were used for 30 hours on the Minong amygdaloid. The hammerstones were only slightly battered, and a few very small flakes were removed. The implication is that a few hammerstones might be all that one miner would need during a summer on Isle Royale, and it might have been as convenient to pick up a few stones on the way to Isle Royale as to acquire them there--particularly if they did not occur near the mines. In support of Dustin's explanation that the material for hammerstones was brought to Isle Royale by the glaciers, granite occasionally occurs as cobbles and boulders on beaches, and as hammerstones, but it is not known to occur as bedrock on Isle Royale. In summary, the available evidence suggests that the hammerstones could have been derived either from Canada or Isle Royale, and that in either case their supply presented no particular difficulties.

CHAPTER VII

OTHER ARTIFACTS FROM ISLE ROYALE

Early investigators of the prehistoric copper mines on Isle Royale speculated about the presence of occupation sites, but none were discovered until 1928. West (1929: 36) suggests that the occupation sites were not associated with the mines:

> As the village sites discovered were all at a distance of two or more miles from any of the groups of aboriginal mines, and because of their limited size and the scarcity of the material they produced, it seems safe to conclude that they were merely temporary camping places, occupied for short periods of time by historic Indians, probably Chippewas, who occasionally visited the island, as we know they did, for the purpose of fishing.

Since West does not mention any copper artifacts from the village sites, his apparently biased sample probably influenced his opinion. A few years later, Guthe and Dustin found copper artifacts at these same sites, and Dustin concluded that these were the camps of the miners (Dustin, 1932: 11; 1957: 31-3). After a study of the pottery from Isle Royale, Quimby (1939: 223) stated that "the location of the camp sites is intimately related to the many prehistoric copper pits in the vicinity. While it is not certain, it is quite probable that the people responsible for the camp sites also operated the copper pits in proto-historic times."

With appearance of McKern's (1942: 167-8) hypothesis of a pre-ceramic (Archaic) "Old Copper Industry" as the earliest known culture in Wisconsin, it was possible to infer that some of the mines on Isle Royale might be older than the reported camp sites. As evidence for the chronological priority of the Old Copper Industry accumulated, and its great age was established by radiocarbon dating in the early 1950's, it became obvious that some of the copper mines in the Lake Superior region were probably of considerable antiquity. This was confirmed in 1956 when radiocarbon dates were released for wood collected by Drier from a fissure mine (Pit 25) at the Minong site (Crane, 1956: 668-9; Drier, 1961b; Rubin and Suess, 1956: 447). The results indicate a minimum date of about 1500 B.C. for the age of the mine.

The presence of an Eastern Archaic occupation on Isle Royale is suggested by several distinctive artifacts, including a copper spear, a ground-stone adz, and the tip of a slate point (Pl. 2a-e). The significance of several other specimens is not certain, but they may be Archaic.

A flat-stemmed copper spear about 90 mm. long was found by West in 1924 in a crevice on the crest of the ridge at the Minong site (West, 1929: 37, Pl. 18, 4; Fox, 1929: 317). This is very similar to a specimen from the Port Washington site in eastern Wisconsin (Quimby, 1957: Fig. 1) which has been geologically dated between 1500 and 400 B.C. (Quimby, 1958: 179; Ritzenthaler and Quimby, 1962: 256-8).

A tanged, curve-bladed copper knife was found on Isle Royale in 1847, the same year in which the prehistoric mines were first recognized. It is the first artifact known to have been found on Isle Royale, and it was found three feet below the surface, beneath an uprooted tree (Squier and Davis, 1848: 201). Unfortunately, the size of the specimen is not specifically indicated, although it is about the same size as an adjacent specimen 200 mm. long in the same illustration. The size is rather crucial because the form is perhaps more similar to the small Late Woodland "butter knives" found on Isle Royale and thought to date around A.D. 1000 (see below) than it is to similar Old Copper specimens which are 130 to 200 mm. long (Quimby and Spaulding, 1957: Figs. 87, 88, 91) and thought to be several thousand years old.

The tip of a slate point was found on a beach of Starr Island about 1950 (Pl. 2a). The fragment is 8 mm. thick, and 20 mm. wide, and is composed of an altered, very fine-grained rock of uncertain composition. Ground slate artifacts are characteristic of the Laurentian Archaic in the Northeast, and may date between 5000 and 500 B.C. in the upper Great Lakes area (Quimby, 1960: 47).

A grooved adz was found by John Rose, a National Park Service employee, while removing a treefall at the Merritt Lane site in 1961. The longitudinal cross section of the adz is a flattened D-shape, and it is 175 mm. long, 60 mm. wide, and 40 mm. thick (Pl. 2e). The groove is 2 to 3 mm. deep and about 23 mm. wide. Similar specimens have been identified as Archaic wood-working tools, but the ends of the Isle Royale specimen are severely battered and flaked as if it had been secondarily used as a hammerstone.

Two possibly Archaic projectile points have been found in the Point Houghton rock shelter. The McDonald-Massee expedition recovered the remains of at least 12 individuals, and a "light drab" "chert" projectile point in 1928 (West, 1929: 23-5, 37-40, Pl. 18, 3). The point is of lanceolate form, about 75 mm. long, with serrated edges, and of a light banded material. In 1960 the survey salvaged the remaining skeletal material in this shelter and an elongated pentagonal point 39 mm. long, 18 mm. wide, and 7 mm. thick (Pl. 2b). The edges of the blade are serrated, and it is made of a light gray, banded flint. Eldon Johnson (person communication,

1962) suggests that the point recovered by the survey may resemble points from probable non-ceramic sites in western Minnesota. From a review of the literature, it is my impression that the projectile points from the Point Houghton rock shelter may be of Archaic affiliation.

A chipped stone fragment was collected at the Chippewa Harbor site by Drier in 1953 (Pl. 2c). The fragment may be the stem of a slightly contracting, rounded stemmed projectile point. This type of stem is characteristic of projectile points in Archaic and Early Woodland cultures.

Another specimen with an Archaic appearance is a discoidal with ground, beveled edges excavated by Guthe (1930) at the Indian Point site in 1930 (Pl. 2d), according to Guthe's field notes, but the Museum of Anthropology's catalog lists it as from the Birch Island site. The specimen is 67 to 70 mm. in diameter, 31 mm. thick, and was made from a naturally or artificially polished discoidal of very dense, dark, fine-grained stone. The edge is crudely pecked to a double bevel, and both faces show a few battering scars. The beveled edge is not the result of use.

One of the major objectives of the survey was the location of an Archaic site which might date from the period of mining suggested by the radiocarbon dates on one mine at the Minong site. Several investigators (Holmes, 1901: 695; West, 1929: 36, Dustin, 1957: 21) have noted the difficulty of locating occupation sites on Isle Royale because of the heavy vegetation. The survey conducted extensive test pitting near known mine sites, and between the present and Nipissing water levels in the general area of mine sites. Several Middle Woodland to early historic sites associated with the present lake level were discovered, but not a single artifact of an Archaic or Early Woodland type was found on abandoned beaches.

The archeology of occupation sites on Isle Royale is beyond the scope of the present paper, but relevant aspects can be summarized on the basis of partially completed studies being prepared for a more comprehensive report. Evidence for aboriginal occupation is known from 23 localities on Isle Royale, about half of which yielded only a very few non-diagnostic artifacts. It may be generalized that the sites contain thin, mostly mixed deposits of Middle Woodland, Late Woodland, Iroquois, and protohistoric and historic artifacts. All but the most meager sites include pottery, chipped stone, and copper specimens. The copper artifacts include awls, wedges, and knives, but small flakes and bars or strips are most common. The only diagnostic copper specimens are several "butter knives" which are of Late Woodland affiliation judging from their occurrence at the Juntunen site in the

Straits of Mackinac (Alan McPherron, personal communication) dating around A.D. 800 to 1100 (Crane and Griffin, 1961: 110). Several of the occupation sites have yielded a few heavily battered and spalled hammerstones which are indistinguishable from those found in the copper mines.

The general implications of these data are that some of the occupants of the known sites were mining and working copper. The early radiocarbon dates from one mine, and the presence of a few possibly Archaic artifacts, indicate that some Archaic occupation also occurred on Isle Royale, although early sites have not been recognized. The presence of several possible Archaic specimens, including an adz, in more recent sites suggests that unrecognized Archaic components could be present in these sites. All of these sites are less than nine feet above the present level of Lake Superior, and according to our reconstruction of lake history (Chapter II) the lake stood nearly 30 feet higher during the Algoma stage about 1200 B.C. Since no occupation site on Isle Royale is known to be horizontally "stratified," partly drowned, or otherwise to show any evidence of a change in lake level since the Middle Woodland occupations of roughly 1500 years ago, perhaps the lake level has been relatively stable around Isle Royale long enough so that very late Archaic occupations are represented at some of the known sites. The long stability of the lake level at Isle Royale may be explained on the basis of Isle Royale's intermediate location between the rising north shore and the falling south shore of the lake. While this may explain the presence of late Archaic specimens, it does not solve the problem of the location of sites occupied before the Algoma lake stage when at least some mining activity is indicated by the radiocarbon dates of about 1500 B.C. at the Minong site. It might also be argued that the only clearly Archaic specimen found at an occupation site is the adz from the Merritt Lane site, and that the obvious abuse to which it has been subjected suggests that it was found and used by a more recent culture than that which produced it. In the final analysis, however, it must admitted that an Archaic or Early Woodland occupation site has not been identified on Isle Royale, and hence no relationships can be recognized between the occupation sites and the earliest prehistoric mines on the island.

CHAPTER VIII

HISTORIC ACCOUNTS OF ABORIGINAL COPPER MINING IN THE LAKE SUPERIOR REGION

Since the discovery of the prehistoric copper mines by Euro-American miners in the middle of the nineteenth century, historic and ethnographic evidence has been used both to support and to refute the notion that the Indians occupying the area in early historic times were still working the mines. Most authorities now suggest that the mines were not abandoned until metals were obtained more easily through trade with Euro-Americans in the seventeenth century (for example, Dustin, 1957: 27; Fox, 1911: 92; Griffin, 1961: 133; Martin, 1933: 69; Moorehead, 1910: 170; Nute, 1944: 19, 58-9). Some writers maintain, however, that the Indians of early historic times regarded copper with superstitious fear, and that they did not know anything about the copper mines (for example, Drier, 1961c: 23; Lemmer, 1960: 15; West, 1929: 51; Whittlesey, 1863: 1-3). The following is an attempt to re-examine some of the historical documents with the aim of evaluating statements regarding aboriginal mining.

In order to appraise the historical accounts, it is necessary to know something about the early Euro-American interest and knowledge concerning the copper, both of which seem to have been lacking. In a 60-page article discussing the reasons for French exploration of the upper Great Lakes, Butler (1882) does not even mention copper, and summarizes the French motives as "Fun, Faith, Fur, False Fancies, Finesse, and Feudalism" (p. 87). This probably overstates the true situation, because, as pointed out below, there was some interest in the copper.

Isle Royale plays a prominent part in the early references to the occurrence of copper in the Lake Superior basin, but there are no clear accounts of Euro-American visits to Isle Royale in search of copper before the 1830's. Boucher learned of copper in the Lake Superior area from traders who had been there between 1660 and 1663:

> In Lake Superior there is a large island, about fifty leagues around, in which there is a fine mine of red copper; there are also found in several places large pieces of this metal in a pure state . . . . They [the traders] have told me that they saw an ingot of pure Copper, weighing according to their estimate more than eight hundred pounds, which lay along the shore; they say that the savages when passing by, make a fire above this, after which they cut off pieces with their axes . . . .

(cited by Kellogg, 1925: 347; brackets hers). The island referred to may be Isle Royale; but since Boucher did not visit Lake Superior himself, and he is not explicit about the sources of his information, we cannot be sure that the traders had visited the island or seen any mines.

In 1667 Allouez journeyed along the north shore of Lake Superior, and it is quite clear that he was referring to Isle Royale when he wrote: "There is one [an island], at least twenty leagues long, where are found pieces of copper, which is held by the Frenchmen who have examined it here to be true red copper" (Thwaites, 1896-1901, Vol. 51: 65; brackets mine). This would seem to imply that the Frenchmen referred to were at the place where Allouez was writing his account, and not on Isle Royale.

In the Relation of 1669-70, Dablon gives an extended account of what was known about the copper deposits on Lake Superior (Thwaites, 1896-1901, Vol. 54: 153-65). The source of his information is not specified, although Kellogg (1925: 348) states that some of it was obtained from Allouez. In speaking of Isle Royale, Dablon uses such terms as "the Savages have told many people," "are said to be," and "it is related that."

There is only one known attempt to visit Isle Royale by Euro-Americans in search of copper prior to the 1830's. In mid to late June, 1738, de la Ronde traveled from La Point to Sault Ste Marie (Thwaites, 1906: 290): " . . . I intended during The Voyage to land on The island where the virgin Copper is said to be [Isle Royale]; but I encountered a gale . . ." and did not reach the island (Thwaites, 1906: 310; brackets his). The only known visit to Isle Royale by a Euro-American prior to the 1830's was made about 1800 by John Tanner (James, 1956: 24-5) who went there with some Indians from Grand Portage to fish and hunt. There are many explicit descriptions by early Euro-Americans of various parts of the Lake Superior basin, and they include occasional references to the finding of float copper. Since Isle Royale played a prominent part in most of the early accounts of copper in the Lake Superior region, the apparent absence of any clear descriptions of early visits to the island may be an indication of lack of interest in the copper.

There were a few official attempts to encourage exploration for copper, but the accounts of them seem less encouraging than those of Boucher and Dablon of a few years earlier. In 1667 Talon sent Peré, a trader who claimed to have found a copper mine himself, on a three-year tour of exploration to verify the missionaries' reports of copper. Jolliet was sent with additional supplies in 1669, but he could not find Peré. In 1670 Talon sent an expedition to

further explore for copper and to find Peré, but it returned without success (Kellogg, 1925: 348-9; Nute, 1944: 27, 31, 160). It appears that another expedition was sent out in 1671 or 1672 " . . . to make a more careful examination of the copper mine only recently discovered by Sieur Peré at lake Superior" (Thwaites, 1896-1901, Vol. 55: 237), but the results of this effort are unknown. The Relation of 1670-1 summarizes the then current knowledge of the copper deposits:

> The reader will also be enabled--on his journey, so to speak--to note all the places on this Lake where copper is said to be found. For, although at present we have no very definite knowledge on the subject, because no thorough surveys have been made, yet the slabs and huge lumps of the metal which we have seen, each weighing a hundred or two hundred livres, and much more; that great rock of copper, seven or eight hundred livres in weight, seen near the head of the Lake by all who pass; and, furthermore, the numerous pieces found at the water's edge in various places,--all seem to force upon us the conviction that somewhere there are parent mines which have not yet been discovered (Thwaites, 1896-1901, Vol. 55: 99).

By 1710 the existence of copper mines was still uncertain, according to the Intendant of New France at that time:

> It is almost certain that there are copper mines on the borders of this lake [Superior] and in the islands within its extent. There are found in the sands pieces of this metal, which the savages make into daggers for their own use. They claim that the island Minong [Royale] and small islets in the lake are entirely of copper (Kellogg, 1925: 350, brackets hers).

As late as 1739 no one in Canada was capable of assaying copper (Thwaites, 1906: 307).

Another line of evidence suggesting that the early Euro-Americans were not particularly interested in the copper deposits in the Lake Superior region is implied by old maps. I have been able to find only one map prior to 1825 which specifically mentions copper in the Lake Superior region. The map was made in 1682 and has a partly illegible note at the east end of Lake Superior reading " . . . Lake they have found some pieces of very pure red copper. It is thought that the mines . . . are not far" (Tucker, 1942: Pl. 8; my translation). There is a note on a very crude map thought to date between 1649 and 1658 which reads: "In the little lake close to the mountains, there are pieces of copper weighing five or six hundred pounds" (Nute, 1943: 25-6). Although it is not clear, the lake referred to may be Lake Superior.

Both of these early references to copper are very vague, while in contrast there are at least 15 maps dating between about 1675 and 1825 which specifically designate the location of the lead mines near the present city of Dubuque, Iowa (Wheat, 1957-60; and Tucker, 1942).

Besides a general lack of interest in copper, there is evidence that the early Euro-Americans did not understand the nature of the native copper deposits of Lake Superior. Foster and Whitney (1850: 13) have pointed out that none of the early accounts mention the silver which occurs in native form with the native copper in the Lake Superior area. Anyone who was familiar with metals and who had spent much time exploring for copper in the Lake Superior area should have noted the silver. Many accounts describe the occurrence of float copper along the shores and in stream beds, but the source of the float copper was not known. In the Relation of 1669-70, Dablon described the copper deposits on Isle Royale, which he had not seen himself: " . . . there are some very steep clay hills where are seen several strata or beds of red Copper, one over another, separated or divided by other strata of earth or of Rocks" (Thwaites, 1896-1901, Vol. 54: 161). A not too dissimilar situation was reported firsthand in 1735 in some detail from the Ontonogan River by Corbin, a carpenter employed by de la Ronde (Thwaites, 1906: 237-40). I am unable to reconcile these descriptions with anything I have been able to learn about the copper deposits of Lake Superior.

The first clear accounts of the identification of a vein in bedrock resulted from the investigations of two German miners who visited the Ontonogan area at de la Ronde's request in 1739 (Thwaites, 1906: 314). De la Ronde had been exploring for copper near La Pointe as early as 1727, but he could not find any bedrock deposits. After the German miners had located some veins in 1739, de la Ronde wrote that he had begged his superiors " . . . to send out skilled Miners from the Mining country to find the main lode for we found only masses of virgin Copper in rich, red, and sandy soils . . . . I found nothing but masses of Copper. Had I had any knowledge of Minerals, I should certainly have had no need of Miners" (Thwaites, 1906: 309-10). Despite the success of the Germans, there was insufficient interest to overcome the problems connected with maintaining or reviving some preliminary attempts at mining of the deposits (Kellogg, 1925: 353-4). The second mining venture on Lake Superior was undertaken by the English on the Ontonogan River in the winter of 1770-1. That they did not understand the nature of the copper deposits is indicated by the fact that they drove a drift into a sterile sandy deposit (Butler and Burbank, 1929: 63). Except for the German miners who visited de la Ronde, Houghton seems to have been the first to understand and describe the copper deposits, which he did in 1841 (Fuller, 1928: 531-2). Even then, the

first American mine was opened in 1844 on a deposit of oxide ore instead of native copper. It seems clear that the failure to recognize native copper veins, or the refusal to believe that the veins could be productively mined, was a factor in delaying the development of mining by Euro-Americans.

The French often used the word mine when discussing the copper deposits of the Lake Superior region, but there are no descriptions of the mines. The term is rarely used in first-hand accounts by those who had seen the copper; and, as West (1929: 48) has previously noted, it does not necessarily refer to an excavation. An early French dictionary defines mine as "Le lieu où se formant les metaux, les minéroux, & quelques pierres précieuses" (Richelet, 1760: 440). The tendency to assume that discoveries of copper indicated that mines had been found was probably reinforced by efforts to please or impress various governmental authorities or financial promoters.

The only known clear assertion that the Indians were mining copper is a statement by Kellogg (1925: 59): "From the Frenchmen dwelling among the Hurons, Sagard obtained what information he could. In addition to Brulé, a youth named Grenoble told the missionaries that he had visited the place where the Indians were taking copper from a mine." This occurred in the 1620's. The statement has been quoted by Griffin (1961: 32, 37, 133) as suggesting that the Indians were mining copper when the Europeans first arrived in the Lake Superior region. Unfortunately, neither the French edition of Sagard's Histoire du Canada (1866) which Kellogg cites, nor Wrong's translation (Publications of the Champlain Society, Vol. 25) is available. However, Kellogg again refers to Sagard's account (p. 346), which she quotes: "There are also mines of copper which should not be slighted. . . . about eighty or one hundred leagues from the Huron country there is a mine of red Copper, of which the Interpreter showed me an ingot on his return from a voyage he made to that country." This is the only reference to copper which I have seen quoted from Sagard's writings, and it does not suggest that the Indians were mining. Without consulting the source cited by Kellogg, we cannot be sure if her interpretation is justified.

Several of the early historic accounts make it clear that the Indians were obtaining copper and shaping it into objects, but there are no clear implications that the Indians were taking it from deep excavations. It is probable that they collected float copper and broke projecting pieces from deposits. If the Indians were actually operating mines, no descriptions of the mines and mining techniques are known. Several accounts indicate the willingness of the Indians to give copper to the Euro-Americans, and to guide them to large pieces of float copper, but other accounts state that the Indians were reluctant to reveal the location of copper deposits.

The ethnographic information known to me does not provide a basis for deciding whether or not the Indians were mining copper in protohistoric or early historic times. Perhaps this can be clarified by archeological investigations.

CHAPTER IX

SUMMARY AND DISCUSSION

The interpretations of Isle Royale and its prehistoric copper mines which have been presented in this paper may now be specifically applied to the five questions posed in the introduction: (1) How large and extensive are the mines? (2) How were they worked? (3) When were they worked? (4) What is the relationship between the mines and the Indian camp sites on the island? (5) What is the relationship of the Isle Royale copper mines to the general archeology of the Lake Superior region, and to the rest of North American prehistory?

The mines may be classified into two types which are reflections of the form of the native copper deposits: (1) fissure mines are narrow, deep shafts occurring on copper-bearing joints or partings, and (2) lode mines are relatively shallow and wide excavations in brecciated amygdaloid where the copper is irregularly scattered through the bedrock. Other types may be present, but the geology suggests that they would be infrequent, and none but lode and fissure mines was noted by the survey.

Prehistoric copper mines are definitely known at only seven sites on Isle Royale, but it is probable that other sites exist. There are no reliable reports of any prehistoric mines on the west end of the island. The fissure mines occur in small groups at four sites near the eastern end of the island, and lode mines occur at one or two localities. By far the largest group of mines on Isle Royale is the Minong site near the head of McCargo Cove where there are over 1000 depressions irregularly scattered over an area 1.6 miles long and 400 feet wide. The depressions at the Minong site may not accurately reflect the subsurface conditions of the very irregular lode mines, and we do not have an adequate basis for estimation of how closely the number of pits reflects the extent of mining. Over 25 fissure mines also occur at this site. The second largest concentration of mines, the Dustin site, is reported to have at least 27 mines of unknown type. Assuming a general correlation between the depressions and the number of mines at the Minong site, we can make a liberal estimate that there were 1500 to 2000 lode mines on Isle Royale before some were destroyed by the historic Minong mine, and that there were about 100 fissure mines on the island.

The largest fissure mine known on Isle Royale is Pit 25 at the Minong site (Drier, 1961b). The top of the mine was about four feet wide and it narrowed to less than one and

one half feet at the maximum depth of 16 feet reached by the survey. On the basis of excavations of other fissure mines, Pit 25 is probably less than 20 feet deep. Neither end of the mine was exposed, but it appears to be more than 20 feet in length. Surface observations suggest that Pit 25 may be larger than most of the fissure mines on the island, which range in size down to barely discernible prospects. For convenience, we may consider a typical fissure mine on Isle Royale to be ten feet long and four feet wide at the surface, and ten feet deep. The volume of this ideal fissure mine would be about 200 cubic feet.

The largest lode mine on Isle Royale of which there is adequate record is Pit 54, also at the Minong site, and described in Chapter V. The surface indication of the mine was a rounded depression about 16 feet across and two feet deep, which is typical of the pits at this site. One half of the depression, including an area extending for about 20 feet from its center, was excavated. The limits of the mine were found only on two opposite sides of the survey's large trench, suggesting that the lode mines were irregular, wide trenches possibly paralleling the strike of the formation. The mine is 15 feet wide, and has a maximum depth of 7 feet, or 12 feet, if the tailings lying above it are included. A depth of 12 feet may be average, although a lode mine explored by historic miners, in which they discovered a large mass of copper, is reported to be 16.5 feet deep (Davis, 1875). On the basis of these data, we may suggest that the volume of all of the debris in and over an average lode mine may be about 2000 cubic feet. The volume of the mine itself, or at least that portion of it under and near the surface depression, may be about 1500 cubic feet. On the basis of the above estimates of the number and average size of the mines on Isle Royale, it is suggested that about 2.25 to 3 million cubic feet of rock were mined.

The amount of copper removed from the mines is very difficult to estimate, but a rough idea can perhaps be made by comparison with the large open workings at the historic Minong mine which presumably produced most of the 250 tons of copper reported by this company (Butler and Burbank, 1929: 90). The historic mines are much larger than the prehistoric mines, but since there are so few of the historic mines, a comparison of their size with those of the prehistoric mines is deceptive. As a rough estimate, there are about ten large open-cuts averaging about 30 feet wide, 225 feet long, and 25 feet deep, and several smaller ones at the historic Minong mine, which together may total around two million cubic feet. This would suggest that the Indians may have mined 280 to 375 tons of copper on Isle Royale, assuming that the copper concentration was the uniform in all of the deposits mined. Another approach to calculating the amount of copper mined by

the Indians could be used if we knew the concentration of copper in the mines. At the historic Minong mine the part of the rock sorted out to be sent to the stamp mill (the ore) contained only one per cent copper (Lane, 1898: 18-19), so that the amount of copper present in the total rock actually removed was much less than one per cent. Since our excavations suggest that the Indians moved a great deal of unproductive rock, it seems reasonable to assume that the production from their mines was also less than one per cent copper.

The major technique in working the mines was probably by battering with hammerstones. Considering the number of hammerstones found in the mines excavated by the survey, it is estimated that there are about 150,000 to 200,000 hammerstones on Isle Royale. The amygdaloid of the lode mines seems to be more easily fractured than the trap enclosing the fissure mines, and this appears to be reflected in the number of hammerstones recovered from the mines. Since the lode mines are in close proximity to each other, and there seem to be large areas completely covered with their tailings, one would expect that the number of hammerstones scattered through the fill might approximate the number rejected or lost in the course of mining the amount of bedrock represented by the tailings in which they were found. The fissure mines are more widely separated, and the hammerstones found in them probably represent only those which were left near the mine and which happened to fall into the mine after it was abandoned. The implications are that there is a greater chance of collecting a more nearly complete sample of hammerstones from the lode mines than from the fissure mines, and that if the lode and fissure mines were equally easy to work, we would expect to collect more hammerstones per unit of rock removed in the lode mines than in the fissure mines. The survey's data suggest, however, that the situation is reversed. In lode mines there is approximately one hammerstone for every 10 to 15 cubic feet of area mined, and in fissure mines there is approximately one hammerstone per five to eight cubic feet of area mined. While the absolute number of hammerstones found in a prehistoric mine may not be indicative of the number actually used in that particular mine, it seems reasonable to suggest that the relative number of hammerstones in lode and fissure mines may be a reflection of the greater resistance to fracture of the trap rock enclosing the fissure mines. There was probably some variation in fracturability among the mines of each type, as well as in different areas of the same mine.

In addition to the high resistance of the trap, the fissure mines are so small that working in them would not be convenient. The greater convenience and ease of working the much larger, open lode mines might offset the uncertainty of working over a large area of amygdaloid in search of scattered pieces of copper.

The failure to find any of the crude scrapers or choppers, like those from Pit 56, in the lode mines may have been due to the survey's excavation technique, but it is also possible that they were needed only, or at least mainly, in the particular circumstances of working the fissure mines. The objects resembling, and which may actually be, canoe paddles would have been useful in clearing overburden and mine debris. Copper chisels and knives may have been used as wedges or to cut roots. Various pursuits not directly related to mining, such as hunting and hide dressing, may have been conducted near the mines as opportunities arose. These activities could account for some of the artifacts found in and near the mines.

In an experiment conducted by the survey, about 25 cubic feet of amygdaloid rock at the Minong site were removed in 30 hours using two one-handed hammerstones. A two-handed hammerstone was also tried, but it did not seem practical to the experimenters. This does not necessarily mean, however, that the one- and two-handed classification proposed in Chapter VI is incorrect. A flat-bladed birch shovel or scoop was made, rather unlike the paddle-shaped implements reported from the mines, and it was useful in removing loose sandy overburden. A large, flat tailing was found to be more efficient in pulling fresh tailings away from the working area. The Indians probably disposed of most of the tailings in lode mines by merely flinging them out as they broke them off, although some finer material may have been carried out in bark baskets or skin bags. In deep fissure mines, where the rock was more resistant to fracturing, the only practical method of removing the presumably fine debris was probably with bags or baskets. The mining would have proceeded so slowly, and the mines are so small, that the mining of a fissure mine is clearly a one-man operation.

Some sort of container would have been needed in some of the fissure mines, and perhaps in some lode mines, to bail water after rains. Rather than trying to bail out a mine after a rain, the Indians probably waited for it to dry out--if it would. However, even after very hard rains, the lode mines which the survey excavated did not collect water except in a few small, shallow pockets, presumably because the bedrock is so fractured. On the other hand, the fissure mines are enclosed in relatively impervious trap rock, and rain water seeps into them along the fissures, filling them rapidly, so that it may have been impractical to work deep fissure mines except during dry periods. The survey found no evidence of any drains such as are frequently mentioned in the older literature.

The survey did not observe any clear indications that fire was used to fracture the rock. The scarcity of charcoal,

and the total absence of ash in the lode mines which were excavated by the survey, is especially significant. Since all of the fissure mines which have been excavated appear to have been filled by natural agencies, any debris found in them, with the possible exception of something lying directly on the bottom, would post-date the mine. The charcoal and wood found in fissure mines may be attributed to debris from forest fires and dead trees which had fallen into the mines after they were abandoned.

Apparently, no one has ever doubted that fire was used to help break up the bedrock in at least some of the mines on Isle Royale. The persistence of this idea may be attributed to a misunderstanding of the nature of the fill in the fissure mines, and to the prevalent ideas about methods of aboriginal mining in North America. In a general discussion of aboriginal mining and quarrying in North America, Holmes (1919: 156) generalizes that: "It is assumed that fire was employed in breaking up the larger and more intractable bodies of rock, when not required in bulk, but the extent of its application in the mining work can only be conjectured." The only evidence mentioned by Holmes to support his conjecture is the presence of blackened patches on protected overhangs in novaculite quarries near Hot Springs, Arkansas (p. 198). Such phenomena are well known on rock overhangs, and they can usually be attributed to mineral stains from weathering and trickling water. In his study of prehistoric gem mining in the Americas, Ball (1941: 12) generalizes that: "Knowledge of breaking rock by building a fire against it and then throwing water upon it appears to have been widely spread." Heizer and Treganza (1944: 302-3) give an extended summary of prehistoric mines and quarries in California, but they could find only one statement on the use of fire. Nevertheless, they observe: "Probably other California tribes used the fire-breaking technique since it is a widely known method among North American Indians." In her summary of turquoise mining in the Southwest, Bartlett (1935: 42) states: "Much evidence of this fire process is to be seen at the Cerrillos mines and elsewhere. The use of fire must have caused the loss of a great deal of fine turquoise which turns white with heat, but was the only possible means of extracting it." At the prehistoric turquoise mines in the Burro Mountains, New Mexico, "the presence of charcoal indicates the use of fire in breaking the rock, followed by hammer work," according to Ball (1941: 25).

Fowke (1902: 622-3) gives a detailed explanation of the working of flint mines at Flint Ridge, Ohio, with the fire-and-water technique, but the only evidence mentioned is that both the flint and the limestone appeared to have been subjected to intense heat, the flint being solid and translucent where not burnt, and a light blue color in the burned areas. W. C. Mills experimentally tried the technique described by Fowke:

> The fire was kindled, and was kept burning for two hours, producing an intense heat on the underlying surface of the flint. The fire was then removed and two buckets of cold water were thrown upon the surface. I fully expected the flint to break in large pieces, but it merely checked and cracked into small pieces to the depth of perhaps half an inch. After the conclusion of this experiment it was apparent that fire as a direct agent in quarrying of flint was perhaps not effective (Mills, quoted by Ellis, 1940: 57).

The survey conducted a similar experiment on the Minong amygdaloid, and it had no noticeable effect on the rock. In discussing use of fire in quarrying at Flint Ridge, Ellis (1940: 57-8) asserts:

> Of all the pits opened in this locality, not one shows any evidence of fire having been used in quarrying. On the other hand, in virtually all of the pits excavated, hammerstones and mauls of various sizes were found, indicating that at this site direct percussion played the largest part in preliminary breakage.

It is evident that all of the data relevant to the use of the fire-and-water technique by the American Indians need to be critically re-examined.

The age of the copper mines on Isle Royale is directly known only from a series of radiocarbon dates on Pit 25, a fissure mine at the Minong site (Table 3), although dates on several mines which were excavated by the survey are forthcoming. The discrepancy between the two samples from the lower levels of Pit 25 is puzzling, especially since they apply to the same specimen, according to Drier (1961b: 6). The application of a test recommended by A. C. Spaulding (1958: 309) indicates that there is about a 35 per cent probability of this amount of error arising through chance alone, so that the apparent discrepancy may be due to the limitations of the dating technique. These two older dates can conveniently be considered to average about 1500 B.C.

Since the Pit 25 mine is over three feet deeper than the lowest dated sample, it seems reasonable to suggest that it took a few hundred years for the mine to fill to the 13-foot level. The radiocarbon dates and their positions in the mine suggest that the rate of accumulation of the fill has markedly decreased through time, so that the true age of the mine may not long pre-date 1500 B.C., assuming that it began to fill shortly after it was dug. A maximum date of 2000 B.C. for this mine seems reasonable. This would place the mine just after the Nipissing lake stage, and near the end of the Xerothermic. The mine is about 140 feet above the Nipissing stage beach.

TABLE 3

RADIOCARBON DATES ON WOOD CHARCOAL COLLECTED BY R. W. DRIER FROM A FISSURE MINE (PIT 25) AT THE MINONG SITE

Depth From Surface in Feet	DATE B.C.	Laboratory Age In Years Ago, Number, And Publication
0		
6 (maximum depth reached by Drier in 1953)	1047+-350	3000+-350; M-320; Crane, 1956: 668-9
11-12	1844+-500	3800+-500; M-371e; Crane, 1956: 668-9
13	1354+-200	3310+-200; W-291; Rubin and Suess, 1956: 447
14 (maximum depth reached by Drier in 1954)		
16 (maximum depth reached by the survey in 1960)		
? (bottom of mine)		

It is conceivable that the dryness of the Xerothermic exposed more copper bearing bedrock than is now visible, but the effects of the Xerothermic on the Minong ridge can only be conjectured. The hardwood forests, which seem to achieve a denser cover on the ridges than do the coniferous forests, were probably more extensive in the past on Isle Royale (Linn, 1957), but they are not specifically known to have covered the Minong ridge. In their absence, the increased dryness of Xerothermic times may have caused the ridge to be more exposed than it is today; and thus copper outcrops would have been more apparent. There is insufficient evidence to suggest, however, that the present conditions on the Minong ridge were greatly modified during Xerothermic.

Viewed from the broader perspective of Great Lakes prehistory, the earliest mines on Isle Royale could be as old as the beginning of the extensive use of copper. The time of this event is a subject of much debate (Mason and Mason, 1961; Quimby, 1962), but a compromise date of 3000 B.C. will be adequate for this paper.

The lowest prehistoric mine located by the survey was 15 feet above the present lake level, post-dating the Algoma stage of 1200 B.C. Since extensive use of copper lasted at least until the end of Middle Woodland times (ca. A.D. 500), and since Middle Woodland occupation sites on Isle Royale are associated with the modern shores, some prehistoric mines should occur along the present shores if mining was being done on Isle Royale in Middle Woodland times. It will be difficult to collect organic material for radiocarbon dating from mines which may be discovered at the present shore line, unless one is found in a very protected bay where the mine has been filled with forest debris rather than being washed clean or filled with cobbles by the lake.

Many of the mines along the shore can be identified as historic through the geological reports of Foster and Whitney (1850) and Jackson (1849), or by the presence of drill holes in the bedrock. The historic mines tend to be rather regular, sloping trenches a few feet wide, and are generally situated on fissures. On Third Island, near the east end of Isle Royale, there is a series of mined fissures for which there are no known historic records. However, since detailed historic records are available only for 1847, the anonymity of the mines is not very significant. Some of the mines may be historic, but near the east end of the island is a fissure which was extensively mined by a very narrow, irregular, and crude excavation. While the mine has a very irregular, primitive form, it could not be definitely ascertained if it was historic or prehistoric. It is unlike the prehistoric fissure mines which have been excavated because it is long and continuous, but this may be because of the

productiveness of the vein and/or because of its accessible situation for ease in mining. At any rate, this is the only good candidate for a prehistoric mine which the survey found along the present shores. There are a number of assertions in the literature that all of the productive historic mines on Isle Royale, most of which are along the present shore, are on prehistoric workings (for example, Dustin, 1957: 11), but the only specific observation on this matter, referred to in Chapter III, is of uncertain validity.

There is no sound basis for inferring a chronological sequence of the two kinds of mines which occur on Isle Royale. The copper deposits exposed along the shore were probably the first ones discovered because they are relatively obvious, and pieces of copper would occur in the water near them. Since very few lode deposits are known near the modern and Nipissing beaches, the inland lode deposits may have been discovered after the fissures had been mined along the coast. The historic miners did not discover the Minong site until over 20 years after they began mining on Isle Royale.

The presence of hundreds of worked copper specimens (mostly fragments), at all of the major occupation sites conclusively demonstrates that copper was being worked by people of Middle Woodland and/or later cultures on Isle Royale. A few hammerstones of the type found in the mines occur in some of these sites, which also suggests that these may be the camps of the miners. On the other hand, all of the copper could have been acquired by collecting nuggets and detaching projecting pieces of copper exposed along the shores. The Middle Woodland occupants may have supplied copper, at least indirectly, to the Hopewell centers south of the Great Lakes. No Hopewell artifacts have been found on Isle Royale, so that if the Hopewell groups did acquire copper from the island, it was probably through the cultures indigenous to the Lake Superior basin. Quimby (1952: 101) has suggested that an obsidian point found on Siskiwit Lake by the McDonald-Massee expedition (West, 1929: 30, 36-7, Pl. 18, 1) indicates trade from other areas in Middle Woodland times, but occasional pieces of obsidian could have been collected from exposures of glacial drift (Poindexter, Martin, and Bergquist, 1951: 79).

There is strong evidence that the large amount of native copper used by the Middle Woodland Hopewell south of the Great Lakes was ultimately derived from the mines on Lake Superior, since no other major sources of native copper are known in eastern North America. A number of attempts have been made to identify the sources of copper artifacts by their chemical content, but these have not been successful (Bastian, 1961; Drier, 1961a; Olsen, 1962). The use of copper continued into historic times, but it diminished considerably after the Middle Woodland period, except in southeastern United States.

There is no evidence that any Lake Superior copper ever reached Mexico or the American Southwest.

The broad pattern of the use of copper in North America is a generally continuous one from about 4000 B.C. to the historic period, with the main centers of copper consumption moving southward. It seems reasonable to suppose that the mines of the Lake Superior region supplied most of this copper.

Using a conservative estimate of 2000 years for the time during which the mines were most actively worked on Isle Royale, the estimated 150,000 to 200,000 hammerstones accumulated at the average rate of only 75 to 100 a year in order to mine 1100 to 1500 cubic feet of rock. The 1500 to 2000 mines were dug at the average rate of about one a year, but there were probably many mines in various stages of excavation at any one time. If the survey's record of mining 25 cubic feet in 30 hours is approximately reliable, then an average of 1300 to 1800 hours per year were required. This could be accomplished by the annual contribution of 25 to 35 hours by each of 50 Indians. In an average year, each of these Indians might use one or two hammerstones and collect five to eight pounds of copper. These calculations are based on liberal estimates of the number and size of the mines on Isle Royale, and a conservative estimate of the length of time involved, so that the amount of labor and copper attributed to each Indian is thought to be a maximum average. Undoubtedly, the amount of copper mined varied from year to year, and we may assume that there were broad trends in the amount mined which correspond to the variation in the amount of copper known for various archeological time periods in eastern United States. The result of the calculations show that an adequate perspective of time, and an appreciation of the cumulative result of small contributions, obviates the necessity of any explanation involving intensive, highly organized prehistoric mining operations in prehistoric times on Isle Royale.

The archeology of the prehistoric copper mines on Isle Royale may also provide some better understanding of aboriginal mining and quarrying elsewhere in North America. A few prehistoric copper mines may be present in Minnesota (W. P. Spaulding, 1897a, 1897b; Eldon Johnson, personal communication, 1962), several are reported on the northeast shore of Lake Superior (Griffin and Quimby, 1961), and they are numerous on the south shore (Whittlesey, 1863). Several early mining men have observed that the mines on Isle Royale are more extensive than those on the mainland (Davis, 1875: 370; Houghton, 1879: 142). Contrary opinions are not known, nor are there any descriptions which suggest that there are any sites comparable in extent to the Minong site. None of the mines on the mainland is known to have been excavated since the early mining

days, but my observations near Ontonogan suggest that some are still available for scientific study.

Perhaps the most extensive evidence of prehistoric mining or quarrying in North America is found at Flint Ridge in central Ohio. Maps and descriptions show that flint was quarried from pits up to 25 feet in depth over an area several miles in extent and covering hundreds of acres (Holmes, 1919: 173-89; Fowke, 1902: 619-24). Other extensive mines and quarries occur in Illinois, Arkansas, and Wyoming. The Magnet Cove novaculite quarries near Hot Springs, Arkansas, have been estimated to comprise 2.7 million cubic feet (Holmes, 1919: 200) which is similar to the estimate for Isle Royale copper mines. The turquoise mines in the Cerrillos District of New Mexico have been said to be the largest and most extensive mines in America (Bartlett, 1935: 41; Pogue, 1915:52), but a critical examination of the literature on this subject is beyond the scope of the present paper.

The flint mines and quarries were probably less difficult to work than the copper mines on Isle Royale because of the nature of the deposits and enclosing bedrock. This is also supported by my impressions from the literature that hammerstones are much less common in the flint mines than they are in the copper mines on Isle Royale.

CHAPTER X

CONCLUSIONS

A brief speculative reconstruction of prehistoric copper mining on Isle Royale is attempted in this chapter. For ease in reading, most qualifying phrases are omitted, although many of the statements are subject to alternative interpretations.

Isle Royale may have been first visited by men in search of game and adventure as early as 7000 B.C., but they did not begin to exploit the copper deposits until about 3000 B.C. These Indians of Archaic culture lived on Isle Royale in as yet undiscovered, small, scattered camps. Most of their activities centered around the food quest, but they would occasionally spend a few hours working a little copper out of the bedrock. The motivation for collecting the copper is not known, but it may have been involved with sociological factors rather than with practical considerations (Binford, 1962: 220-4).

The Indians did not deliberately prospect for copper, but in the course of their travels about the island, they would watch for nuggets and veins of this unusual material which they may have regarded as some special kind of rock. The mines were dug with cobbles and boulders collected on Isle Royale or picked up from the mainland shores from which the Indians embarked in their canoes. Three or four hammerstones would be an ample supply for a family spending several weeks on Isle Royale during the summer. Flakes broken off hammerstones, perhaps copper knives, and sticks or broken paddles would have been useful in removing sod or loose dirt covering part of the copper-bearing bedrock. The bedrock was broken by repeated blows from hammerstones which were usually held in the bare hands, but sometimes they were hafted. Several pounds of copper would be collected by each miner in the course of a summer.

The Indians of Archaic culture who mined for copper may have been local residents of the Lake Superior region, or they may have come to Lake Superior during the summer from central Wisconsin where the most copper artifacts have been found. Some copper reached as far as New England, probably through channels of kin reciprocity or trade. At any rate, the mining was pursued in the course of an annual round of hunting deer, moose or caribou, and rabbits, fishing, and collecting berries and plants. There is no basis for suggesting any highly organized efforts to procure the copper. References to the mines may have been included in their

religion, mythology, or traditions, and some special features of their social organization may have facilitated the transfer of copper from the Lake Superior region.

By Middle Woodland times (200 B.C. to A.D. 500), the main centers of copper consumption had shifted south of the Great Lakes. The remains in camp sites on Isle Royale from this period include the pottery, chipped stone, and copper artifacts characteristic of the indigenous cultures of the Lake Superior basin, which suggests that the mining was conducted by local residents. The cultural demands for copper markedly decreased in Late Woodland times, and by the time that the Euro-Americans arrived on Lake Superior, it is possible that the Indians had lost all tradition of the mines, although they continued to collect copper nuggets and to shape them into small knives, awls, and ornaments such as beads. Considered from an overall viewpoint, the cultures present in the Lake Superior basin and on Isle Royale in A.D. 1600 were probably not markedly different from any other culture which had been present in the area for over 4000 years.

In conclusion, the prehistoric copper mines of the Lake Superior region, of which the Isle Royale mines are assumed to be representative, provide an apparently unique archeological record of the procuring of native copper by a relatively early and primitive technology. The reason for this uniqueness lies not in the special cultural characteristics of the miners, but in the availability of large amounts of native copper exposed in bedrock and as float copper. It is reasonable to suppose that the presumed long distance relationships indicated by imported materials found in Middle Woodland and Mississippian sites in central and southern United States may have been one of the factors contributing to the development of cultures indigenous to eastern North America. Copper from Isle Royale may have played some part in this. The extent and nature of the mines on Isle Royale indicate that a great deal of labor was expended in order to procure a relatively small amount of copper, but when viewed in the perspective of the 4-5000 year period in which copper was used in North America, the extensive mining of copper on Isle Royale is seen not as a great cultural achievement, but only as the cumulative effect of a minor activity carried out over a long period of time.

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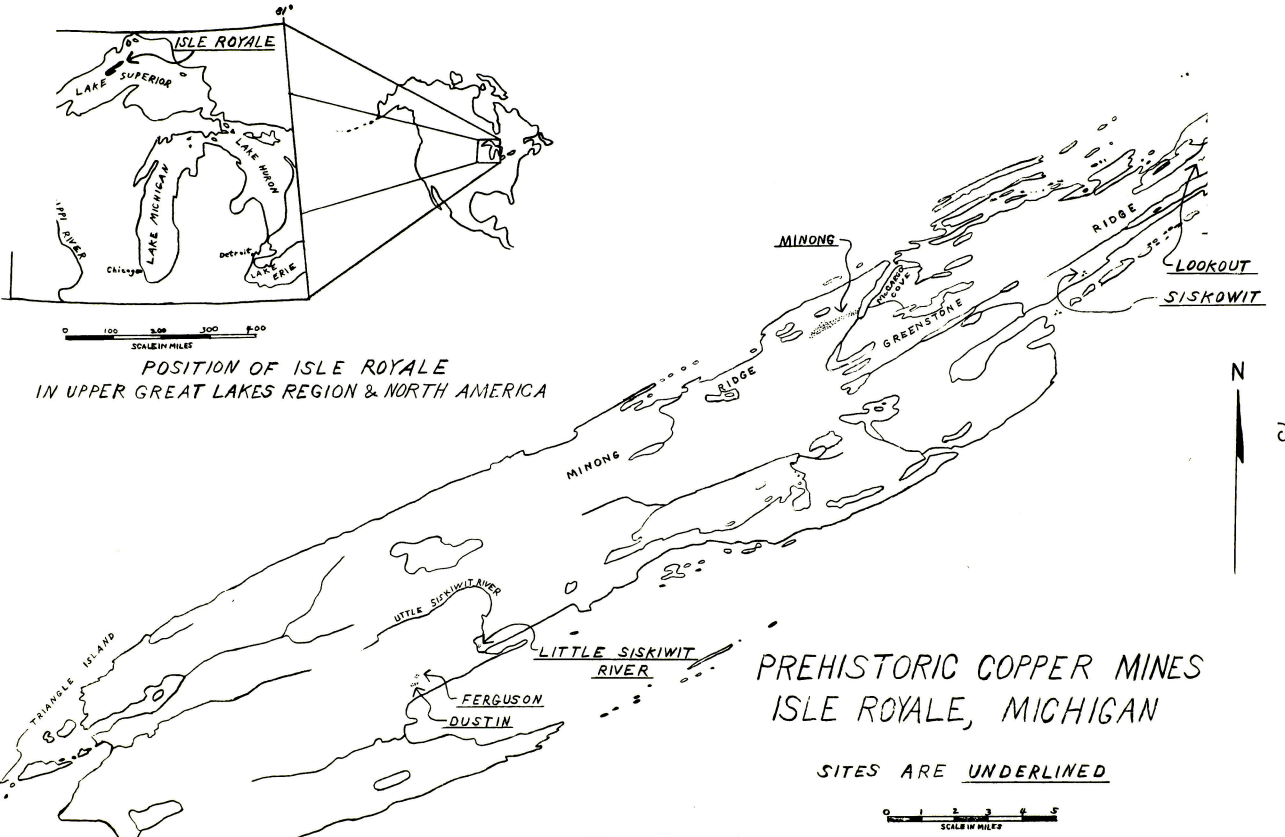

ISLE ROYALE
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
Chicago
Detroit
MISS. RIVER
SCALE IN MILES
POSITION OF ISLE ROYALE
IN UPPER GREAT LAKES REGION & NORTH AMERICA
MINONG
RIDGE
RICHARD'S QUARRY
GREENSTONE
LOOKOUT
SISKOWIT
N
MINONG
RIDGE
LITTLE SISKIWIT RIVER
TRIANGLE ISLAND
LITTLE SISKIWIT RIVER
FERGUSON
DUSTIN
PREHISTORIC COPPER MINES
ISLE ROYALE, MICHIGAN
SITES ARE UNDERLINED
SCALE IN MILES

Figure 1.

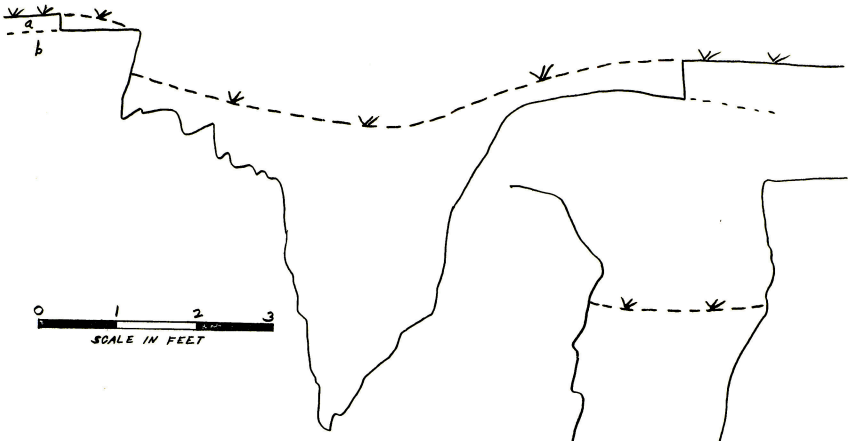


Figure 2. Cross section of a fissure mine (Pit 56) at the Lookout side. Profile in approximately the same plain is shown in Plate 1a. a. sod, b. Greenstone trap bedrock.

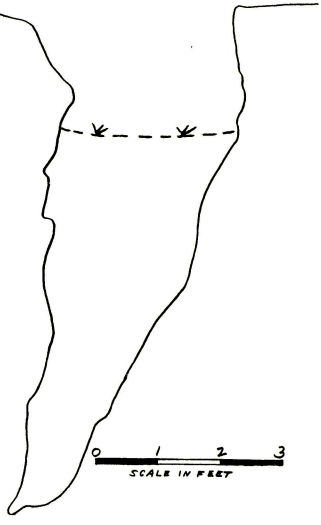


Figure 3. Cross section of a fissure mine (Pit 4) at the Lookout site.

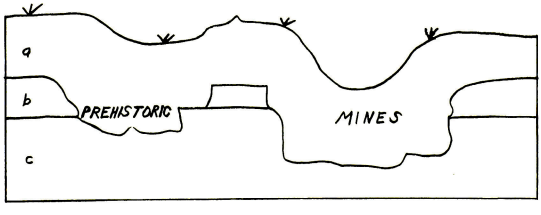


Figure 4. Cross section of lode mines at the Minong site (modified from Winchell, 1881: Fig. 7). a. tailings, b. glacial or lake deposit of clay and silt, c. Minong amygdaloid bedrock. No scale given, but one inch probably equals about ten feet.

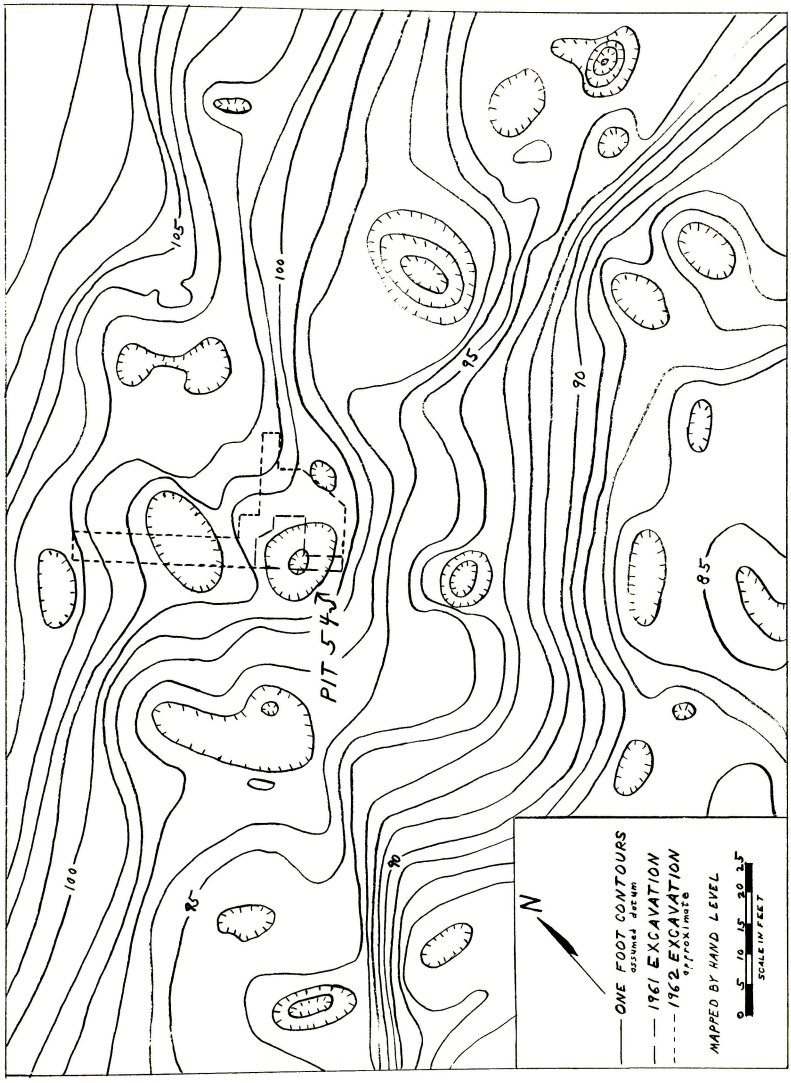


Figure 5. Surface Features of Lode Mines in Locality of Pit 54, Minong Site.

PLATE 1.

EXCAVATED FISSURE AND LODE MINES

Pit 56 fissure mine at the Lookout site:

a. Profile near central section in approximately the same plain as the cross section in Figure 2. Note the angular rocks in the peaty fill, fragment of a hammerstone in the profile, and the smooth walls near the bottom of the mine.

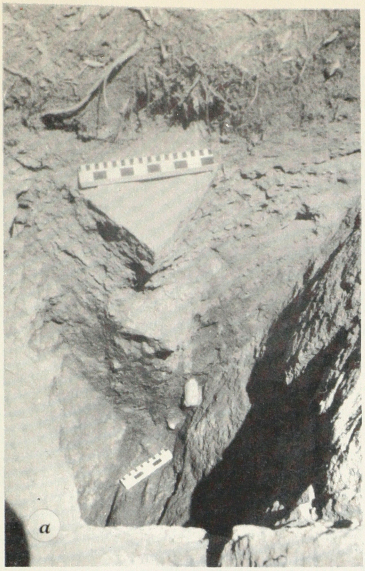
b. General area of the mine after completion of excavation. Shallowly explored fissures at the right. Circle at right edge marks position of the large piece of exposed copper.

c. Nearly vertical view into the mine. The copper-bearing calcite vein at the bottom, and the smooth, although irregular, walls are visible.

Pit 54 lode mine at the Minong site:

d. Part of the 1961 excavation. Note roughness and fragmentation of the bedrock, and the coarse fill of tailings. Bottom of the mine is not exposed.

Scales in centimeters and tenths of feet.



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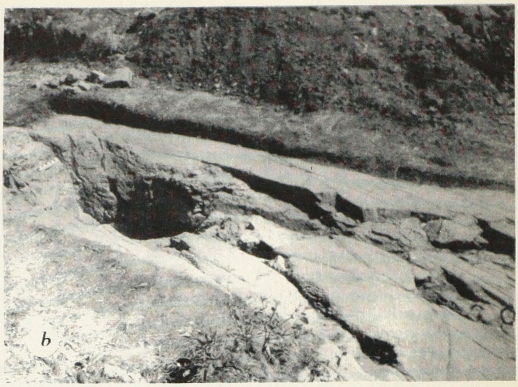

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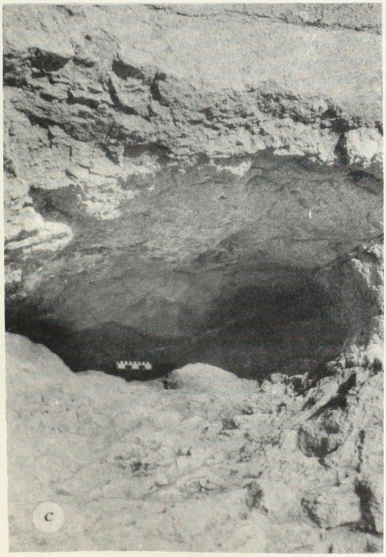

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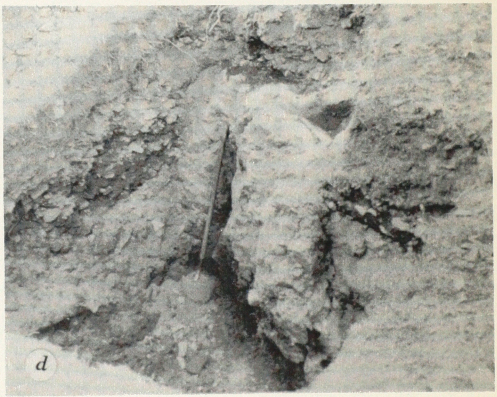

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PLATE 2.

SELECTED ARTIFACTS FROM ISLE ROYALE

Possible Archaic artifacts from various sites:

a. Slate point from Starr Island. Surface find by Kenneth Johnson. (Isle Royale National Park museum no. 163)

b. Projectile point of banded flint from the Point Houghton burial site. (Museum of Anthropology no. 62111)

c. Possible projectile point base from the Chippewa Harbor I site. (Museum of Anthropology no. 39595)

d. Pecked discoidal from the Indian Point site. (Museum of Anthropology, no. 5333)

e. Grooved and battered adz from the Merritt Lane site. (Museum of Anthropology no. 62600)

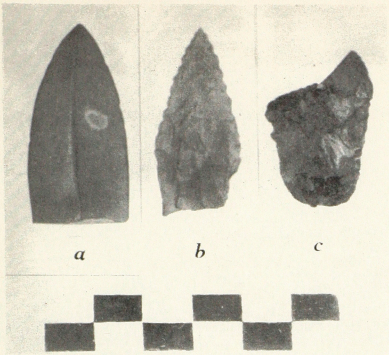
Artifacts from Pit 56 fissure mine at the Lookout site:

f. Disk-shaped scraper or chopper (Museum of Anthropology no. 62483)

g. Scraper, chopper, or unusual hammerstone (Museum of Anthropology no. 62478)

h-j. Scrapers or choppers (Museum of Anthropology nos. 62479, 62496, 62499)

Scales in centimeters.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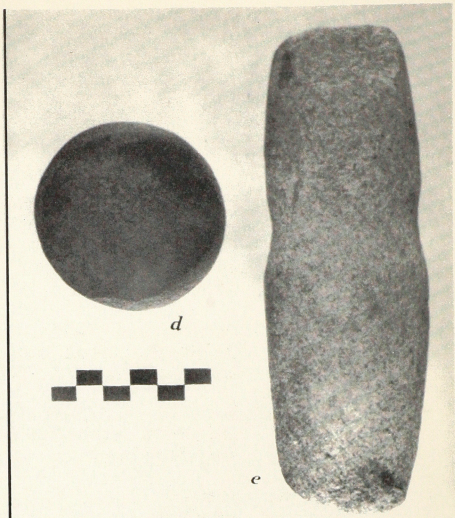
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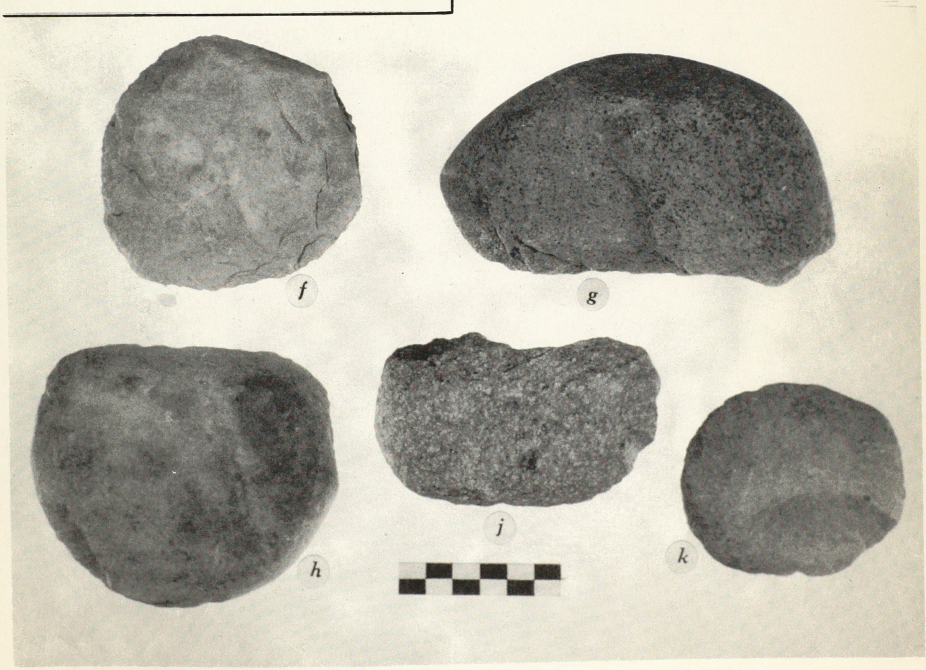
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g
h
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