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Book 9
Mineral Extraction Data

Seafarer Site Survey
Upper Michigan Region

for
U.S. Navy
Naval Electronic Systems Command
Washington, D.C.

by
EDAW Inc.
under contract to
GTE Sylvania
Communication Systems Division

UNCLASSIFIED

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Iron ore mining is the major industry in the Study Area. Numerous occurrences of other metallic minerals are documented, but no mine is currently producing ore from any of these deposits. Six mines are currently producing iron with a total current capacity of 17 million long tons of pellets and ore. Most of the iron production for the next 25 years will be from the Marquette Basin.

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BOOK 9

MINERAL EXTRACTION DATA of the UPPER MICHIGAN REGION PROJECT SEAFARER

for
U. S. Navy. Naval Electronic Systems Command

by
EDAW, Inc., 50 Green Street, San Francisco 94111

Under Contract to
GTE Sylvania, Communication Systems Division

April, 1976

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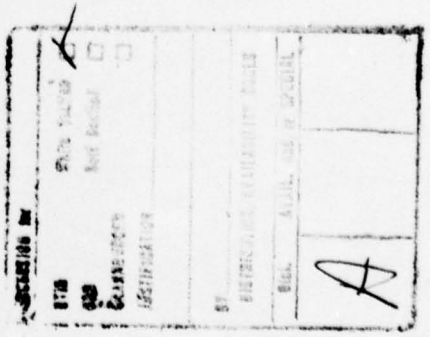

SUMMARY

Iron ore mining and beneficiation is the major industry in the Study Area. Six of the seven major iron producing districts of Michigan having historic or current production are located within the defined area. Numerous occurrences of other metallic minerals, including gold, silver, lead, copper, zinc, and uranium, have been documented, but no mine is currently producing ore from any of these deposits. Many of these deposits have unproved reserves; however, the larger ones may constitute resources that may be economically extractable in the next several decades. A small, but stable industry, involving the production of industrial minerals from numerous pits and quarries, rounds out the mineral-based industry of the region.

Cumulative production of iron ore from the more than 200 historic iron mines in the region exceeds 750,000,000 tons. Six mines currently are producing iron ore in the Study Area, and construction and development work is scheduled to begin on a seventh iron mine in April 1976. Total production from the district's mines in 1974 amounted to 11,500,000 long tons (2,200 pounds) of iron ore pellets and direct-shipping ore having a total value of $214,000,000. The current (1976) capacity of these iron mines is approximately 17,000,000 long tons of pellets and ore, and the anticipated capacity of existing and planned facilities for 1985 is about 30,000,000 long tons. Most of the iron production for the next 25 years will be from the Marquette Basin.

The Keweenaw Peninsula, a region having considerable historic copper production, lies to the north of the Study Area. Practically all of the copper mines in the peninsula are currently inactive.

Iron is mined from relatively thin, iron-rich beds within the Precambrian metasedimentary sequence. To the north of the Study Area, copper has been mined from the Portage Lake Lava Series. Geologic settings having a potential for future mineral production include 1) various greenstone belts as sources of precious metals and base metals; 2) the Michigamme Slate as a source of uranium; and 3) shale interbeds in the Kona Dolomite as sources of copper. Iron production will undoubtedly continue for several decades, and there is considerable potential for increased output from the mining of lower grade deposits and the reworking of old waste dumps as new beneficiation processes

are developed. Numerous deposits of sand and gravel as well as other nonmetallic minerals exist throughout the Study Area, but they generally have not been of major economic significance because of low demands.

The locations of all significant mining areas are shown on the Mineral Extraction Data Map. Also shown are areas having historic, anticipated, or potential significance for the production of metallic minerals. Identification of these areas is based on favorable bedrock types, known mineral occurrences, and proximity to existing or planned mines. Bedrock and surficial geologic conditions having a direct relationship to mineral deposits are shown on the Bedrock and Surficial Geologic Data Maps.

EVOLUTION

Processes and Time Leading to the Existing Conditions

Evolution of Mineral Deposits

Iron Formation: An iron formation is a sedimentary rock rich in iron and composed mainly of chemical precipitates. This type of rock is thought to have formed in basins of restricted circulation into which rivers that drained areas of intense chemical weathering and leaching discharged. The character of iron formation mineralogy is thought to be related to the oxidation-reduction potential of the ancient marine environment, perhaps being controlled by water depth, circulation, and distance from shorelines. During the course of formation of this rock type, iron was precipitated from solution in sea water as oxides (magnetite, hematite), carbonates (chiefly siderite), silicate (glauconite), or sulfide (pyrite minerals), in association with silica (chert), carbonates and fine grained clastic sediments. The sedimentary beds thus deposited subsequently were subjected to structural deformation by folding and faulting, and to metamorphic alterations by heat and pressure. The formations also were locally affected by solution leaching, which had the important consequence of removing silica and leaving the rock relatively enriched in iron oxide. The present distribution of iron formations are thus controlled by relationships between: original basins of deposition, structural deformation by folding and faulting; depth of erosion; subsequent metamorphism, and in particular the degree to which the formations have been relatively enriched through selective leaching of silica and carbonate.

Ore-grade concentrations of manganese occur locally within the iron formations. Identified manganese minerals are oxides and are interpreted as secondary deposits, postdating deposition of the iron formations. The manganese apparently was dissolved from primary host rocks, then transported and concentrated by selective precipitation from ground water.

Native Copper Deposits: The Northern Michigan native copper deposits of the Keweenaw Peninsula, to the north of the Study Area, are localized within favorable zones in the interlayered basaltic flows and conglomerates of the Keweenawan sequence. The evolution of these deposits depended on a succession of events, beginning with the deposition of host rocks having suitable internal fabric and permeability to transmit copper-bearing solutions. The solutions may have been derived either from magmatic sources, or from the

leaching of native metals under conditions of low pressure and temperature. Subsequent to the initial episode of mineralization, the deposits have undergone relatively little alteration, though the host rocks of the Portage Lake Lava Series have been mildly deformed by folding and faulting.

Between 1967 and 1973 the mines exploiting the northern Michigan copper deposits had been inactive. The reason for this inactivity was not the lack of ore reserves per se, but labor troubles combined with mining conditions that did not allow the northern peninsula mines to compete economically with foreign suppliers and the large copper porphyry open pit mines of the southwestern United States. However, Homestake Mining Company reopened one of the old calumet and Hecla underground properties, about 20 miles north of the Study Area, during 1973. Work since then has been confined to exploration and development, with no ore having been smelted or shipped.

Base-Metal and Precious Metal Deposits in Greenstone Belts and Related Metamorphic Rocks: Much of the metal production from the southern part of Ontario, Canada, has come from ore deposits related to three large geologic units having similar lithology and structure. These three units are called "greenstones," they are Archean in age, and they represent complete magmatic crystallization sequences ranging from ultramafic rocks through felsic rocks (Goodwin, 1971). The ore deposits are massive sulfide bodies, and most are associated with the late-crystallizing felsic rocks.

Four units of somewhat similar lithology occur in and around the Study Area (Figure 1). These units have been called "greenstone belts" by Bodwell (1972) who attempted to point out similarities between them and the three Canadian Shield greenstones. However, several major dissimilarities are obvious in the context of metallic mineralization. The more significant of these dissimilarities are as follows: 1) The Michigan "greenstones" are primarily basaltic lavas, and although some felsic rocks are present, they appear to be minor constituents in terms of the entire greenstone belt. However, major parts of the Michigan greenstone belts are covered by glacial drift that may conceal mineralized felsic rocks; 2) Most of the reported mineralization in the Michigan greenstones occurs in epigenetic quartz veins rather than as syngenetic magmatic differentiation deposits similar to those of the Canadian Shield.

Of the four greenstone belts, only one is Archean in age, the Marquette-Dead River belt. The Marquette-Dead River belt has been explored extensively, and it is reported to have numerous occurrences of base-metal sulfides and gold. Most of the gold produced in the Study Area came from three mines in the Marquette-Dead River belt. For the most part, mineralization occurs in quartz veins, although disseminated sulfides have been found within the host rock at some localities.

The three Huronian greenstone belts are the Badwater-Brule belt, the Hemlock belt, and the Quinnesec belt. Minor base-metal and precious metal mineralization has been reported for these rocks, but no production or significant amounts of exploratory work have been documented.

Placer Deposits: Minerals that are chemically stable at the earth's surface resist weathering. As surrounding, less stable rocks are dissolved and disintegrated, they either are carried away by surface water or remain and become part of a soil horizon. Lighter particles are moved more readily, while heavy minerals tend to become residual deposits. With the passage of time, movements of the particles result in a natural segregation by specific weight. This results in zones where heavy particles are concentrated. Such heavy minerals could occur as residual concentrations near bedrock outcrops. Also, heavy minerals may be washed into streams and accumulate in sand bars or other irregularities along channel bottoms where stream velocities are reduced. Concentrations of both types are called placer deposits.

Within the Study Area, one "placer gold deposit" has been reported in the Yellow Dog Plain of northern Marquette County. Here placer gold was said to have been concentrated in a large glacial outwash plain by a number of small streams that originated at the front of a melting glacier. However, extensive exploratory work conducted by two mining companies during 1974 and 1975 failed to show any economic concentrations of placer gold in the Yellow Dog Plain.

Uranium Mineralization in the Michigamme Slate: The existence of relatively high concentrations of uranium in the Middle-Precambrian Michigamme Slate has been reported by several investigators. The locations and relative concentrations of uranium in this unit formerly were thought to be solely related to this initial depositional environment. However, recent investigations of similar deposits elsewhere has provided evidence to indicate the possibility that uranium concentration may be related to post-lithification

deformation that occurred when the shales were metamorphosed to slates. This recent hypothesis has caused renewed interest in the Michigamme Slate as a host rock for economic uranium mineralization, and at least one organization was actively conducting an exploration program during 1975.

Copper Mineralization in the Kona Dolomite: The Kona Dolomite is a Middle-Precambrian metasedimentary unit consisting of thick beds of dolomite interbedded with thinner layers of shale that have undergone low grade metamorphism. Copper mineralization is present in several of the shale layers in concentrations that currently make them almost economically recoverable. The origin of this copper mineralization is a matter of debate. One school feels that the copper was deposited along with the fine-grained sediments of the shale, while the opposing school feels that the copper was emplaced by secondary enrichment subsequent to the lithification of the shales. Regardless of the origin of these deposits, they may become economically mineable by the end of this century.

Evolution of the Mining Industry

Iron ore was discovered in the Upper Peninsula in 1844, when a government survey party noticed erratic compass behavior. The cause of this disturbance was investigated by Michigan State geologists, and was reported to be "Spathose and magnetic ores abounding in the area." This discovery of iron-bearing rocks and an earlier discovery of extensive copper deposits on the Keweenaw Peninsula were probably the largest mineral finds in the Midwestern United States during the 19th century. Word of the iron deposits spread rapidly, and by 1846, more than 100 new iron mining companies had been formed. Since the beginning of production, approximately 750,000,000 tons of iron ore have been mined in this region.

Anticipated Future Conditions

Although iron is the only significant mineral resource currently being mined in the Study Area, there exists real potential for future production of large quantities of other mineral resources. Man's activities could have effects on future mineral extraction in the Study Area, and consequently the potential for future mining operations must be considered.

The production of iron ore most likely will continue to be the major industry in the Study Area for the remainder of

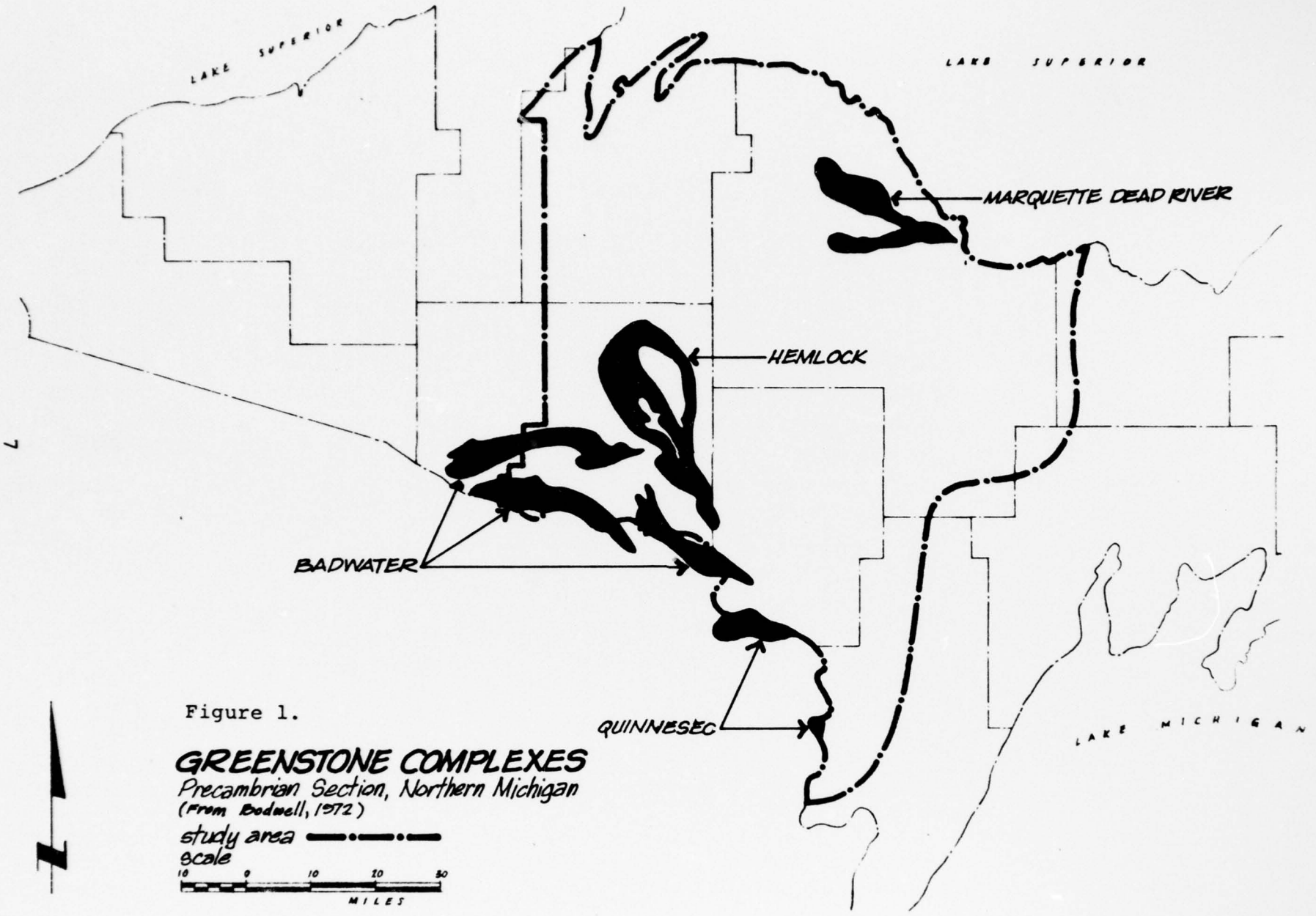
LAKE SUPERIOR
LAKE SUPERIOR
MARQUETTE DEAD RIVER
HEMLOCK
BADWATER
QUINNESEC
LAKE MICHIGAN
GREENSTONE COMPLEXES
Precambrian Section, Northern Michigan
(From Bodwell, 1972)
study area
scale
10 0 10 20 30
MILES

Figure 1.

this century. It is doubtful that any large bodies of direct-shipping ore remain undiscovered. However, by the year 2000, essentially all the iron ore produced in the United States will come from lower grade taconite deposits. The Lake Superior district (including iron deposits in Minnesota, Michigan, and Wisconsin) will be the principal domestic source of this ore.

Six mines currently are producing iron ore in the Study Area, and construction and development work is scheduled to begin on a seventh iron mine in April 1976. Two additional properties may be developed by the end of the century. The current (1976) capacity of the existing iron mines is approximately 17,000,000 long tons of pellets and ore, and the anticipated capacity of existing and planned facilities for 1985 is about 30,000,000 long tons. Most of the iron production in the Study Area during the next 25 years will be from the Marquette Basin.

There has been an increase in mining of lower grade ores that must be treated in metallurgical plants to produce a product that is richer in iron than the ore from the mine. In addition to this iron-rich concentrate (usually in the form of small, round pellets), the mills produce large amounts of finely ground waste rock, called tailings. The tailings are disposed of by transporting them as a slurry to a tailings dam, where the solids settle out and the liquid evaporates or is decanted off. As larger tonnages of lower grade ore are mined, correspondingly greater areas will be needed for the construction of tailings disposal areas. The total area required for these dams eventually will exceed several thousand acres, and the accumulated solids may reach a thickness of 100 feet or more above the original ground surface.

A problem related to iron mining is the subsidence of the ground surface in areas underlain by active and inactive underground mines. Although the trend today is away from underground mines and toward deeper open pits, many inactive underground mines do exist in the Study Area. The Institute of Mineral Research, in Houghton, is collecting data on subsidence, and their records, although not yet complete, indicate that most of the documented subsidence has occurred in and around the population centers of Iron River, Crystal Falls, Ishpeming, and Iron Mountain.

No copper is currently being mined in the Study Area, but documented areas of copper mineralization exist in the

Huronian Kona Dolomitic sedimentary rocks southeast of Marquette. These deposits may become economically mineable by the end of the century.

One of the most promising areas for future metallic mineral exploration is a greenstone belt extending over an area of 400 square miles north of Ishpeming and west of Marquette (Figure 1). All recorded gold production in the Upper Peninsula came from this belt, which contains about fifty reported occurrences of copper, lead, zinc, gold, and silver. This greenstone unit is somewhat similar to the host rock of several large metal-producing districts in Canada, specifically Manitouwadge, Noranda Kirkland Lake, and Timmins. Three other similar volcanic belts, varying from 4 to 225 square miles in area, exist within the Study Area (Figure 1).

Future production of uranium from the highly conductive, graphitic-pyritic Michigamme Slate also is a possibility to be seriously considered.

Conflicting information exists on the economic potential of the Yellow Dog Plain for placer gold deposits. The most recent, and probably the most thorough, data were collected during two independent exploration programs conducted in 1974 and 1975. Both of these investigations concur in concluding that the Yellow Dog Plain is essentially "out of the running" as a mineral resource for the foreseeable future.

Numerous sites for the potential production of nonmetallic minerals, including sand and gravel, building stone, crushed rock, limestone, and clay, exist within the Study Area. Because these sites are so numerous and there is not a large demand for these relatively low unit-value materials in the Study Area, these deposits probably are not of great economic value.

The metallic mineral deposits described above are of considerable importance because of the increasing scarcity of high grade metal deposits. Many of the world's richer deposits are already exhausted. Consequently, the development of both medium grade and extensive low grade deposits are important considerations in assuring a future supply of metals.

Additional exploratory work, directed at finding currently unrecognized metallic mineral deposits, undoubtedly will be conducted in the future. These programs will include both

conventional geologic methods, such as mapping and drilling, and geophysical methods. Most of the geophysical methods that have proven useful in the past involve the measurement of variations in induced electrical fields or in the earth's magnetic field. These methods include induced polarization and both airborne and terrestrial electro-magnetic surveys.

DISTINCTIVE UNITS AND CHARACTERISTICS

Introduction

This section of the report presents a brief discussion of the mineral deposits and the geologic setting in which they occur. The regional geologic conditions described in Geologic Setting of the Mineral Deposits are meant to provide background information useful in understanding the descriptions of individual mining districts. A more detailed description of the bedrock geology of the region appears in the Bedrock Geologic Data Report.

Mining Districts And Mineral Deposits consists of descriptions of individual mining districts that are currently in production or have been in production in the past. This section is divided into two general categories: 1) Metallic Mineral; and 2) Nonmetallic Minerals. Appendix A contains additional detail on specific mining districts and individual mines.

Most of the material presented in this section of the report deals with iron ore deposits, as they are the most numerous, have been the most important economically, and represent the major known economic reserves of the region.

Geologic Setting Of The Mineral Deposits

Most of the metallic mineral deposits of the Upper Peninsula occur in Precambrian rocks, specifically the Archean Series, the Huronian Series, and the Keweenawan Series. The Archean rocks are the oldest group, and they consist of altered lava flows intruded by granite.

The next younger rock series, the Huronian, is largely a thick section of sedimentary rocks that overlaps the Archean Series. These sedimentary units, mainly shales, sandstones, quartzites and dolomites, have been intruded by basic igneous rocks, also of Huronian age. Metamorphic rocks, mainly slates and marbles, occur elsewhere in the Huronian section. The Huronian sedimentary section also contains several iron-rich units known as "iron formations."

The youngest Precambrian rocks, the Keweenawan Series, are principally lava flows and conglomerates, with minor units of shale and sandstone. Keweenawan rocks are the host for Michigan's native copper deposits. Because they have been subjected to less tectonic activity and erosion than the Archean and Huronian rocks, their history has generally been easier to interpret.

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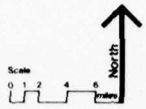

MINERAL EXTRACTION

- Areas Producing Metallic Minerals
- Dense Mine Areas (See Text)
- Areas Having Historic, Anticipated or Potential Significance for the Production of Metallic Minerals
- Iron Mines, Both Producing and Those with Past Production
- Clay Deposits Suitable for Brick or Tile
- Gravel and Sand Pits(P) and Rock Quarries (Q)
- Metallic Minerals (No Current Production)
  - Ag - Silver
  - Au - Gold
  - Be - Beryllium
  - Cu - Copper
  - Mn - Manganese
  - Mo - Molybdenum
  - Pb - Lead
  - Zn - Zinc

Shallow-dipping Paleozoic sedimentary rocks overlie the Precambrian sequence and crop out in the eastern part of the Study Area. Here Cambrian and Ordovician sedimentary formations dip gently in a southeasterly direction to form the northwesterly rim of the Michigan Basin. These rocks are mainly sandstones, dolomites, and limestones. A few isolated outcrops of Paleozoic rocks occur elsewhere within the Study Area.

Throughout most of the Study Area, the bedrock sequence is mantled by Quaternary glacial deposits. Both the Paleozoic rocks and the glacial deposits are of less importance than the Precambrian rocks in the context of past and future mineral production.

Mining Districts and Mineral Deposits

Metallic Minerals

Iron: Four distinct stratigraphic units of iron-rich rock have been identified in the Huronian section. Three of these "iron formations" have been the sources of most of the iron ore mined in the Upper Peninsula. The most productive unit has been the Negaunee Iron Formation, a unit also known as the Vulcan Iron Formation and the Ironwood Iron Formation in other parts of the region. The Riverton Iron Formation has been the second largest producer, while significant amounts of ore also have been mined from the Bijiki Iron Formation. The iron formations and associated rocks are complexly folded, and large volumes of these units clearly have been removed by erosion. Consequently, the original areal extents and the stratigraphic relationships among the iron ore formations are matters of speculation. Six of the seven major iron-producing districts, or "iron ranges," of Michigan are within the Study Area. These six iron ranges; 1) Marquette, 2) Gwinn, 3) East Menominee, 4) Felch, 5) Iron River-Crystal Falls, and 6) Amasa Oval, are shown on Figure 2.

Important features of each of these six major iron ranges are summarized in Table 1 and shown in Figure 2. Each district is briefly described in the following text.

- Marquette Iron Range - The Marquette Iron Range is a tightly folded basin of iron-bearing units and associated rocks approximately 33 miles long and 3 to 6 miles wide. The major axis of this basin trends almost east-west and dips gently to the west. A segment of the basin, separated from the main part of the range by faulting, is located near Palmer, and is called the

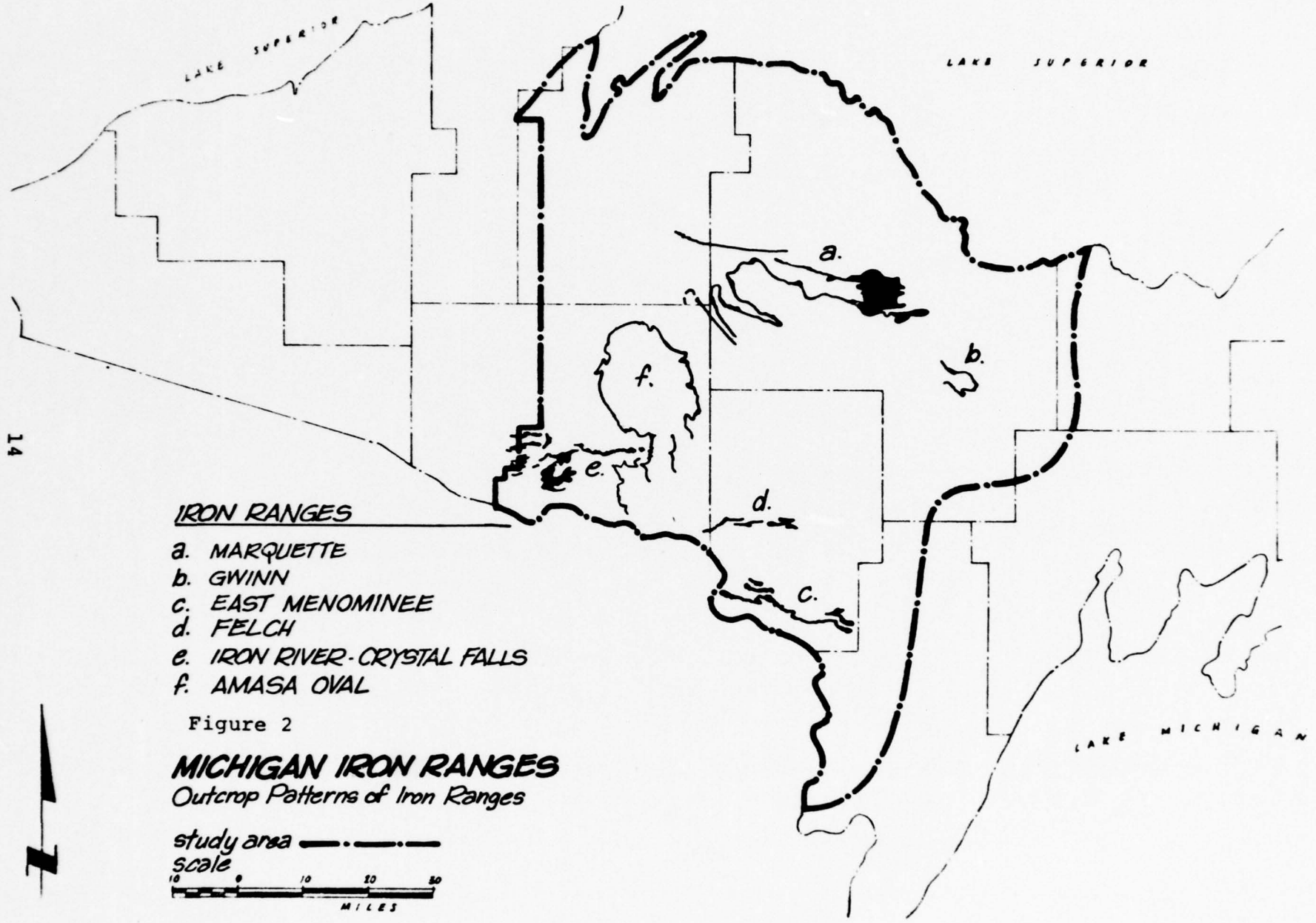

Figure 2

MICHIGAN IRON RANGES

Outcrop Patterns of Iron Ranges

Table 1. SUMMARY OF KNOWN INFORMATION ON IRON MINING DISTRICTS WITHIN THE STUDY AREA

District	Activity	Formations Mined	Past Recorded Production (long tons)	1974 Estimated Reserves (millions of tons)
Marquette	active	Negaunee Bijiki Greenwood	through 1974 427,183,498	17,465
Gwinn	inactive	Riverton	12,785,000	
East Menominee	inactive	Vulcan	through 1974 311,232,305	1,800
Felch	active	Vulcan		
Iron River-Crystal Falls	active	(Sherwood?) Riverton		
Amasa Oval	inactive	Amasa (Riverton?)		

Only three of these, the Marquette, Iron River-Crystal Falls, and Felch are still actively mined.

Table 2. ACTIVE IRON MINES AND PITS

Range-Dist.	Mine	Company	Mine Location
Marquette			
	Empire (open pit-pellets)	Cleveland Cliffs Iron Co. 1460 Union Commerce Bldg. Cleveland, Ohio 44114	1 mile NW of Palmer in Sec. 17, T47N, R26W Marquette County
	Mather (underground-direct shipping ore and pellets)	Cleveland Cliffs Iron Co. (Operator for the Negaunee Mine Co.) 1460 Union Commerce Bldg. Cleveland, Ohio 44114	"B" Shaft, west side Negaunee, in Sec. 1, T47N, R27W, Marquette County
	Republic (open pit-pellets)	Cleveland Cliffs Iron Co. (Operator for the Negaunee Mine Co.) 1460 Union Commerce Bldg. Cleveland, Ohio 44114	1 mile S of Republic in Sec. 7, T46N, R27W, Marquette County
	Tilden (open pit siliceous ore pellets)	Cleveland Cliffs Iron Co. 1460 Union Commerce Bldg. Cleveland, Ohio 44114	3 miles S of Ishpeming in Sec. 26, T47N, R27W, Marquette County
Iron River-Crystal Falls			
	Sherwood (underground-direct shipping ore)	Inland Steel Co. 30 West Monroe Street Chicago, Illinois 60603	1/2 mile N of Iron River in Sec. 23, T43N, R35W, Iron County
Felch			
	Groveland (open pit-pellets)	The Hanna Mining Co. 100 Erieview Plaza Cleveland, Ohio 44114	3 miles E of Randville in Sec. 31, T42N, R29W, Dickinson County

Amasa-Oval, East Menominee, Gwinn - (Not Active)

Palmer District. Another isolated segment of this range, called the Republic District, is located south of Lake Michigamme and extends southeast to Republic. The Negaunee Iron Formation is the principal source of iron ore in this district.

The Negaunee is underlain by a series of quartzites, dolomites, and slates that crop out around the perimeter of the basin. The strata above the Negaunee consist of quartzites, slates, volcanics, and a thinner, lower grade iron formation, the Bijiki. (Refer to Appendix A for listing of individual mines located on the Negaunee and Bijiki iron formations.) Strata within the basin generally dip toward its major axis at 30-70°, but in some places the strata have an almost vertical attitude.

Most of the iron ore produced has been mined at the east end of the range. Four general types of iron ore which have been produced and shipped from the Marquette Iron Range are 1) high grade, direct shipping "soft" ores; 2) high grade, direct shipping "hard" ores; 3) siliceous ores; and 4) concentrates and agglomerates (pellets concentrated from low grade ores). Traditionally, Lake Superior direct shipping ores have had a base iron content of 51.5%. Recently, however, the standards for direct shipping ores have been upgraded and have averages of 54% iron, reflecting a growing competition with foreign ores.

The Marquette Range has been and still is the largest iron producer of the six ranges. Total direct-shipping ore produced from 1854 through 1974 was 427,183,498 long tons. Although only four mines are still operating in the area, production levels are still high. Production from this district in 1974 totaled 9,008,916 long tons of shipping ore and pellets.

- Gwinn Iron District - The Gwinn Iron District is south of the Marquette Range and due south of the City of Marquette (Figure 2). The Gwinn District is a basin about 6 miles long and from 1 to 2 miles wide and the general trend of its major axis is N45°W. The basin is an isolated down-folded remnant of sedimentary rocks completely surrounded by granite. The iron-bearing unit of the basin is overlain by a thick slate series and it is very thin compared to the other Michigan ranges. The phosphorous content of the ore is quite high, which make it less desirable than other ores of

the region. The area was first explored in 1869, and the first mine opened in 1871. In the period 1872-1947, eight mines produced 12,785,258 tons of ore (refer to Mineral Extraction Data Map for names and locations of mines). Mining activity ceased in the district in 1947.

- East Menominee Iron Range - The East Menominee Iron Range consists of two belts of iron formation stretching 25 miles between Iron Mountain and Waucedah (Figure 2). The belts are parallel, striking in an east-southeast direction and dipping steeply to the south. The northern belt is discontinuous, with a 5 mile gap in the center. The oldest rock in the local geologic column is a granite gneiss, which crops out 1/2 to 4 miles northeast of the northern iron formation belt. A quartzite lies stratigraphically above the granite gneiss and in turn is overlain by a dolomite that underlies the iron formation. The iron-bearing rocks are separated into two strata by a thin slate. The two iron formation beds are near the ground surface throughout the district because of an apparent repetition of the stratigraphic sequence by faulting.

  The earliest report of the discovery of iron ore on the East Menominee Range was made in 1848 when a specular ore was identified in Section 30, T40N, R30W. The first exploration work was done in 1866, but the first shipment of ore was not made until 1874. Historically the Menominee Range is Michigan's second largest producer of iron ore. No mines are currently operating in the Menominee Iron Range.

- Felch Iron District - The Felch Iron District is an east-west trending, tightly folded syncline of sedimentary rocks that include iron formation. It extends from west of Randville to east of Felch, and is about 1 mile wide and 15 miles long. Four major mining operations have produced siliceous ores. (Consult map and Appendix A for further details.) The stratigraphy of this district is somewhat similar to that of the East Menominee Range. The oldest rock member is a granite gneiss upon which rests a quartzite overlain by a dolomite. Above the dolomite is a schist, and on top of the schist lies the iron formation. One open pit mine, the Groveland, currently is active in this district, and it produces about 2,000,000 long tons of pellets per year.

- Iron River-Crystal Falls Iron Range - Discovery of iron ore in the Iron River-Crystal Falls range was credited to a United States land survey in 1851. Mining in the area did not begin until 1882. The first mine to open was the Iron River Mine south of the City of Iron River. Most of the ore produced from the area is a mixture of soft red hematite and yellow limonite with smaller amounts of hard blue hematite. The iron-bearing rock unit of the Iron River-Crystal Falls range is found in a triangular-shaped basin between the towns of Iron River, Crystal Falls and Florence, Wisconsin. The formation is thought to underlie the entire 70 square miles of the basin. This relationship has not been completely substantiated because of thick glacial cover in some areas (refer to Surficial Geologic Data Map) as well as the great depth of the iron formation in the central part of the basin.

  The oldest rocks in the basin area are volcanic lavas that are up to 5 miles thick in some areas. The lavas crop out along the north and southwest sides of the basin, as well as along most of the east end. Between the lavas and the iron formation (which is stratigraphically above the greenstone) are a series of mudstones or slates. The upper part of these slates has a high carbon content and contains as much as 40% finely disseminated pyrite. Above the iron formation is another series of slates and a graywacke unit. This entire series of sediments has been squeezed into a tightly folded basin.

  Most of the mining in the Michigan part of the range has been in the immediate vicinity of Iron River and Crystal Falls, at the apices of the basin and on the limb extending south from Crystal Falls. The ore appears to be concentrated in the lower part of the iron formation. Most of the ore produced from this range was mined at depths shallower than the mines of the Marquette and Gogebic Ranges; however, in some areas, iron has been mined to depths greater than 2,000'. Unlike the softer ores of the Marquette and Gogebic Ranges, the ores of the Iron River-Crystal Falls Range are comparatively hard. Most of the ore-bearing formation is nearly vertical in attitude.

  One underground mine, the Sherwood, currently is operating in the Iron River-Crystal Falls Range. This is a small operation that produces about 400,000 long tons of direct-shipping ore per year.

- Amasa Oval Iron Range - This range is a subsection of the Iron River-Crystal Falls Range and is located north of Crystal Falls. A relatively thin iron formation intersects the surface in a large oval pattern. Ore has been produced in the vicinity of Amasa and east of Crystal Falls. This district is of minor economic importance.

Gold: In 1880, Julius Ropes discovered a gold-bearing quartz vein northwest of the town of Ishpeming. This discovery prompted further exploration in the immediate area, and other gold mines were developed in the 1880s and 1890s. Other gold mines in the vicinity of Ishpeming having recorded production are the Michigan, Gold Lake, Superior, Peninsula, and Fire Center. Many smaller discoveries of gold were made in this area, but none developed beyond the stage of prospects. (Refer to Appendix A for listing of other gold prospects and locations.) Of the above-mentioned mines, the three largest gold producers were the Ropes, Michigan, and Fire Center Mines. The Ropes gold mine was recently acquired by Callahan Mining Company of New York, who conducted an exploration and evaluation program on the property. Resumption of production is not anticipated in the near future.

All of the mines and prospects are located in the Dead River Greenstone Belt in northern Marquette County. The rocks of this greenstone belt are classified into two groups, the Mona schist and Kitchi schist. The Mona schist is thought to be the older of the two, and consists predominantly of basaltic lava flows with lesser amounts of mafic tuff. The Kitchi schist is made up of intermediate to felsic agglomerate with smaller amounts of felsic tuff and basalt. Since deposition, these two sequences have undergone varying degrees of metamorphism resulting from numerous episodes of magmatic intrusion.

Gold mineralization in the greenstone belt is associated with systems of quartz veins. The Ropes deposit occurs in a zone of near vertical fissures that have been filled by quartz veins, some of which are as thick as 38'. At the Michigan deposit, gold is reported to occur with sulfide mineralization along the margins of quartz veins. Pyrite is the principal sulfide, with minor amounts of chalcopyrite, galena, sphalerite, and molybdenite. The veins at the Michigan vary in width and geometric attitude. The Fire Center gold is associated with base metal sulfides (pyrite and arsenopyrite) in quartz-sulfide veins and silicified shear zones. Nugget-sized specimens of native gold

have been taken from the Ropes and Michigan Gold Mines; however, gold occurs only as fine disseminations in the other mines and prospects.

Gold also is reported to occur in placer deposits within the sands and gravels of the Yellow Dog Plain in northern Marquette County. To date, "mining" has been confined to hand-panning for mineral specimens. (Refer to Anticipated Future Conditions for further discussion on the placer gold deposits of the Yellow Dog Plain.)

Copper: Copper was the first metal mined in the Upper Peninsula of Michigan. Approximately 4,000 years ago, the "copper culture" Indians recovered native copper from large boulders and outcrops in the Keweenaw Peninsula. No copper mines have ever operated within the Study Area.

The Portage Lake Lava Series of Upper Precambrian age is the host rock of one of the richest copper producing areas of the past. All of the copper mines located on the Portage Lake Lava Series lie north of the Study Area. (See Evolution for a discussion of producing deposits north of the Study Area and potential areas of production within the region.)

Manganese: Manganese is produced as a by-product of the iron mining operations. In most of the iron mines, the ore contains only minor amounts of manganese, but in a few mines, the ore is highly manganiferous. Some of the mines noted for their production of manganese are the Bengol (Cannon), Rogers, Chicagon, Fortune Lakes, Bristol, Balkan-Judson, and the Mastodon Mines. (Refer to Appendix A for locations and more detailed information on these mines.) Manganese occurs almost entirely in the mineral hausmannite, which occurs as veins in the iron ores. The manganiferous ore bodies grade laterally and vertically into the normal types of iron ore. Other manganiferous minerals present in minor amounts are rhodochrosite, susexite, seamanite, and neotocite. No statistics are readily available on total manganese production. James, et al. 1968), calculated an average manganese content of 0.2% for Michigan iron ores. Use of this figure could be misleading, however, as the manganese is not distributed uniformly throughout the iron formations.

Non-Metalic Minerals

Slate: Extensive deposits of slate occur in Baraga County, chiefly on the westerly side of the Huron Mountains near Huron Bay. From 1975 to 1888, slate was quarried at a number of sites near the small settlement of Arvon. Further development of this local slate industry failed chiefly because of poor methods of quarrying. This slate is of uniform quality and texture and is black.

Quartz: Vein quartz was mined near Ishpeming by the Michigan Quartz Silica Company of Milwaukee. The quartz was ground to a fine powder and used chiefly for the manufacture of wood filler and paint. Some of the product was also used in the manufacture of scouring polishes. Analyses submitted by the company stated that this quartz was pure quality silica and commercially usable.

Graphite: Graphite-bearing slate occurs southeast of L'Anse in Baraga County. Quarries were operated about 9 miles southeast of the town by the Detroit Graphite Company and by the Northern Graphite Company of L'Anse during the early part of the 20th century. The ground graphite was used for making paints. The quarries were worked only intermittently, when a demand for graphite existed, and they were never operated for any continuous length of time, nor have they been operated in the recent past.

Crushed Rock (Trap Rock): There are abundant resources of rocks suitable for crushing and use as road base material or general fill within the Study Area. Rock currently is quarried mainly in the Marquette and Negaunee areas because of the greater demand in and around the larger population centers. Currently the chief sources of crushed rock are waste materials from the copper and iron mines. The iron formation rock from Marquette County is generally preferred because it is harder than the waste rock associated with copper mines. The cost of moving these materials to distant markets limits this industry to the immediate areas around the mining districts.

Sandstone: In the past, sandstone quarrying was an economically significant industry in Michigan. One of the better quality sandstones was quarried from the Jacobsville sandstone, in the northwestern part of the Study Area. The Jacobsville is a reddish sandstone thought to be either Upper Precambrian or Lower Cambrian in age. Large scale quarrying of this formation was carried on just north of the Study Area near the Portage Entry in Houghton County.

Two smaller quarrying sites exist within the Study Area along the eastern shore of Keweenaw Bay in Baraga County. The decline of this once profitable industry has been attributed to the increased use of synthetic building materials, such as cement and bricks, and to the long haul distances to the larger metropolitan areas.

Marble: Parts of the Kona dolomite in the Marquette iron district and the Randville dolomite in the Menominee and Crystal Falls districts have been metamorphosed into dolomitic marbles. These marbles vary in texture, and their colors vary from white to shades of blue, pink, green, and brown. In many places, the marble contains interbeds of slates and quartzites, but in a few areas, the rock is of suitable quality for mining. Several small quarries have been opened in these two districts, but most have failed because of excessive costs due to handling large amounts of waste products. One quarry, producing crushed marble for decorative stone, is currently operated by Caspian Construction Company in Dickinson County.

A belt of altered peridotite rocks approximately 5 miles in length occurs northwest of Ishpeming in Marquette County. These rocks have been altered to an aggregate of serpentine and dolomite, and have been given the name Verde Antique Marble. The rock is actually a serpentine with intricate veins and strings of dolomite running throughout. The color of serpentine varies from olive to a dark forest green, with the dolomite being generally white. The stone is of high quality, takes a good polish, and is used for decorative building materials. Large amounts of Verde Antique Marble exist in the greenstone belt. Around the 1920s, a quarry operated about 5 miles northwest of the City of Ishpeming, but it closed down due to financial problems.

Limestone: Precambrian and Paleozoic limestones and sandstones crop out in the eastern portion of the Study Area. (See Bedrock Data Report for more detailed description of Paleozoic rocks.) There are large reserves of minable limestone, but production in this area has been minimal, as the closest market for this material is in southern Michigan, where similar limestone deposits exist. There currently are two producing limestone quarries within the Study Area. One small quarry is located in the far northwest corner of Delta County. Another operation of moderate size is operated by Lindberg and Sons in central Marquette County. Because of the sparse population in the Study Area, these operations are sufficient to meet the local demands for crushed limestone.

Granite and Feldspar: Feldspar and amphibolite are quarried by Caspian Construction Company near the towns of Felch and Randville in Dickinson County. These materials are crushed bagged, and sold for decorative landscaping stone. Several other small quarries, in a "semi-active" status, are present in the Randville-Felch region. In western Marquette County, a feldspar quarry formerly was operated to provide material for coating vitrified brick and certain kinds of tile. Feldspar from the western part of the Northern Peninsula has also been sued in the manufacture of pottery, electrical porcelain, and various enameled wares. Some of the intrusive granites might provide excellent monumental stone and crushed mineral materials if a demand were created to warrant expansion of the industry.

Clays: The clays within the Study Area are of three general origins: 1) glacial clays, 2) lake clays, and 3) river clays. Most of these materials are not pure clay minerals, but are clay-sized rock flour with varying amounts of mixed clays or clay-like minerals. They are termed clays from the engineering standpoint because of their fine grain size.

In general, red glacial clays are calcarious. Gray and brown glacial clays and lake clays are generally less calcarious, but in areas where glacial deposits are rich in limestone fragments they may contain a larger percentage of lime. River clays are normally the least calcarious. Glacial clay deposits contain pebbles and boulders and river clay deposits generally contain sand. However, the lake clay deposits are comparatively free of coarser materials.

Many of the glacial clays have been mined for the local manufacture of common brick and tile. Most of the clays are low grade or low quality. However, pockets of pottery clay occur throughout the Study Area and have been used locally for the manufacture of fired ceramics. Areas identified as lake plains are potential sources of future clay production.

Sand and Gravel: A vast mantle of glacial deposits exist within the Study Area. These extensive deposits could be the sources of supply of sand and gravel. Statistics available from the Michigan Department of Natural Resources indicate that at least thirty-six sand and gravel pits were active in the Study Area during 1974. Numerous other abandoned or inactive pits exist.

Roofing Granules: In the Felch area there have been several roofing granule quarries. The Harvey Quarry near Marquette also produced granules for a period of time.

RELATIONSHIP TO OTHER DATA

There is a direct relationship between mineral deposits and geologic conditions. The distribution and character of mineral deposits are governed by bedrock geologic conditions, or, in the case of sand and gravel deposits, placer gold, etc., by surficial geologic conditions. The concentration of valuable minerals in specific locations within the earth's crust is the result of certain types of geologic processes, such as the intrusion of igneous rocks, unique sedimentary conditions, regional metamorphism, etc. Consequently, a definite relationship exists between various types of minerals and the host rock (or environment) in which they are likely to be found. For example, in the Upper Peninsula, copper, molybdenum, lead, zinc, gold and silver deposits are generally associated with greenstone belts, while the iron formations occur within the Middle Precambrian sedimentary rocks.

The location of mines within the Study Area is an obvious indication of the locations of some of the deposits, but is also dependent on other factors. The thickness of glacial deposits has a great influence on the potential for discovery of minerals present in the bedrock sequence, and, after discovery, on the economics of extraction. Exposed mineral concentrations are obviously more easily located than those buried beneath appreciable thicknesses of glacial cover. Even where modern geophysical exploration methods have indicated that mineral concentrations may be present at depth, the cost of drilling through overburden to prove out reserves can be prohibitive. Equally important may be the cost of stripping off the glacial deposits to get at the ore.

Ground water conditions also have a significant influence on the feasibility of developing and operating both open pit and underground mines. Where large flows of water enter the workings, the cost penalties associated with pumping may be sufficient to make the operation uneconomic. Mining operations may also affect ground water levels in the immediate vicinity of mines and the quality of surface flows and/or ground water if the discharge of contaminated water used in procesing is not controlled.

The location of the mining and mineral resources industry obviously has had a large effect on the pattern of land use of the entire Study Area. Many towns and cities have been established because of the presence of deposits that could

be exploited in the immediate vicinity. Land values are also definitely influenced by the presence of extractable ores. Conversely, the presence of former mining areas may have an adverse effect on land values because of strippings, tailings deposits, etc., left on the land surface. In a few areas, caving into old underground workings is affecting developed areas. Some portions of Negaunee are affected by this problem, which has necessitated the closing of some streets.

VALIDITY

General Procedures and Data Sources

The Mineral Extraction Data Map represents an effort to compile all available maps, reports, professional papers, unpublished private papers, unpublished thesis work, and personal communications with resident geologists familiar with potential mineral resources within the Study Area, into an accurate and up-to-date representation of known and potential mineral resources.

Sources used were compiled by consulting bibliographic indices published by the U. S. Geological Survey and The Michigan Geological Survey, as well as the Bibliography of Current Research of the Geology of the Lake Superior region, and Indices to Michigan Geologic Theses. The associated map indices of these publications were also consulted for mine locations. All publications consulted are listed on the accompanying bibliography.

Much valuable information and general guidance was provided by Drs. J. Kalliokoski, S. Nordeng and B. Hamil, Professors of Geology at Michigan Technological University; Mr. Gerald Anderson, Chief Geologist, Cleveland Cliffs Iron Company, Ishpeming; Messrs. Kenneth Gravelle and Jack Van Alstine, Geologists with the State of Michigan, Escanaba Office; Mr. Robert Reed, Geologist with the State of Michigan, Lansing; Messrs. William A. Todd and Willard Bodwell, Longyear Realty Company, Marquette; Mr. Robert Winston, Geologist, Groveland Mine; and Mr. Robert Edwards, Superintendent, Sherwood Mine.

As would be expected, much of the information developed by private industry pertaining to mineral deposits is confidential. It is possible that some of this information may be made available at a later time. However, it is likely that a substantial body of information dealing with both proven reserves and areas with potential for future development will remain unavailable for the foreseeable future.

Data Reliability

Data pertaining to existing mines, including their locations, size, minerals mined, and past production records are thought to be relatively accurate. Information on reserves and areas with potential for future development of mineral resources is much less reliable in that it represents only a compilation of that information which is published or was made available by those consulted.

Because an area has not been delineated as a future potential area does not necessarily mean it is barren and of no value. More likely it means that it has not been properly explored for reasons such as deep glacial overburden, inaccessibility because of poor roads, difficult topography, private ownership, or absence of financing for exploration, etc. It also could mean that data do exist but have not been released by private industry. Figure 3 shows the distribution of known detailed mapping as well as areas subjected only to geologic reconnaissance.

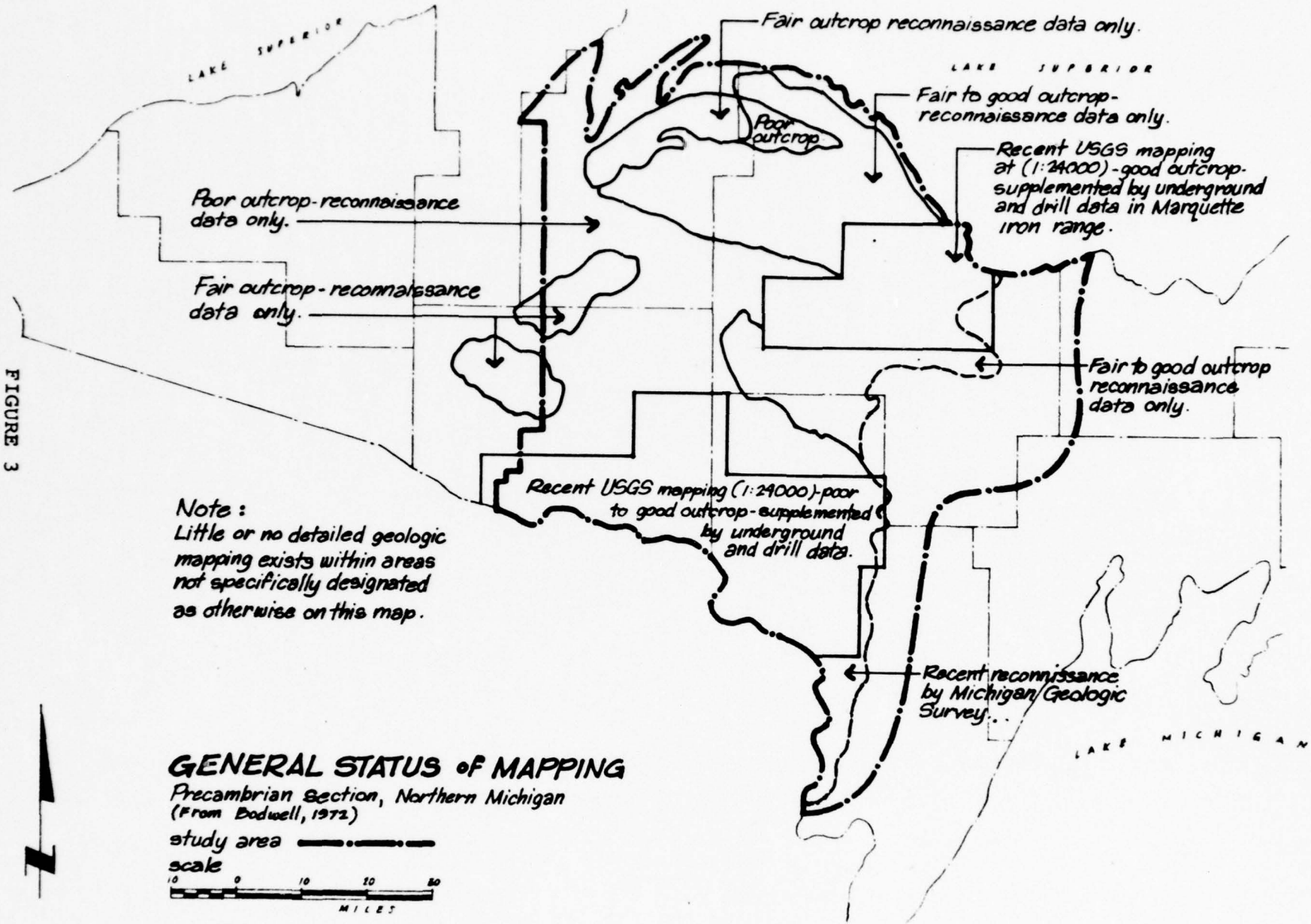
LAKE SUPERIOR
Fair outcrop reconnaissance data only.
LAKE SUPERIOR
Fair to good outcrop-reconnaissance data only.
Poor outcrop
Recent USGS mapping at (1:24000)-good outcrop-supplemented by underground and drill data in Marquette iron range.
Poor outcrop-reconnaissance data only.
Fair outcrop-reconnaissance data only.
Fair to good outcrop reconnaissance data only.
Recent USGS mapping (1:24000)-poor to good outcrop-supplemented by underground and drill data.
Note:
Little or no detailed geologic mapping exists within areas not specifically designated as otherwise on this map.
Recent reconnaissance by Michigan Geologic Survey.
LAKE MICHIGAN
GENERAL STATUS of MAPPING
Precambrian Section, Northern Michigan
(From Bodwell, 1972)
study area
scale
10 0 10 20 30
MILES

FIGURE 3

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APPENDIX A

IRON MINES, GOLD MINES, AND MISCELLANEOUS QUARRY AND PIT OPERATIONS

Appendix A is a listing of iron mines, gold mines, and miscellaneous quarry and pit operations for various minerals such as dolomite, feldspar, marble, sand, gravel, etc. This appendix provides additional information on the mines and mineral extraction locations shown on the Mineral Extraction Data Map.

Iron mines are listed numerically and are identified by the corresponding numbers on the Mineral Extraction Data Map. Gold mines with recorded production are listed alphabetically and are identified by the corresponding letters.

Because of the high density of mine locations in some portions of the Study Area, it was not possible to individually label all the locations that are listed in Appendix A. Therefore, some mining areas that include many individual mines have been shown on the map as areas identified by capital letters. A list of those lettered areas and the mines within each of them follows. In addition to mines that are individually identified on the map, Area D also contains precious and base metal occurrences of the metals listed in the table.

Areas	Iron Mines and Metallic Elements within lettered areas on the Mineral Extraction Data Map
A	55, 92, 126, 129, 136, 151, 155, 159, 164
B	56, 63, 74, 82, 85, 90, 120, 132, 149, 163, 169
C	Au, Cu, Mo, Pb, Zn
D	43-44, 47, 49, 51, 52-54, 57-60, 61-62, 64-66, 67-69, 71-73, 75-76, 78-81, 86-89, 91, 93-95, 96-104, 106-111, 113-116, 117-124, 125, 128, 131, 133-135, 137, 139, 141-143, 145-148, 150, 152, 156, 158, 160-162, 166-168
E	174, 176-179, 181, 186-190, 192, 194, 198, 201-203, 207-209, 211, 215, 222, 226-227, 230, 233, 245, 250, 261-262, 264-265, 267, 274, 277, 279, 282-288
F	170, 175, 180, 193, 200, 204, 212, 217-218, 221, 224, 228, 234-236, 238, 242, 248, 251, 253-254, 259-260, 266, 270, 278
G	172, 182, 184, 196-197, 205-206, 214, 240, 247, 249, 255-256, 258, 263, 268, 275

IRON MINES

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
		For mines which state in the "Remarks" column that they also include other former mines, the total production figures do not include production of the mines before they were assimilated. These older mines will appear separately, and have production figures for the years that they were a separate mine.							
		Blank boxes indicate unavailability of data for individual mines.							
MARQUETTE CO. T48N-R26W SW-SW SEC 32 / T47N-R26W NW-NW SEC 5 E½-NE SEC 6	43 ADAMS / CLEVELAND-CLIFFS IRON CO.	1913-1924	IRON SOFT, RED NON-BESSEMER	NEGAUNEE IRON FORMATION		UG	650	292,348	
MARQUETTE CO. T47N-R27W NE-NW SEC 19	44 ALBION / ST. CLAIRE BROS.	1872-1879	IRON LOW GRADE OF ORE	" "		?		4,592	ALSO CALLED GILMORE
MARQ. CO. T48N-R26W W½-SW SEC 32	45 AMERICAN / AMERICAN-BOSTON MINING CO.	1880-1922	IRON SOFT, RED BESSEMER " " NON-BESSEMER	NEGAUNEE IRON FORMATION SLATES DOLOMITES VOLCANICS QUARTZITES		UG	2,100	1,784,101	WORKED BY CAVING METHOD

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T48N-R28W SE-SW SEC 32 SW-SE SEC 32	46 BOSTON / AMERICAN-BOSTON MINING CO.	1880-1896	IRON SOFT, RED BESSEMER " " NON-BESSEMER	NEGAUNEE IRON FORMATION SLATES DOLOMITES VOLCANICS QUARTZITES		UG		62,542 TONS	A LATER LEASE HELD BY HANNA MINING CO.
MARQ. CO. T47N-R27W SE-SW SEC 2	47 AMES / NEGAUNEE MINE CO.	1893-1894	IRON	" "		UG		6,298	LATER DATE INCLUDED IN WITH THE MATHER MINE
MARQ. CO. T45N-R25W NW SEC 28	48 ARCHIBALD / ROLLING MILL MINING CO.	1911-1942	IRON SOFT, RED, HIGH PHOSPHORUS	" "		UG	1,306	1,881,606	
MARQUETTE CO. T47N-R26W NW-SW SEC 5 SE SEC 6	49 ATHENS / ATHENS IRON MINING CO.	1918-	IRON SOFT, RED NON BESSEMER	" "		UG	2,405	AS OF 1950 11,006,853	WORKED BY TOP SLICING, SUBLEVEL AND BLOCK CAVING
MARQ. CO. T45N-R25W N1/2-SW SEC 20 W1/2-SE SEC 20 SE-SE SEC 20	50 AUSTIN / C.C.I. CO.	1905-1929	IRON SOFT, RED BESSEMER AND NON-BESSEMER	" "		UG	364	1,589,156 / NONE	WORKED BY TOP SLICING
MARQ. CO. T48N-R26W SW-SE SEC 32	51 BARASA	1903	IRON	" "		UG		8,768	
MARQ. CO. T47N-R28W NW, SEC 2 SW-NE SEC 2 N1/2-NE SEC 2	52 BARNES AND HECKER / INLAND STEEL CO.	1923-1927	IRON SOFT, RED NON BESSEMER	" "		UG	1,000	419,433	TOP SLICING METHOD USED.

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R27W S½-NE SEC9	53 BARNUM / C.C.I. Co.	1868-1897	IRON	NEGAUNEE IRON FORMATION QUARTZ, SLATES VOLCANICS DOLOMITES		UG		889,862 TONS /	LATER INCLUDED AS PART OF THE CLIFFS SHAFT MINE
MARQ. CO. T47N-R26W W½-NW SEC8	54 BAY STATE / BAY STATE MINING CO.	1872-1883	IRON	" "		UG		16,637 /	LATER PARTS OF MINE INCLUDED IN THE MARY CHARLOTTE, AND THE TRACEY
BARAGA CO. T48N-R31W NW-SW SEC22	55 BEAUFORT / C.C.I. Co.	1882-1905	IRON REDDISH YELLOW, HIGH PHOSPHORUS	IRON FORMATION	OP			354,654 /	ORIGINALLY WORKED BY ROOM & PILLAR, LATER AS PART OF CCI'S OHIO LOW GRADE PROJECT
MARQ. CO. T48N-R29W NE-SW SEC35	56 BESSIE / JOHN M. LONGYEAR	1891-1906	IRON SOFT, BROWN HIGH PHOSPHORUS	NEGAUNEE Fe FORM.		UG	200	59,097 /	
MARQ. CO. T47N-R28W N½-NW SEC3 N½-N½ SEC4	57 BLUEBERRY / NORTH RANGE MINING CO.	1929-1950	IRON SOFT, DARK RED NON-BESSEMER	NEGAUNEE Fe FORM. SLATES, CHERTS, DOLOMITES, VOLCANICS		UG	1,650	5,303,505 /	ORIGINALLY OPERATED BY FORD MOTOR CO.
MARQ. CO. T47N-R26W SE-SW SEC6 S½-SE SEC6	58 BREITUNG-HEMATITE / JONES AND LAUGHLIN CO.	1870-1937	SOFT, BESSEMER, NON-BESSEMER AND SILICEOUS	" "		UG	1,200	1,728,976 /	WORKED BY SLICING AND CAVING
MARQ. CO. T47N-R26W SW-NE SEC6 NW-SE SEC6 NE-SW SEC6	59 BUNKER HILL / C.C.I. Co.			NEGAUNEE Fe FORM. SLATES QUARTZITES DOLOMITES VOLCANICS		UG		/	RESERVE PROPERTY WHICH BECAME PART OF THE NEGAUNEE

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T48N-R27W S½-SEC SEC 35 T47N-R27W N½-NE-NE SEC 2	60 CAMBRIA / REPUBLIC IRON AND STEEL CO.	1875-1935	IRON SOFT, BROWN NON-BESSEMER	NEGAUNEE Fe FORM., CHERTS, SLATES, VOLCANICS, DOLOMITES		UG	1,509	5,455,337 TONS /	
MARQ. CO. MARQ. CO. T47N-R27W N½ N½-NW SEC 1	61 CAMBRIA-JACKSON / C.C.I. CO.	1936-	IRON SOFT, BROWN NON-BESSEMER	" "		UG		AS OF 1950 4,879,718 /	THIS MINE INCLUDES THE FORMER CAMBRIA, LILLIE AND HARTFORD MINES
MARQ. CO. T47N-R26W NW SEC 33	62 CARR / MEXICAN IRON CO.	1873-1874	IRON	" "		UG		2,380 / NONE	LATER CALLED THE MEXICAN MINE
MARQ. CO. T48N-R29W S½-SW SEC 31 SW-SE SEC 31	63 CHAMPION / NORTH RANGE MINING CO.	1868-	IRON HARD AND SOFT HIGH GRADE NON-BESSEMER	NEGAUNEE Fe FORM. SLATES QUARTZITES DOLOMITES VOLCANICS		UG	2,000 PLUS	AS OF 1950 4,765,398 /	FORMERLY OPERATED BY C.C.I. CO., CHAMPION IRON CO. OLIVER IRON MINING CO.
MARQ. CO. T47N-R28W NE SEC 3	64 CHASE / C.C.I. CO.	1913-1916	IRON HARD, NON-BESSEMER	" "		UG	350	184,042 /	ALSO INCLUDES THE DEY, AND DEXTER MINES
MARQ. CO. T47N-R26W S½-SE SEC 7	65 CHICAGO /	1879-1883	IRON	" "		UG		9,012 /	LATER BECAME THE EAST CHICAGO FORTY
MARQ. CO. T47N-R27W E½-NE SEC 10 NW-NW SEC 11	66 CLEVELAND / C.C.I. CO.	1849-1898	IRON HARD, NON-BESSEMER	" "		UG		/	ONE OF THE FIRST MINES IN AREA ORIGINALLY WORKED BY MARQUETTE IRON CO

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R27W SE SEC 10	67 CLEVELAND LAKE / C.C.I. CO.	1854-	SOFT, RED, BESSEMER, NON-BESSEMER	NEGAUNEE Fe FORM SLATES QUARTZITES DOLOMITES VOLCANICS		UG		AS OF 1950 16,253,841 TONS	LATER IN 1943 BECAME PART OF THE MATHER MINE
MARQ. CO. T47N-R26W SEC 6	68 CLIFFS ARTIC / C.C.I. CO.		IRON	NEGAUNEE IRON FORMATION					HELD AS A RESERVE
MARQ. CO. T47N-R27W N½ SEC 9	69 CLIFFS SHAFT / C.C.I. CO.	(ACTIVE) 1887-1971	IRON HARD, RED NON-BESSEMER	NEGAUNEE Fe FORM. SLATES, CHERTS, DOLOMITES, VOLCANICS		UG	985	AS OF 1950 19,571,465 1971 SHIPMENT 86,467	THIS MINE INCLUDES FORMER BARNUM, BANCROF SECTION 10 EXPLO AND THE OLD CLEVELAND MINE
MARQ. CO. T46N-R29W SW SEC 6	70 COLUMBIA / KLOMAN IRON CO.	1873-1883	IRON	" "				94,813	LATER OPERATED BY COLUMBIA IRON CO.
MARQ. CO. T47N-R26W SW-NW SEC 7	71 DAVIS /	1887-1896	IRON	" "		UG		110,736	FORMERLY CALLED WHEELING AND GRAND RAPIDS
MARQ. CO. T47N-R28W E½-NW SEC 3	72 DEXTER / DEXTER MINING CO.	1883-1897	IRON	" "		UG		118,512	LATER INCLUDED IN WITH THE CHASE MINE
MARQ. CO. T47N-R28W W½-NE SEC 3	73 DEY /	1884	IRON	" "		UG		2,709	BECAME PART OF THE DEXTER MINE

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T48N-R29W SE-SW SEC32	74 EAST CHAMPION / EAST CHAMPION IRON CO.	1873-1889	IRON	NEGAUNEE Fe FORM		UG		76,002 TONS /	ALSO CALLED KEYSTONE OR IRON DUKE MINE
MARQ. CO. T47N-R26W SE-SE SEC7	65 EAST CHICAGO FORTY / JONES AND LAUGHLIN ORE CO.	1879-1883	IRON SOFT, RED NON-BESSEMER AND SILICEOUS	" "		UG		463,274 /	OPERATED LATER AS PART OF THE MARY CHARLOTTE MINE
MARQ. CO. T47N-R27W SW-SW SEC2	75 EAST NEW YORK / C.C.I. CO.	1888-1905	IRON RED SPECULAR BESSEMER	NEGAUNEE IRON FORMATION				327,604 / NONE	LATER INCLUDED AS PART OF MATHER MINE
MARQ. CO. T47N-R26W SW SEC 19	76 EMPIRE / C.C.I. CO.	(ACTIVE) 1907-1971	IRON HARD, RED, SILICEOUS	" "	OP			1907-1928(768,474) 1971 SHIPMENT 3,380,130 /	FORMERLY OPERATED BY EMPIRE IRON CO RE-OPENED BY C.C.I. CO.
MARQ. CO. T47N-R30W NE-NW SEC28	77 ERIE / REPUBLIC STEEL CORP.	1876-1883	IRON	" "		UG		9,194 /	ONCE CALLED FREMONT MINE
MARQ. CO. T47N-R27W SE-SE SEC6	78 EXCELSIOR / IRON CLIFFS CO.	1872-1895	IRON	" "				17,939 /	
MARQ. CO. T47N-R28W SE-NE SEC24	79 FITCH /	1890-1895	IRON	" "				40,263 /	ALSO KNOWN AS MERRYWEATHER

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T48N-R27W E½-SW SEC35	80 FOREST CITY	1902	HIGH GRADE IRON ORE	NEGAUNEE IRON FORMATION				NO RECORD	
MARQ. CO. T47N-R27W SE-SE SEC22	81 FOSTER C.C.I. CO.	1868-1903	IRON	" "		UG		351,713 TONS	FORMERLY OPERATED BY IRON CLIFFS
MARQ. CO. T47N-R29W SE-NE SEC3 SS-NW SEC2 N½-S½ SEC2 SW-SW SEC2	82 FOXDALE REPUBLIC STEEL CORP.	1901-1905	IRON NON-BESSEMER	" "		UG		31,447	BASICALLY AN UNDEVELOPED RESERVE
MARQ. CO. T45N-R25W SW-NW SEC27 SW SEC 27	93 FRANCIS C.C.I. CO.	1893-1939	SOFT, RED HIGH PHOSPHORUS	NEGAUNEE Fe FORMATION		UG		502,131	ORIGINALLY CALLED NORTHWESTERN MINE
MARQ. CO. T45N-R25W NE-SW SEC 35 S½-SW SEC 35 T44N-R25W NW-NE SEC 2	84 GARDNER-MACKINAW C.C.I. CO.	1919-1941	IRON SOFT RED HIGH PHOSPHORUS	" "		UG	1,570	1,326,440	
MARQ. CO. T48N-R29W SE-SE SEC29	85 GIBSON	1885-1887	IRON	BIJIKI Fe FORMATION				16,357	ALSO KNOWN AS GIBSON-MITCHELL
MARQ. CO. T47N-R27W W½-NW SEC19	86 GOODRICH CAPT. GOODRICH OF CHICAGO	1873-1882	IRON	NEGAUNEE IRON FORMATION				49,754	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R28W SE-SW SEC 14 SW-SE SEC 14 NE-NW SEC 23 N½-NE SEC 23	87 GREENWOOD / INLAND STEEL CO.	1932-	IRON HARD, BLUE-BLACK, NON-BESSEMER	NEGAUNEE Fe FORM. SLATES QUARTZITES VOLCANICS DOLOMITES		UG	1,900	AS OF 1950 1,505,584 TONS	
MARQ. CO. T48N-R27W SEC 36	88 HARTFORD / C.C.I. CO.	1889-1910	HARD, BROWN NON-BESSEMER	" "		UG		1,950,422	FORMERLY CALLED BEN NEELY LATER BECAME PART OF THE CAMBRIA MINE
MARQ. CO. T47N-R26W NW-SE SEC 7	89 HIMROD / HIMROD HEMATITE CO.	1873	IRON	" "		UG		2,065	ALSO CALLED ORION MINE
MARQ. CO. T48N-R29W E½-NE SEC 29	90 HORTENSE	1887-1890	IRON	BIJIKI Fe FORMATION				30,574	ALSO KNOWN AS THE KIDDER MINE
MARQ. CO. T47N-R27W NW-NE SEC 28	91 HOWELL-HOPPOCK	1873-1874	IRON	NEGAUNEE IRON FORM.				2,206	
BARAGA CO. T48N-R31W NW SEC 25	92 IMPERIAL / FORD MOTOR CO.	1882-1933	IRON SOFT, BROWNISH YELLOW, HIGH PHOSPHORUS	IRON FORMATION		UG		2,057,781	WORKED BY TOP SLICING FORMERLY OPERATED BY C.C.I. CO.
MARQ. CO. T47N-R26W SW SEC 29 NW SEC 32	93 ISABELLA / YOUNGSTOWN MINES CORP.	1916-1934	IRON SOFT, RED BESSEMER	NEGAUNEE IRON FORMATION		UG	1,252	1,965,929	WORKED BY STOPING

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R27W SEC. 1	94 JACKSON / C.C.I. CO.	1848-1924	SOFT, RED SILICEOUS	NEGAUNEE IRON FORMATION	OP			4,357,256 TONS	LATER COMBINED WITH THE CAMBRIA MINE
MARQ. CO. T47N-R26W S½-NE SEC 1	95 KRUSE / ROLLING MILL MINING CO	1919-1927	IRON SILICEOUS	" "	OP			309,525	
MARQ. CO. T47N-R26W NE-SE SEC 5	96 LACKAWANNA /	1886-1888	IRON	" "		UG		17,780	
MARQ. CO. T47N-R27W	LAKE ANGELINE / C.C.I. CO.	1864-1922	IRON SOFT, RED BESSEMER	" "	UG & OP		424	9,319,679	
MARQ. CO. T47N-R27W SW-SW SEC 14 SE-SE SEC 14	97 LAKE SALLY / JONES & LAUGHLIN ORE CO.	1865-1916	IRON HARD, RED SILICEOUS	" "		UG		35,434	ORIGINALLY NAMED IRON MOUNTAIN CONSIDERED AN UNDEVELOPED RESERVE
T47N-R27W N½-SE SEC 9 NW-SW SEC 10 SW-SW SEC 10 E½-SW SEC 10 SW-SE SEC 9 SEC 16 SEC 21 & ½a-NW SEC 10	98 LAKE SUPERIOR GROUP / OLIVER IRON MINING CO.	1858-1945	IRON HARD, SILICEOUS BESSEMER AND SOFT, NON-SILICEOUS BESSEMER	NEGAUNEE IRON FORMATION		UG	1,450	25,103,189	WORKED BY TOP SLICING
MARQ. CO. SW-SE SEC 35	99 LILLIE / REPUBLIC IRON AND STEEL CO.	1875-1912	IRON HARD, BROWN NON-BESSEMER	" "		UG	1,000	1,869,003	LATER INCLUDED IN THE CAMBRIA JACKSON MINE PROPERTIES

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R27W SW-NW SEC 6 N½-S½ SEC 6	100 LLOYD C.C.I. CO.	1911-	IRON SOFT, RED NON-BESSEMER	NEGAUNEE Fe FORMATION QUARTZITES, DOLOMITES, SLATES, VOLCANICS		UG	1,355	8,845,824	FORMERLY CALLED THE MORRIS-LLOYD MINE
MARQ. CO. T47N-R27W E½-NE SEC 20	101 LOWTHIAN	BEFORE 1882	IRON	" "				NO RECORDED TONNAGE	
MARQ. CO. T47N-R26W NW-SW SEC 5 NE-SW SEC 5 E½-SE SEC 6	102 LUCKY STAR C.C.I. CO.	1926-	IRON	" "		UG		3,238	WAS OPERATED THROUGH THE ATHENS MINE FROM 1954 ON
MARQ. CO. T47N-R26W SW-SW SEC 6 NW-NW SEC 7	103 LUCY C.C.I. CO.	1870 - 1913	IRON SOFT, RED SILICEOUS	" "		UG	390	622,797	FORMERLY CALLED McCOMBER
MARQ. CO. T47N-R26W NW-NW SEC 5 N½-N½ SEC 6 T48N-R26W E½-SW, SE SEC 31 W½-SW SEC 32	104 MAAS C.C.I. CO.	1907-	IRON SOFT RED BESSEMER AND NON-BESSEMER	NEGAUNEE Fe FORMATION QUARTZITES, VOLCANICS, DOLOMITES, SLATES		UG	IN 1950 1,438	AS OF 1950 16,048,021	TOP SLICING AND CAVING METHODS
MARQ. CO. T47N-R30W SW-NW SEC 20	105 MAGNETIC MAGNETIC IRON CO.	1906	IRON	" "				292	
MARQ. CO. T47N-R26W W½-NW SEC 30	106 MAITLAND PALMER MINING CO.	1918-1928	IRON SILICEOUS	NEGAUNEE IRON FORMATION	OP & UG			1,021,189	PREVIOUSLY USED TO BE SHAFT MINE OF THE SAME NAME

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R26W NE-NW SEC 7 N½-NE SEC 7	107 MANGANESE MAAS & LONSTORF	1883-1895	IRON	NEGAUNEE IRON FORMATION		UG		8,711 TONS	THIS ALSO INCLUDES TWO SMALL MINES NAMED AETNA AND SCHAOT
MARQ. CO. T47N-R27W N½-N½ SEC 14	108 MARQUETTE	1860-1892	IRON	" "				268,071 NONE	
MARQ. CO. T47N-R26W NE-SE SEC 7 S½-NW SEC 8 N½-SW SEC 8	109 MARY CHARLOTTE JONES AND LAUGHLIN ORE CO.	1872-1948	IRON SOFT, RED NON-BESSEMER	" "		UG		6,890,949	FORMERLY OPERATED BY MARY CHARLOTTE MINING CO.
MARQ. CO. T47N-R27W SEC 2, SEC 1	110 MATHER C.C.I. CO.	(ACTIVE) 1943-1971	IRON NON-BESSEMER	NEGAUNEE Fe FORM. DOLOMITES, SLATES, VOLCANICS, CHERTS		UG	AS OF 1950 SHAFT WAS 2,352	TOTAL AS OF 1950 4,555,744 1971 SHIPMENT 651,065	INCLUDES FORMER CLEVELAND HEMATITE, EAST NEW YORK, IRON CENTER, AND JACKSON MINES
MARQ. CO. T48N-R30W S½ SEC 19 SW SEC 20	111 MICHEGAMME C.C.I. CO.	1872-1905	IRON NON-BESSEMER	BIJIKI IRON FORMATION		UG	661	935,880	
MARQ. CO. T47N-R28W S½-SW SEC 7 NW-NW SEC 18	112 MICHIGAN	1872-1873	IRON	NEGAUNEE Fe FORM.				4,439	ALSO KNOWN AS THE CONRAD
MARQ. CO. T47N-R27W N½-NW SEC 21	113 MILLER	BEFORE 1902	IRON	" "				4,756	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R26W S½-NW SEC 7	114 MILWAUKEE-DAVIS / JONES AND LAUGHLIN ORE CO.	1879-1915	IRON RED, SEMI-HARD NON-BESSEMER	NEGAUNEE IRON FORMATION		UG	385	411,734 TONS /	1879-1890 WAS JUST THE MILWAUKEE MINE WHEELING AND DAVIS MINES ALSO PART OF M&D
MARQ. CO. T47N-R27W W½-SE SEC 21	115 MITCHELL / JONES AND LAUGHLIN ORE CO.	1872-1913	IRON	" "		UG	768	233,750 /	FIRST OPERATED BY THE MITCHELL MINING CO.
MARQ. CO. T47N-R26W S½-SE SEC 28	116 MOORE / OLIVER IRON MINING CO.	1873-1904	IRON	" "		UG		87,769 /	WENT ALSO UNDER FOLLOWING NAMES: GRIBBON, MOORE, ROYAL, CONSOLIDATED MESABI'S FRIEND
MARQ. CO. T47N-R27W S½-NE SEC 10	117 MORO / C.C.I. CO.	1890-1918	IRON HARD, NON-BESSEMER SPECULAR	" "		UG	814	1,119,854 /	WORKED BY ROOM AND PILLAR
MARQ. CO. T47N-R28W SE-NE SEC 1 NE-SE SEC 2	118 MORRIS / INLAND STEEL CO.	1912-	IRON SOFT, RED, NON-BESSEMER	NEGAUNEE Fe FORM. SLATES, DOLOMITES, VOLCANICS, CHERTS		UG	AS OF 1950 1,850	AS OF 1950 7,829,387 /	FORMERLY OPERATED BY C.C.I. CO.
MARQ. CO. T47N-R27W SE SEC 16	119 NATIONAL / OLIVER MINING CO.	1878-1884	IRON	" "				150,216 /	IN THE 1950's NORTH RANGE MINING CO. TOOK TONNAGE OF ORE FROM STOCKPILE
MARQ. CO. T47N-R26W SW SEC 32 NW SEC 5 E½-NE SEC 6	120 NEGAUNEE / C.C.I. CO.	1887-1949	IRON SOFT, RED NON-BESSEMER	" "		UG	1,317	22,735,479 / NONE	WORKED BY STOPING AND SLICING

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Underground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R27W NW-NW SEC20	121 NEW BURT	1879		NEGAUNEE Fe FORM SLATES, DOLOMITES, VOLCANICS, CHERTS					NO RECORDED TONNAGE ALSO CALLED SECTION 19 MINE
MARQ. CO. T47N-R27W NW-NW SEC20	122 NEW ENGLAND / LAKE SUPERIOR IRON CO.	1866 - 1873	IRON	NEGAUNEE IRON FORMATION				110,506 TONS	
MARQ. CO. T47N-R27W SE-SE SEC3	123 NEW YORK	1864 - 1919	RED SPECULAR BESSEMER	" "				1,124,182	FORMERLY CALLED YORK MINE
MARQ. CO. T47N-R26W SE-SW SEC6 SW-SE SEC6	124 NEW YORK HEMATITE / ADAMS AND FOLEY	1870 - 1882	IRON	" "				37,587	ONCE KNOWN AS IRON VALLEY
MARQ. CO. T47N-R27W NW SEC 5	125 NONPAREIL / ST. LAWRENCE IRON CO.	1882 - 1887	IRON	" "				23,295	FORMERLY CALLED THE ST. LAWRENCE MINE
BARAGA CO. T48N-R31W SE-SW SEC22 SW-SW SEC22	126 NORWOOD / C.C.I. CO.	1887 - 1888	IRON	IRON FORMATION	OP			5,753	
MARQ. CO. T46N-R30W SE-NE SEC2 NE-SE SEC2	127 NORTH REPUBLIC	1888	IRON	NEGAUNEE IRON FORMATION				289	ALSO KNOWN AS THE METROPOLIS MINE

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R27W SW-SW SEC 13	128 OGDEN / C.C.I. CO.	1897-1928	IRON SILICEOUS	NEGAUNEE IRON FORMATION	OP			657,024 TONS	
BARAGA CO. T48N-R31W S½-SE SEC 22	129 OHIO / C.C.I. CO.	1907-1920	IRON SOFT & HARD REDDISH YELLOW HIGH PHOSPHORUS	NEGAUNEE Fe FORM. QUARTZITES, VOLCANICS, DOLOMITES, SLATES	OP			477,083	FORMERLY OPERATED BY NIAGARA IRON CO.
MARQ. CO. T48N-R29W W½-NE SEC 29	130 PASCOE / D.A. MERRITT	1882-1886	IRON	BIJIKI Fe FORMATION				59,806	
MARQ. CO. T47N-R26W NW-SW SEC 6	131 PENDILL / McCOMBER IRON CO.	1878-1884	IRON	NEGAUNEE IRON FORMATION				45,993	LATER CALLED EAST JACKSON MINE ALSO WAS ONCE PART OF LUCY PROPERTY
MARQ. CO. T48N-R29W S½-NW SEC 29 N½-SW SEC 29	132 PHOENIX / DALLIBA IRON MINING CO.	1881-1887	IRON	BIJIKI Fe FORMATION				59,114	ALSO CALLED THE DALLIBA MINE
MARQ. CO. T47N-R26W NW-SW SEC 4	133 PIONEER / PIONEER IRON CO.	1886-1888	IRON	NEGAUNEE IRON FORM.	UG			15,409	LEASED BY C.C.I. CO.
MARQ. CO. T47N-R26W NW-NE SEC 32	134 PLATT / DONORA IRON CO.	1892-1896	IRON	" "				73,844	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE Co. T47N-R27W NW-NE SEC 12	135 PONTIAC	BEFORE 1902	IRON	NEGAUNEE IRON FORMATION				1,500 TONS	NO RECORD OF SHIPMENTS
BARAGA CO. T48N-R31W N½-NW SEC 26	136 PORTLAND / NIAGARA IRON MINING CO.	1909-1915	IRON SOFT, RED AND YELLOW, NON-BESSEMER	IRON FORMATION	OP			272,036	
MARQ. CO. T47N-R26W SE-SW SEC 28	137 PRIMROSE / OLIVER IRON MINING CO.	1896	IRON	NEGAUNEE Fe FORM.				6,040	ALSO KNOWN AS THE JOYCE MINE
MARQ. CO. T45N-R25W SE SEC 18 NE-NE SEC 19 NW SEC 20	138 PRINCETON / C.C.I. CO.	1872-1947	IRON SOFT, RED, HIGH PHOSPHORUS	NEGAUNEE IRON FORM.	UG		548	3,221,588	ALSO INCLUDED ON THIS PROPERTY ARE THE SMALLER MINES, SWANZEY SWANZEY & CHESHIR
MARQ. CO. T47N-R26W E½-SW SEC 5 W½-SE SEC 6 NW-SE SEC 5 SW-SE SEC 5 NE-SW, SE-SW	139 QUEEN GROUP / OLIVER IRON MINING CO.	1886-1917	IRON HARD & SOFT RED, NON-BESSEMER	" "	UG		740	8,195,123	THIS GROUP INCLUDED: BUFFALO, SOUTH BUFFALO, PRINCE OF WALES, AND QUEEN MINES
MARQ. CO. T46N-R29W SEC. 7	140 REPUBLIC / C.C.I. CO.	(REOPENED PRESENTLY ACTIVE) 1872-1937	IRON HARD, SPECULAR BESSEMER AND NON-BESSEMER	NEGAUNEE Fe FORM. SLATES, VOLCANICS, DOLOMITE, QUARTZITES	UG		2,910	UP TO 1937 TOTAL 8,563,170 SHIPMENT FOR 1971 3,109,667	ORIGINALLY OPERATED BY REPUBLIC IRON CO. REOPENED BY C.C.I
MARQ. CO. T47N-R26W NW-NE SEC 33	141 RICHARDS	1887-1897	IRON	" "				8,261	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R26W SW SEC 27	142 NEW RICHMOND / RICHMOND IRON CO.	1927-	IRON HARD, RED SILICEOUS	NEGAUNEE Fe FORM. SLATES VOLCANICS DOLOMITES QUARTZITES	OP			AS OF 1950 3,511,218 TONS	
MARQ. CO. T47N-R26W SW-SW SEC28	143 OLD RICHMOND / RICHMOND IRON CO.	1896-1927	IRON HARD, RED, SILICEOUS	" " / " "	OP			3,604,913	
MARQ. CO. T47N-R30W NW SEC 35	144 RIVERSIDE / OLIVER MINING CO.	1888-1893	IRON	" "				16,160	
MARQ. CO. T47N-R26W S½-NE SEC 7	145 ROLLING MILL / JONES & LAUGHLIN ORE CO.	1871-1927	IRON SOFT, RED, NON-BESSEMER HIGH PHOSPHORUS AND SILICEOUS	" "	OP AND UG			2,997,802	INCLUDES ROLLING MILL-UG KRUSE MINE-OP
MARQ. CO. T47N-R26W NW-SW SEC17	146 ROWLAND	BEFORE 1902	IRON	NEGAUNEE Fe FORMATION				2,988	
MARQ. CO. T47N-R27W W½-NE SEC19 SE-NW SEC 19 NE-SW SEC 19 NW-SE SEC 19	147 SAGINAW / SAGINAW MINING CO.	1872-1891	IRON	" "	UG			451,424	ORIGINALLY OPERATED BY MAAS, LONSTORF, AND MITCHELL
MARQ. CO. T47N-R27W S½-NW SEC 15 SW-NE SEC 15	148 SALISBURY / C.C.I. CO.	1872-1924	IRON SOFT, RED, NON-BESSEMER	" "	UG		830	4,489,102	WORKED BY TOP SLICING

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R29W SW-SE SEC 2 SE-SW SEC 2	149 SAMPSON / C.C.I. CO. FORD MOTOR CO.	1866-1892	IRON	NEGAUNEE Fe FORMATION				267,805 TONS /	FORMERLY KNOWN AS LINCOLN, EDWARDS ARGYLE MINES 1953 BECAME PART OF HUMBOLT
MARQ. CO. T47N-R27W NE-NE SEC 12	150 SECTION 12 / IRON CLIFFS CO.	1879-1882	IRON	" "				21,887 / NONE	
BARAGA CO. T48N-R31W S1/2-NW SEC 24 N1/2-SW SEC 24	151 SPURR / SPURR IRON MINING CO.	1873-1886	IRON	IRON FORMATION				164,244 /	ALSO CALLED SPURR MOUNTAIN MINE
MARQ. CO. T47N-R26W SE SEC 29	152 STAR WEST / CORRIGAN McKINNEY AND CO.	1873-1911	IRON SOFT, BLUE SILICEOUS	NEGAUNEE IRON FORMATION	UG			209,115 /	LATER THE PROPERTY OF OLIVER MINING CO., MINE ALSO CALLED HOME, WHEAT, AND PROUT
MARQ. CO. T45N-R25W SW SEC 17	153 STEGMILLER / OLIVER IRON MINING CO.	1909-1917	IRON SOFT, BLUE HIGH PHOSPHORUS	" "	UG		307	418,417 /	FORMERLY CALLED THE BROTHERTON MINE
MARQ. CO. T45N-R25W S1/2-SW SEC 20 N1/2-NW SEC 29	154 STEPHENSON / C.C.I. CO.	1907-1941	IRON SOFT, RED, HIGH PHOSPHORUS	NEGAUNEE Fe FORM.	UG		604	3,844,233 /	
BARAGA CO. T48N-R31W E1/2 SEC 23 S1/2-SW SEC 23	155 STEWARD / STEWARD IRON CO.	1874-1878	IRON	IRON FORMATION				2,987 /	LATER HELD BY ORLEANS IRON CO.

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type Open Pit	Type Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R26W SW-SW SEC 5	156 SUNDRY PARCEL NO. 1 / JONES AND LAUGHLIN ORE CO.		IRON	NEGAUNEE Fe FORMATION		UG			RESERVE PROPERTY HELD TILL 1954
BARAGA CO. T49N-R33W NE-NW SEC 9	157 TAYLOR / TAYLOR IRON CO.	1880-1883	IRON	" "	OP			32,970 TONS	
MARQ. CO. T47N-R27W N1/2 SEC 6	158 TILDEN / C.C.I. CO.	(ACTIVE) 1929- PRESENT	IRON HARD, RED, SILICEOUS	NEGAUNEE Fe FORM. SLATES QUARTZITES DOLOMITES VOLCANICS	OP			AS OF 1950 4,035,003 / 1971 SHIPMENT 33,534	
BARAGA CO. T48N-R31W N1/2-SE SEC 21	159 TITAN / S.P. BURT PRESIDENT	1882-1888	IRON	IRON FORMATION		UG		90,371	EXPLORED FURTHER IN THE 1900's BY C.C.I.
MARQ. CO. T47N-R26W N1/2-NE SEC 7 N1/2-NW SEC 8	160 TRACY / JONES & LAUGHLIN ORE CO.	(ACTIVE) 1886-	IRON	NEGAUNEE Fe FORM. SLATES QUARTZITES VOLCANICS DOLOMITES		UG		1971 SHIPMENT 464,457	PRESENTLY OPERATED BY C.C.I. HELD TILL 1954 AS A RESERVE INCLUDES THE OLD MINES, MANGANESE & BAY STATE
MARQ. CO. T47N-R27W NE SEC 25 T47N-R26W W1/2-NW SEC 30	161 (NEW) VOLUNTEER / PALMER MINING CO.	1926-	IRON HARD, GREY-RED SILICEOUS	" " / " "	OP			AS OF 1950 4,574,470	THIS ALSO INCLUDES THE MAITLAND PROPERTY (W1/2-NW SEC 30)
MARQ. CO. T47N-R26W SE, E5 1/2-SW SEC 30 N1/2-N1/2 SEC 31	162 (OLD) VOLUNTEER / VOLUNTEER ORE CO.	1871-1906	IRON	NEGAUNEE IRON FORMATION		UG	600	1,705,971	THIS ALSO INCLUDES THE PALMER ALSO KNOWN AS THE HOWE AND CASCADE

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R29W N½ SEC 11 E½-NW SEC 11	163 WASHINGTON WASHINGTON IRON CO.	1865 – 1920	IRON HARD, STEEL GRAY, NON-BESSEMER	NEGAUNEE IRON FORMATION		UG	730	1,100,741 TONS	LATER HELD BY C.C.I. THIS INCLUDES HUMBOLT AND BARON PROPERTIES
BARAGA CO. T48N-R31W N½-NE SEC 26 SE-NE SEC 26	164 WEBSTER WEBSTER IRON CO.	1882 – 1900	IRON SOFT, BROWN NON-BESSEMER	IRON FORMATION	OP			34,999	LATER HELD BY C.C.I. CO.
MARQ. CO. T46N-R29W SEC 7 LOTS 4 & 6	165 WEST REPUBLIC WEST REPUBLIC IRON CO.	1881 – 1889	IRON	NEGAUNEE IRON FORMATION				133,077	NOW A PART OF THE REPUBLIC MINE IN THE PAST ALSO CALLED TOLEDO
MARQ. CO. T47N-R26W SW-NW SEC 7	166 WHEELING	1884 – 1887	IRON	" "		UG		10,522	LATER BECAME THE DAVIS MINE. THEN THE MILWAUKEE-DAVIS MINE
MARQ. CO. T47N-R26W NE-NE SEC 32	167 WICKS	BEFORE 1902	IRON	" "				196	ALSO KNOWN AS WICK
MARQ. CO. T47N-R27W SW SEC 21	168 WINTHROP WINTHROP IRON CO.	1870 – 1903	IRON BROWN, BESSEMER, SILICEOUS	" "		UG		2,590,560	LATER OLIVER MINING CO. HELD IT AS A RESERVE

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MARQUETTE CO. T47N-R29W S½-SW SEC 1 SE-SW SEC 2 SE SEC 10	169 HUMBOLT C.C.I. CO. AND FORD MOTOR CO.	(ACTIVE) 1953-1971	IRON HIGH GRADE OR BY CONCENTRATION OF JASPER	NEGAUNEE IRON FORMATION QUARTZITES DOLOMITES SLATES VOLCANICS	OP			1971 SHIPMENT 3,380,130 TONS	THESE PROPERTIES ALSO INCLUDE WASHINGTON AND SAMPSON MINES
SE-SW SEC 10 SEC 11, SEC 12 N½ SEC 13, SEC 14 NE-NW SEC 15 SE-NE SEC 15 N½-NE SEC 15									
IRON CO. T42N-R33W SE-SE SEC 11 SW-SW SEC 12	170 ALPHA INLAND STEEL CO.	1903	IRON SOFT, RED, NON-BESSEMER	RIVERTON Fe FORM. SLATES, GRAYWACKE	UG			1,370	VERY SMALL OPERATION
DICKINSON CO. T40N-R30W SE-SW SEC 17 SW-SE SEC 17 NE-NW SEC 20 NW-NE SEC 20	171 ANTOINE ANTOINE ORE CO.	1895-1925	IRON HARD, RED, SILICEOUS	VULCAN IRON FORMATION	OP		100	2,269,444	INCLUDES OLD CLIFFORD AND TRADERS PROPERTIES
DICK. CO. T39N-R29W NE-NW SEC 8 NE SEC 8 N½-NW SEC 9	172 ARAGON OLIVER IRON MINING CO.	1889-1931	IRON SOFT, NON-BESSEMER	" "	UG		1,363	11,160,975	INCLUDES THE SMITH WHITE EXPLORATION
IRON CO. T43N-R32W E½-SE SEC 23	173 ARMENIA CORRIGAN McKINNEY & CO.	1889-1914	IRON SOFT, RED, HIGH PHOSPHORUS	AMASA Fe FORMATION CHERT, FERRUGINOUS SLATE	UG		700	713,395	ALSO KNOWN AS THE ANGUS SMITH MINE
IRON CO. T43N-R34W S½-SW SEC 31 W½-SE SEC 31	174 BAKER HANNA IRON ORE CO.	1909-1915	IRON SOFT, RED, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES GRAYWACKES	UG		550	267,107	FORMERLY OPERATED BY CORRIGAN McKINNEY

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit / Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T42N-R33W NE-NW SEC 13 S½-NW SEC 13 N½-SW SEC 13 SE-NW SEC 13 NE-SE SEC 13	175 BALKAN-JUDSON BALKAN MINING CO.	1882-1942	IRON SOFT, RED, HIGH PHOSPHORUS AND MANGANIFEROUS	RIVERTON Fe FORMATION SLATES GRAYWACKES	UG	710	4,441,799 TONS	OLD MASTODON MINE INCLUDED WORKED BY STOPING AND SLICING
IRON CO. T43N-R34W W½-NW SEC 19 N½-SW SEC 19 S½-SW SEC 19	176 BATES BATES IRON CO.	1915-1947	IRON SOFT, YELLOW HIGH PHOSPHORUS	" "	UG	2,040	4,054,666	LATER OWNED BY HANNA MINING CO.
IRON CO. T43N-R35W N½-SE SEC 36 S½-SE SEC 36 T43N-R34W NW-SW SEC 31	177 BENGAL-TULLY VERONA MINING CO.	1913-1952	IRON SOFT, RED-BROWN HIGH PHOSPHORUS	RIVERTON IRON FORM. SLATES, GRAYWACKES	UG	(TULLY-700 FEET) 3 SHAFTS 875 (BENGAL)	UP TO 1950 6,825,040	LATER ACQUIRED BY HANNA MINING CO.
IRON CO. T42N-R34W SW-NW SEC 6 NW-SW SEC 6	178 BERKSHIRE BRULE MINING CO.	1908-1930	IRON SOFT, RED-BROWN HIGH PHOSPHORUS	Fe FORM. SLATES GRAYWACKES	UG	782	AS OF 1950 4,189,686	LATER OPERATED BY THE VERONA MINING CO. INCLUDES THE COTTRELL MINE TOP SLICING — SUBCAVING METHODS
IRON CO. T43N-R35W NE-SW SEC 26	179 BETA PITTSBURGH COKE AND IRON CO.	1886-1942	IRON	RIVERTON Fe FORM. SLATES, GRAYWACKES	UG	435	27,156 NONE	LATER INCLUDED IN THE NANAIMO
IRON CO. T42N-R33W NE SEC 12	180 BOOK NORTH RANGE MINING CO.	1943-1958	IRON SOFT, RED, HIGH PHOSPHORUS	" "	OP AND UG	500	2,273,122	
IRON CO. T42N-R34W N½-NW SEC 6	181 BORLAND VERONA MINING CO.	OLD	IRON	" "	UG			HELD AS A RESERVE

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
DICKINSON CO. T40N-R31W N½-SE SEC25	182 BRADLEY / JACKSON IRON AND STEEL CO.	1937-	IRON SOFT, SILICEOUS BESSEMER	VULCAN IRON FORMATION	OP			THROUGH 1950 486,786 TONS	FORMERLY PART OF LUDINGTON AND CHAPIN MINES
DICK. CO. T39N-R28W N½-NW SEC22 NW-NE SEC 22	183 BREEN / MINERAL MINING CO.	1877-1880	IRON HARD, RED, SILICEOUS BESSEMER	" "	UG AND OP			75,425	OLDEST MINE IN THE MENOMINEE RANGE
DICK. CO. T39N-R29W S½-NW SEC 9	184 BRIER HILL / BRIER HILL MINING CO.	1882-1883	IRON	" "				14,981	LATER PART OF THE PENN MINES
IRON CO. T43N-R33W E½-SE SEC19 W½-SW SEC 20	185 BRISTOL-YOUNGSTOWN / BRISTOL MINING CO.	1890-	IRON BROWN, HIGH PHOSPHORUS, MANGANIFEROUS	RIVERTON IRON FORMATION	UG		1,950	THROUGH 1961 11,806,519	ONCE CALLED THE CLAIR MINE LATER LEASED BY INLAND STEEL CO.
IRON CO. T43N-R35W NE-SW SEC 34 NW-SE SEC 34	186 BRULE / BRULE MINING CO.	1936	IRON HARD, RED, HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATE AND GRAYWACKES	UG		490	4,200	ALSO KNOWN AS HIAWATHA NO. 3 LATER OWNED BY MANNA MINING CO.
IRON CO. W½-W½ SEC7 T42N-R34W	187 BALTIC / VERONA MINING CO.	1901-	IRON SOFT, RED-BROWN, HIGH PHOSPHORUS	" "	UG			THROUGH 1950 2,574,216	
IRON CO. T42N-R35W SE & SE SEC 1	188 FOGARTY / VERONA MINING CO.	1907-1949	IRON SOFT, RED, BROWN, HIGH PHOSPHORUS	" "	UG			1,515,721	

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IRON CO. T42N-R34W S½-SW SEC 6	189 BUCK / VERONA MINING CO.	1922-1961	SOFT, RED, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES		UG	753	THROUGH 1962 15,368,486 TONS	WORKED BY STOPING AND SLICING
IRON CO. T43N-R35W SE SEC 27	190 BUCKHOLTZ / MINERAL MINING CO.		IRON	" "					A RESERVE PROPERTY
DICKINSON CO. T41N-R28W SE-NW SEC 8 SW-NE SEC 8	191 CALUMET / CALUMET ORE CO.	1882-1913	IRON HARD, RED, SILICEOUS	VULCAN IRON FORMATION	OP AND UG		215	175,917	WORKED BY STOPING
IRON CO. T43N-R35W E½-NE N½-SE SW-NE N½-SE SW-NE ALL SEC 22 E½-NE	192 CARDIFF / WICKWIRE MINING CO.	1922-1923	IRON MEDIUM HARD, RED BROWN, HIGH PHOSPHORUS	RIVERTON IRON FORMATION SLATES, GRAYWACKES		UG	530	144,415	INCLUDES KEWEENAW AND McGOVERN MINES NOW HELD BY HANNA MINING CO.
IRON CO. T43N-R32W N½-SW SEC 31	193 CARPENTER / HANNA FURNACE CO.	1914-1928	IRON HARD AND SOFT RED, HIGH PHOSPHORUS	" "		UG	760	2,735,452	ALSO OPERATED BY THE HOLLISTER MINING CO.
IRON CO. T42N-R35W NE SEC 1	194 CASPIAN / VERONA MINING CO.	1903-1937	IRON SOFT, RED, BROWN, HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATES, GRAYWACKES		UG	539	6,623,320	WORKED BY STOPING AND SLICING
IRON CO. T43N-R32[illegible] NE-SW SEC 26 NW-SE SEC 26 SE-NW SEC 26	195 CAYIA / JONES AND LAUGHLIN	FIRST PRODUCTION 1952	IRON	AMASA Fe FORMATION CHERT, FERRUGINOUS SLATE		UG			UNDER DEVELOPMENT RESERVE PROPERTY

09 Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
DICKINSON CO. T40N – R30W S½-SW SEC 30 SW-SE SEC 30	196 CHAPIN / OLIVER IRON MINING CO.	1880 – 1934	IRON SOFT, NON-BESSEMER	VULCAN IRON FORMATION		UG AND OP	1,520	26,409,278 TONS	LATER OWNED BY NORTH RANGE MINING
DICK. CO. T40N – R30W N½-SW SEC 30	197 HAMILTON / OLIVER IRON MINING CO.	1886 – 1892	IRON SOFT, NON-BESSEMER	" "		UG		96,072	LATER OWNED BY NORTH RANGE MINING
IRON CO. T43N – R35W NE-SE SEC 35	198 CHATHAM / DRULE MINING CO.	1907 – 1920	IRON BROWN, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES AND GRAYWACKES		UG	4 LEVELS	1,381,175	LATER PART OF HIAWATHA NO. 1
IRON CO. T43N – R34W NW-NE SEC 26 S½-NE SEC 26 NE-SE SEC 26	199 CHICAGON / MONROE IRON MINING CO.	1911 – 1922	IRON HARD, RED, HIGH PHOSPHORUS, MANGANIFEROUS	" " / " "		UG	1,080	1,234,339	HELD LATER BY HANNA IRON ORE CO. WORKED BY STOPING METHOD
IRON CO. T43N – R32W NW SEC 31	200 COLUMBIA / CORRIGAN McKINNEY STEEL CO.	1882 –	IRON	" "		UG	AS OF 1950: 1,783	THROUGH 1950 4,308,601	NOW HELD BY REPUBLIC STEEL TOBIN AND COLUMBIA COMPRISE OLD SHELDON AND SHAFER PROPERTY
IRON CO. T42N – R34W NE-SW SEC 6	201 CORRY "40" / BRULE MINING CO.	1922 – 1928	IRON SOFT, RED HIGH PHOSPHORUS	" "		UG	400	67,616	HAULED UP THROUGH THE BERKSHIRE MINE SHAFT
IRON CO. T43N – R35W E½-SE SEC 34	202 CORTLAND / WICKWIRE MINING CO.	1912 – 1914	IRON HIGH PHOSPHORUS	RIVERTON Fe FORMATION		UG		52,148	ACQUIRED BY HANNA MINING CO.

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T42N-R35W NE-SE SEC 1	203 COTTRELL / BRULE MINING CO.	1915-1916	IRON SOFT, RED BROWN, HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATES AND GRAYWACKES		UG	262	75,134 TONS /	COTTRELL MINE USED IN OPERATION OF THE BERKSHIRE
IRON CO. T43N-R32W E½-NE SEC 21	204 CRYSTAL FALLS / CORRIGAN McKINNEY & CO.	1882-1913	IRON SOFT, BROWN, HIGH PHOSPHORUS	" "		UG	455	1,744,015 /	LATER HELD BY INLAND STEEL CO.
DICKINSON CO. T40N-R30W S½-SW SEC 22	205 CUFF / GLOBE IRON CO.	1899-1942	IRON	VULCAN IRON FORMATION		UG		83,306 /	FORMERLY KNOWN AS PROTECTION OWNED BY OLIVER IRON MINING CO.
DICK. CO. T39N-R30W N½-NE SEC 3 NE-NW SEC 3	206 CUNDY / CUNDY IRON CO.	1896-1913	IRON HARD, GRAY, SILICEOUS	" "		UG	603	846,078 /	LATER OWNED BY OLIVER MINING CO. STOPING METHOD USED
IRON CO. T43N-R35W #1 NE-NW SEC 23 #2 W½-SE SEC 14 #3 SE-SE SEC 14 BARNETT SW SEC 23	207 DAVIDSON GROUP DAVIDSON #1, #2, #3 BARNETT / PICKANDS MINING CO.	1911-1953	IRON SOFT, YELLOW, HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATES, GRAYWACKES		UG	#1 950 #2 445 #3 AS OF 1950 900	8,197,014 /	3 SHAFTS WORKED BY STOPING AND CAVING
IRON CO. T43N-R35W W½-SW SEC 14	208 DAVIDSON #4 / DAVIDSON ORE MINING CO.	1913-1921	IRON	" "		UG	220	128,599 / NONE	IN PAST ALSO CALLED WAPAMA
IRON CO. T42N-R34W NE SEC 7	209 DE GRASSE / VERONA MINING CO.	1950	IRON SOFT, RED-BROWN, HIGH PHOSPHORUS	" "		UG		28,682 /	OPERATED AS PART OF THE BUCK GROUP

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit / Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T42N-R33W NE-SW SEC24	210 DELPHIC	1883-1896	IRON SOFT, RED, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES	UG		33,770 TONS	
IRON CO. T43N-R35W W½-W½ SEC25	211 DELTA / DELTA MINING CO.	1920-1925	IRON HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATES, GRAYWACKES	UG	360	95,759	
IRON CO. T42N-R33W W½-NE SEC1	212 DUNN / CORRIGAN McKINNEY & Co.	1887-1915	IRON SOFT, REDDISH-BROWN, HIGH PHOSPHORUS	" "	UG	1,420	2,208,511	ACQUIRED BY REPUBLIC STEEL CORP. WORKED BY STOPING
DICKINSON CO. T39N-R28W NE-NE SEC22	213 EMMETT / EMMETT MINING CO.	1882-1884	IRON	VULCAN IRON FORMATION	UG		131,940	CONTROL PASSED TO KIMBERLEY'S OF SHARON, PA.
DICK CO. T39N-R29W S½-NW SEC6	214 FEW / E.C. EASTMAN AND CO.	1907-1910	IRON HARD, SILICEOUS, LOW PHOSPHORUS	" "	UG		18,000	
IRON CO. T43N-R35W NE-SW SEC14 SE-SW SEC14	215 FORBES / PITTSBURGH COKE & IRON CO.	1913-1937	IRON SOFT, YELLOW, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES GRAYWACKE	UG	475	2,283,822	PROPERTY WAS USED AS SITE FOR THE DAVIDSON SHAFT
DICK. CO. T40N-R30W NE-SW SEC25	216 FOREST / OLIVER IRON MINING CO.	1904	IRON HARD, BLUE, BESSEMER	VULCAN IRON FORMATION	UG		11,988	ORE FOUND IN SMALL POCKETS

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IRON CO. T43N-R33W SW-NE SEC 26 NE-NE SEC 26 N½-NW SEC 25 S½-SW SEC 24	217 FORTUNE LAKE / FORTUNE LAKE MINING CO.	1953-1958	IRON MOSTLY SOFT HEMATITIC 2.0% MANGANESE	RIVERTON Fe FORMATION SLATES AND GRAYWACKES		UG	300	1,316,905 TONS	LATER OPERATED BY PICKANDS MATHER & CO.
IRON CO. T43N-R32W SE SEC 30 W½-SW SEC 29 NE-SW SEC 29	218 GENESEE / CORRIGAN McKINNEY STEEL CO.	1902-1935	IRON SOFT, REDDISH-BROWN, HIGH PHOSPHORUS	RIVERTON IRON FORMATION		UG	860	1,198,383	ACQUIRED BY REPUBLIC STEEL ONCE KNOWN AS ETHEL
IRON CO. T44N-R33W NW-NW SEC 15	219 GIBSON / ROGERS BROWN ORE CO.	1885-1911	IRON	" "		UG		159,453	LEASED TO NORTH RANGE IRON CO.
DICKINSON CO. T40N-R30W S½-NE SEC 20	220 GLOBE CORNELL / HIMROD FURNACE CO.	1880-	IRON SILICEOUS	VULCAN IRON FORMATION	OP			AS OF 1950 725,055	ORIGINALLY IN 1887 TERMED EXHAUSTED REOPENED 1935 PRODUCED SINCE THEN
IRON CO. T43N-R32W E½-SW SEC 21 SW-SE SEC 21	221 GREAT WESTERN / CORRIGAN McKINNEY STEEL CO.	1882-1925	IRON SOFT, REDDISH-BROWN, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES		UG	1,250	2,296,739	WORKED BY STOPING METHOD
IRON CO. T43N-R35W E½-E½ SEC 33 SW-SE SEC 33 SE-SW SEC 33 SW-NE SEC 33	222 GREIG-KELLY-JACKSON / INLAND STEEL		IRON	" "					RESERVE PROPERTY
DICK. CO. T42N-R29W S½-NE SEC 31 SE-NW SEC 31 NE-SW SEC 31 N½-SE SEC 31	223 GROVELAND / CORRIGAN McKINNEY	(REOPENED ACTIVE) 1891-1913	IRON HARD, GRAY SILICEOUS	VULCAN IRON FORMATION	OP		AS OF 1913 300	1891-1913 TOTAL 156,032 1971 SHIPMENT: 2,015,700	INTERESTS ACQUIRED BY HANNA MINING CO.

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type Open Pit	Type Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T43N-R32W SW-NE SEC 21 NW-SE SEC 21	224 HAGERMAN		IRON	RIVERTON Fe FORMATION		UG			RESERVE PROPERTY HELD BY REPUBLIC STEEL CORP.
IRON CO. T44N-R33W W½-SW SEC 4	225 HEMLOCK HEMLOCK RIVER MINING CO.	1891-1938	IRON HARD, RED, HIGH PHOSPHORUS	" "		UG	500	2,125,756 TONS	WORKED BY STOPING METHOD
IRON CO. T43N-R35W W½-NE SEC 35 NE-SW SEC 35 S½-SW SEC 35 SE SEC 35 NW-SE SEC 35	226 HIAWATHA NO. 1 MUNRO MINING CO.	1893-	IRON HARD, RED, HIGH PHOSPHORUS	RIVERTON IRON FORMATION SLATES, GRAYWACKES		UG	AS OF 1950 2,100	AS OF 1950 8,502,729	LATER WORKED BY HANNA MINING CO. ALSO INCLUDES OLD HANNA, AND WICKWIRE MINES
IRON CO. T43N-R35W NE SEC 2 NW SEC 2 SW-SW SEC 36 T42N-R35W E½-NE SEC 2 NW SEC 1	227 HIAWATHA NO. 2 OLIVER IRON MINING CO.	1935-	IRON HARD, RED, HIGH PHOSPHORUS	" "		UG	AS OF 1950 2,280	AS OF 1950 3,137,064	LATER WORKED BY HANNA MINING CO. ALSO INCLUDES DUFF, DOBER AND ISABELLA MINES
IRON CO. T43N-R32W W½-SW SEC 22	228 HILLTOP OLIVER MINING CO.	1899-1919	IRON RED, HIGH PHOSPHORUS	" "		UG		98,202	
IRON CO. T43N-R32W W½-SW SEC 13	229 HOLLISTER HOLLISTER MINING CO.	1890-1914	IRON SOFT, RED, HIGH PHOSPHORUS	AMASA Fe FORMATION CHERT, FERRUGINOUS SLATE		UG		143,117	EARLIER WAS OPERATED BY OLIVER MINING CO.
IRON CO. T43N-R35W W½-NW SEC 23 NW-SW SEC 23 NE-SW SEC 23 W½ NW-SE SEC 23	230 HOMER BUFFALO IRON MINING CO.	(ACTIVE) 1915-1971	IRON MEDIUM RED BROWN, HIGH PHOSPHORUS	RIVERTON IRON FORM. SLATE GRAYWACKE		UG	1,310	AS OF 1961 12,174,619 1971 SHIPMENT 449,065	LATER BY HANNA MINING OPERATED ALSO INCLUDES MINCKLER MINE

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit / Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T43N-R32W E½-SE SEC 27 SE-SE SEC 27 NE-SE SEC 27	231 HOPE / HOPE IRON MINING CO.	1892-1903	IRON HARD, RED, HIGH PHOSPHORUS	AMASA Fe FORMATION CHERT, FERRUGINOUS SLATE	UG	90	28,530 TONS /	ONCE OPERATED BY OLIVER IRON MINING CO. SOUTH HOPE MINE INCLUDED HERE.
DICKINSON CO. T40N-R30W NE-NE SEC 27	232 INDIANA / THOMAS FURNACE CO.	1882-1920	IRON SOFT AND HARD, RED BESSEMER, AND SILICEOUS	VULCAN IRON FORMATION	OP AND UG		244,527 /	LATER DRILLED BY INLAND STEEL CO.
IRON CO. T43N-R35W N½-NE SEC 23 NW-NW SEC 24	233 JAMES / MINERAL MINING CO.	1907-1954	IRON SOFT, YELLOW, HIGH PHOSPHORUS	RIVERTON Fe FORMATION	UG	900	8,326,342 /	ONCE CALLED OSANA OPERATED ALSO BY JAMES MINING CO.
IRON CO. T43N-R32W E½-SE SEC 29	234 KIMBALL / CORRIGAN McKINNEY & CO.	1907-1915	IRON HARD, RED, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKE	UG	360	35,757 /	WORKED BY STOPING
IRON CO. T43N-R32W NW-SE SEC 20	235 LAMONT / CORRIGAN McKINNEY & CO.	1889-1910	IRON SOFT, BROWN HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATES AND GRAYWACKE	UG	1,040	558,524 /	ALSO KNOWN AS THE MONITOR MINE
IRON CO. T43N-R33W NE-SE SEC 36	236 LAWRENCE / VERONA MINING CO.	1920	IRON	" "	UG		584 /	ALSO KNOWN AS WILKINSON
IRON CO. T43N-R32W SW-NE SEC 26	237 LEE PECK /	1892	IRON	AMASA Fe FORMATION CHERT FERRUGINOUS SLATE	UG	100	2,844 /	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T43N-R32W W½-SW SEC 21	238 LINCOLN / CORRIGAN McKINNEY STEEL CO.	1891-1909	IRON HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES GRAYWACKE		UG	453	241,627 TONS	ORIGINALLY CALLED FAIRBANKS
DICKINSON CO. T39N-R29W NW-SE SEC 12 E½-SE SEC 12 SE-NE SEC 12 T39N-R28W SW SEC 7 &W-NW SEC 7	239 LORRETTO / LORRETTO IRON CO.	1887-1940	IRON SOFT, BLUE, NON-BESSEMER, BESSEMER	VULCAN IRON FORMATION		UG		3,729,581	LATER OPERATED BY AMERICAN-BOSTON MINING CO. THIS ALSO INCLUDES THE ELEANOR AND STURGEON RIVER MINES
DICK. CO. T40N-R31W E½-SE SEC 25 N½-SE SEC 25	240 LUDINGTON / OLIVER MINING CO.	1880-1894	IRON SOFT, BLUE, NON-BESSEMER, BESSEMER	" "		UG	1,796	1,001,518	ALSO INCLUDES THE BRADLEY MINE.
IRON CO. T43N-R31W SW-SW SEC 17 NW-NW SEC 20	241 MANSFIELD / OLIVER MINING CO.	1890-1913	IRON HARD, BROWN, NON-BESSEMER	RIVERTON Fe FORMATION		UG	1,517	1,462,504	
IRON CO. T42N-R33W NE SEC 13	242 MASTODON / MASTODON IRON CO.	1882-1896 (1942 ONE SHIPMENT)	IRON SOFT, RED, HIGH PHOSPHORUS AND MANGANIFEROUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES		UG	435	447,315	ALSO OPERATED BY BALKAN MINING CO. WORKED BY SUB-LEVEL CAVING
IRON CO. T43N-R32W SE-NE SEC 23	243 McDONALD / McDONALD MINING CO.	1909-1913	IRON SOFT, BROWN, NON-BESSEMER	AMASA Fe FORMATION CHERT, FERRUGINOUS SLATE		UG	325	30,289	WORKED BY STOPING
DICK. CO. T42N-R28W N½-NE SEC 32	244 METROPOLITAN / METROPOLITAN IRON AND LAND CO.	1882-1888	IRON	VULCAN IRON FORMATION		UG		107,027	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T43N-R34W SE SEC 29	245 MICHAELS / CORRIGAN MCKINNEY STEEL CO.		IRON	RIVERTON IRON FORMATION		UG			RESERVE PROPERTY LATER ACQUIRED BY REPUBLIC STEEL IN 1935
IRON CO. T44N-R33W NE-NW SEC 9	246 MICHIGAN / OLIVER IRON MINING CO.	1893-1916	IRON HARD, BROWN, HIGH PHOSPHORUS	" "		UG	656	350,270 TONS	ORIGINALLY CALLED GIBSON ALSO INCLUDES THE WARNER MINE, 1948 LEASED TO NORTH RANGE MINING
DICKINSON CO. T40N-R30W NE-NW SEC 31 NW-NE SEC 31	247 MILLIE / HEWITT AND DESSAU MINING CO.	1881-1936	IRON SEMI-HARD, RED TO BLACK, BESSEMER, LATER SILICEOUS	VULCAN IRON FORMATION	OP AND UG		1,200	503,934	ALSO OPERATED BY OLIVER MINING, AND NORTH RANGE ALSO CALLED THE HEWITT
IRON CO. T43N-R33W NE-NW SEC 36 N½-NE SEC 36 SE-NE SEC 36	248 MONONGAHELA / HOLLISTER MINING CO.	1901-1943 1952-1956	IRON HARD AND SOFT, RED, HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATES AND GRAYWACKES		UG		1,787,656	ALSO OPERATED BY HANNA IRON CO. AND ACQUIRED BY REPUBLIC STEEL
DICK. CO. T39N-R29W NW-SE SEC 6 NE-SW SEC 6	249 MUNRO / MUNRO MINING CO.	1903-1921	IRON HARD, RED, SILICEOUS	VULCAN Fe FORMATION	OP AND UG			576,254	
IRON CO. T43N-R35W W½-SW SEC 26	250 NANAIMO / NANAIMO MINING CO.	1882-1908	IRON SOFT, YELLOW, HIGH PHOSPHORUS	RIVERTON Fe FORMATION		UG	362	373,765	ALSO OPERATED BY MINERAL MINING CO.
IRON CO. T43N-R32W E½-SE SEC 21	251 NEELY / INLAND STEEL CO.		IRON	" "					RESERVE PROPERTY HELD BY INLAND SINCE 1948

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit / Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
DICKINSON CO. T42N - R28W N½-NW SEC 32	252 NORTHWESTERN NORTHWESTERN MINING CO.	1883 - 1903	IRON	VULCAN IRON FORMATION	UG		35,810 TONS	
IRON CO. T43N - R32W S½-NE SEC 30	253 ODGERS CORRIGAN MCKINNEY STEEL CO.	1916 - 1935	IRON SOFT, REDDISH-BROWN, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES AND GRAYWACKES	UG	868	2,101,381	MCKINNEY STEEL MERGED WITH REPUBLIC STEEL WORKED BY STOPING
IRON CO. T43N - R32W NE-SE SEC 20	254 PAINT RIVER CORRIGAN MCKINNEY STEEL CO.	1882 - 1913	IRON SOFT, RED, HIGH PHOSPHORUS	RIVERTON Fe FORM. SLATES AND GRAYWACKE	OP AND UG		382,078	LATER HELD BY REPUBLIC STEEL CO. ALSO KNOWN AS FAIRBANKS MINE
DICK. CO. T39N - R29W S½-NW SEC 9 S½-NE SEC 9 NE-NE SEC 9 N½-SE SEC 9 SE-SE SEC 9	255 PENN MINES MENOMINEE MINING CO.		IRON SOFT, GRAY-RED, NON-BESSEMER	VULCAN IRON FORMATION	UG	EAST VULCAN 1,281 WEST VULCAN 2,091	21,644,135	INCLUDES NORWAY N½-SE SEC 5 CYCLOPS S½-SE SEC 5 CURRY, WEST VULCAN AND EAST VULCAN MINES
SEC 10, SW SEC 11 S½-SE SEC 11 E½-SE SEC 6 S½ SEC 5 N½ SE SEC 5	255 " " " "		" "	" "	"		" "	LATER OPERATED BY PENN IRON MINING CO.
DICK. CO. T40N - R30W NW SEC 32 S½ " " S½-SW (STEEL RIDGE) SEC 32 SE →	256 PEWABIC PEWABIC CO.	1880 - 1918	IRON SOFT, RED, SILICEOUS SOFT, BLUE, NON-BESSEMER	VULCAN Fe FORMATION	UG	941	9,452,440	ALSO INCLUDES THE KEEL RIDGE MINE LATER OPERATED BY EMMETT MINING CO.
IRON CO. T44N - R33W N½-NE SEC 22 SE-NE SEC 22	257 PORTER NEVADA MINING CO.	1916, 1927	IRON SOFT, RED, NON-BESSEMER	RIVERTON Fe FORMATION	UG	850	733,327	OPERATED LATER BY HEMLOCK RIVER MINING CO., NOW HELD AS RESERVE BY INLAND STEEL

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type Open Pit	Type Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
DICKINSON CO. T40N - R30W SE SEC 34	258 QUINNESEC CORRIGAN MCKINNEY STEEL CO.	1878 - 1935	IRON SEMI-HARD REDDISH-BROWN, SILICEOUS	RIVERTON Fe FORMATION	OP AND UG			512,235 TONS	ACQUIRED BY REPUBLIC STEEL CO. IN 1935.
IRON CO. T43N - R32W S½-N½ SEC 19 SW SEC 19 W½-SE SEC 19 T43N - R33W NE-SW SEC 24 N½-SE SEC 24 SE-NE SEC 24	259 RAUENNA-PRICKETT HOLLISTER MINING CO.	1911-1943	IRON HARD AND SOFT RED, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES AND GRAYWACKES	OP AND UG		350	635,227	ACQUIRED BY INLAND STEEL FIRST OPERATED AS OPEN PIT THEN UNDERGROUND
IRON CO. T43N - R33W S½-SE SEC 36	260 RICHARDS CORRIGAN MCKINNEY STEEL CO.	1913-1927	IRON SOFT, BROWN, HIGH PHOSPHORUS	" "	UG			534,448	
IRON CO. T43N - R35W E½-NE SEC 35 NW-NW SEC 36 SW-SW SEC 36 T42N - R35W NW-NE SEC 1 SE-NE SEC 12	261 RIVERTON GROUP OLIVER IRON MINING CO.	1882-1937	IRON SOFT, BROWN, HIGH PHOSPHORUS AND MANGANIFEROUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES	UG		1,750	5,881,550	INCLUDES: DOBER NW SEC 1 BUFF E½-NE ISABELLA SW-SW SEC 31 THESE LATER BECAME PART OF HIAWATHA #2
IRON CO. T43N - R34W SW SEC 21 W½ SEC 29 NE SEC 29 SW SEC 29 S½-NE SEC 29	262 ROGERS MUNRO IRON MINING CO.	1914 - 1945	IRON HARD, RED, HIGH PHOSPHORUS MANGANIFEROUS	Fe FORM. SLATES AND GRAYWACKES	UG		500	2,907,375	INCLUDES: BLAIR SW SEC 29 ERICKSON SW SEC 21 SWANSON S½-NE SEC 29 SCHIEBLER NE-NE SEC 29 PAULSEN NW-NE SEC 29 WHITE E½-NW SEC 29
DICK. CO. T39N - R29W SW-SW SEC 4	263 SAGINAW SAGINAW MINING CO.	1879-1909	IRON BESSEMER	VULCAN IRON FORMATION	OP			502,985	ALSO REFERRED TO AS THE PERKINS MINE.
IRON CO. T43N - R35W SE-SE SEC 26	264 SHERIDAN PICKANDS & MATHER CO.	1889-1900	IRON	Fe FORM. SLATES, GRAYWACKE	UG		180	116,299	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T43N-R35W SE-NE SEC 23 NE-SE SEC 23	265 SHERWOOD REPUBLIC STEEL CORP.	(ACTIVE) 1931-	IRON SEMI-HARD, REDDISH-BROWN, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES		UG	1,625	AS OF 1961 7,410,785 TONS 1971 SHIPMENT 360,144	ACQUIRED BY INLAND STEEL IN 1943.
IRON CO. T42N-R33W NW-SE SEC 13	266 SOUTH MASTODON	1887-1890	IRON	" "		UG		8,203 NONE	ALSO KNOWN AS MANHATTAN
IRON CO. T43N-R35W E½-NW SEC 24 SW-NW SEC 24	267 SPIES-VIRGIL C.C.I. CO.	1917-1955	IRON SOFT, RED, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES		UG	SPIES 1,200 VIRGIL 1,256	4,195,111	VIRGIL MINE SW-NW SEC 24 CLOSED 1946
DICKINSON CO. T39N-R29W NW-SW SEC 4	268 STEPHENSON LUMBERMAN'S MINING CO.	1879-1887	IRON	VULCAN Fe FORMATION		UG		39,350	
DICK CO. T39N-R29W NW-NW SEC 13	269 STURGEON OLIVER MINING CO.	1925	IRON SOFT, BLUE BESSEMER	" "		UG	152	533	
IRON CO. T43N-R32W SW SEC 30	270 TOBIN CORRIGAN MCKINNEY STEEL	1901-1960	IRON SEMI-HARD REDDISH-BROWN HIGH PHOSPHORUS	RIVERTON Fe FORM SLATES, GRAYWACKE		UG	1,783	9,497,352	ACQUIRED BY REPUBLIC STEEL IN 1935
DICK. CO. T39N-R29W N½-NE SEC 14	271 VERONA VERONA MINING CO.	1900-1904	IRON SILICEOUS	VULCAN Fe FORMATION		UG		130,975	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
DICKINSON CO. T40N - R30W S½-SW SEC 34	272 VIVIAN VERONA MINING CO.	1902-1913	IRON HARD, RED, SILICEOUS	VULCAN Fe FORMATION		UG	310	482,187 TONS	WORKED BY UNDERHAND STOPING
IRON CO. T44N - R33W E½-NW SEC 9 SW-NE SEC 9 NE-SW SEC 9 SE SEC 9 SW-SW SEC 10 E½-NW SEC 15 NE-NW SEC 15 NE-NE SEC 16	273 WARNER HEMLOCK RIVER MINING CO.	1915-1937	IRON HARD, RED, PURPLE, NON-BESSEMER	RIVERTON IRON FORMATION		UG	1,239	1,868,637	THIS INCLUDES: MICHIGAN NE-NW SEC 9 GIBSON NW-NW SEC 15 BAY SHORE NE-NE SEC 16 NORTH RANGE REOPENED IN 1950
IRON CO. SE-NW SW-NE > SEC 23 (WAUSECA) E½-NW-SE SEC 23 (ARONSON) T43N - R35W	274 WAUSECA-ARONSON MINERAL MINING CO.	(ACTIVE) 1926-	IRON HARD, RED, HIGH PHOSPHORUS	SHERWOOD Fe FORMATION SLATES GRAYWACKE		UG	1,510	AS OF 1961 9,758,578 1971 SHIPMENT 99,966	ACQUIRED BY HANNA COAL AND ORE CO.
DICK. CO. T40N - R31W SW-NW SEC 25 NW-SW SEC 25	275 WEST CHAPIN JACKSON IRON & STEEL CO.	1922-1936	IRON HARD, RED, SILICEOUS	RIVERTON Fe FORMATION		OP		144,760	
IRON CO. T42N - R35W NE-NW SEC 35 NW-NE SEC 35	276 WICKWIRE WICKWIRE MINING CO.	1911-1917	IRON MEDIUM, RED-BROWN, HIGH PHOSPHORUS	SHERWOOD Fe FORMATION GRAYWACKES SLATES		UG	313	128,869	NW-NE SEC 35 NOW INCLUDED WITH HIAWATHA #1 SHAFT
IRON CO. T42N - R35W E½-E½ SEC 12	277 YOUNGS G.W. YOUNGS MINING CO.	1905-1928	IRON HARD, BROWN HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES		UG	518	802,751	MINE ALSO KNOWN AS NEWMAN AND OPERATED BY NEWMAN ORE CO.
IRON CO. T43N - R32W W½-SW SEC 20	278 YOUNGSTOWN OLIVER IRON MINING CO.	1882-1897	IRON	" "		UG		151,425	REOPENED IN 1950 BY INLAND STEEL AS THE BRISTOL-YOUNGSTOWN MINE

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit / Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T42N-R34W E½-NW SEC 7	279 ZIMMERMAN / HANNA IRON ORE CO.	1907-	IRON SOFT, RED, HIGH PHOSPHORUS	RIVERTON Fe FORMATION SLATES, GRAYWACKES	UG	OPERATED SIX LEVELS	AS OF 1950 3,609,727 TONS	ACQUIRED BY THE VERONA MINING CO. 1944, OPERATED AS THE BOCK GROUP
IRON CO. T43N-R34W NW SEC 26	280 CAMPBELL-SHERWOOD / INLAND STEEL CO.			" "				A RESERVE PROPERTY
IRON CO. T42N-R28W SEC. 32 SEC. 33 SEC. 34	281 FELCH PROPERTIES / HANNA IRON ORE CO.							HELD AS LOW-GRADE ORE LAND RESERVES
IRON CO. T43N-R34W SW¼ SEC 31	282 CANNON / M.A. HANNA CO.	1953-1963	IRON	RIVERTON Fe FORMATION SLATE, GRAYWACKES	UG	1,450	4,894,517	
IRON CO. T43N-R35W NE-SW SEC 36	283 CYR / MICHIGAN MINING CO.	1912	IRON	RIVERTON Fe FORMATION SLATES AND GRAYWACKES	UG	182		
IRON CO. T43N-R35W SE-SW SEC 36	284 LENNOX / IRON COUNTY STEEL CORP.	1910-1912	IRON	RIVERTON Fe FORM. "	UG	358	NO PRODUCTION LISTED	
IRON CO. T43N-R35W SW-NE SEC 36	285 BARRAS / VERONA MINING CO.	1907	IRON	" "	UG	244	NO PRODUCTION RECORDED	

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
IRON CO. T42N-R35W NW-NW SEC 1	DOBER [286] / OLIVER IRON MINING CO.	1888-1935	IRON	RIVERTON Fe FORMATION; SLATES AND GRAYWACKES		UG		10,980 TONS /	LATER BECAME PART OF THE HIAWATHA #2
IRON CO. T42N-R35W SE-SE SEC 1	FOGARTY [287] / VERONA MINING CO.	1907-1942	IRON	" "		UG	1,420	1,499,070 TONS /	LATER OPERATED AS PART OF THE BOCK MINE
IRON CO. T42N-R34W NW-NW SEC 7	BALTIC [288] / VERONA MINING CO.	1901-1922	IRON	" "		UG	1,220	2,535,262 /	BECAME PART OF BOCK MINE

GOLD MINES

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T48N-R27W SEC 29 S½-NW	ROPES GOLD MINE [A]	1882-1897	GOLD	QUARTZ VEINS IN VOLCANIC TUFF WITHIN A PERIDOTITE INTRUSION		UG	16 LEVELS	30,400 OUNCES 130,000 OUNCES RESERVES ESTIMATED TO A DEPTH OF 1,510 FEET	
MARQ. CO. T48N-R28W SEC 35 2½ MILES SW OF ROPES	MICHIGAN GOLD MINE [B]	1890-1894 REOPENED 1934	GOLD	QUARTZ VEINS IN ALTERED BASALTS		UG	250	2,060	
MARQ. CO. T48N-R27W SEC 30	BJORK-LUNDEEN PROSPECT [C]	1890's	GOLD		OP				
MARQ. CO. T49N-R27W SEC 35	FIRE-CENTER MINE [D]	1891-1893	GOLD	QUARTZ-SULFIDE VEINS IN RHYOLITE PORPHRY		UG	100	100	2 SHAFTS SUNK
MARQ. CO. T49N-R28W SEC 25	SILVER CREEK LOCATION	TURN OF CENTURY	GOLD	FOUND WITH MASSIVE GALENA AND SPHALERITE	OP	UG AND			4 SHAFTS SUNK PLUS TRENCHES DUG
MARQ. CO. VARIOUS EXPLORATIONS IN 6 TOWNSHIPS T48 & 49N - R26, 27, 28W	MORGAN GOLD MINING CO.								EXACT LOCATIONS NOT KNOWN
T49N-R27W SEC 23 T49N-R27W SEC 35 T49N-R28W SEC 6	" "	"	"	QUARTZ SULFIDE VEINS DISSEMINATED PYRITE CHALCOPYRITE		UG			"

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T48N-R28W SEC 35 (WEST OF THE MICHIGAN MINE)	GOLD LAKE MINE [E]	NON-ACTIVE (OLD)	GOLD			UG	60		
MARQ. CO. T48N-R28W SEC 35	SUPERIOR GOLD MINE [F]	NON-ACTIVE (OLD)	GOLD			UG			VERY SMALL OPERATION
MARQ. CO. T48N-R28W SEC 25	PENINSULA GOLD MINE [G]	NON-ACTIVE (OLD)	GOLD			UG			VERY SMALL OPERATION
MARQ. CO. T48N-R28W NE1/4-NW1/4 SEC 36	GRUMMET [H]	NON-ACTIVE	GOLD			UG	62		THREE SHAFTS SUNK

DOLOMITE QUARRY

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
MARQUETTE CO. T47N-R25W SEC 8	LINDBERG AND SONS	(ACTIVE)	CRUSHED DOLOMITE		OPEN PIT				MODERATELY SMALL SCALE OPERATION

MISCELLANEOUS MINERALS

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Maximum Depth (feet)	Total Production / Reserve	General Remarks
DICKINSON CO. T42N – R30W NW¼-NW¼ SEC26 T42N – R29W SE¼-SW¼ SEC 30 SW¼-SE¼ SEC 30	AGGREGATE SPECIALTIES	(ACTIVE)	CRUSHED FELDSPAR AND AMPHIBOLITE	SLATE AND QUARTZITES	OP				
DICK. CO. T42N – R28W SE-SW SEC26	METROPOLITAN FELCH QUARRY CORP.	(ACTIVE)	MARBLE CRUSHED	SLATE & QUARTZITES	OP				SMALL OPERATION
MARQUETTE CO. T48N – R27W SEC 30	MICHIGAN VERDE ANTIQUE MARBLE CO.	(INACTIVE) (1917- ?)	VERDE ANTIQUE MARBLE	ALTERED PERIDOTITES	OP				SMALL OPERATION
MARQ. CO. T48N – R28W NE SEC 35 SLIGHTLY EAST OF THE MICHIGAN GOLD MINE	MARQUETTE GREEN MARBLE CO.	(INACTIVE) SUSPENDED OPERATIONS 1917	VERDE ANTIQUE MARBLE	"	"				"
BARAGA CO. T51N – R31W SW SEC 28	ARVON SLATE QUARRY	1875–1888	BLACK SLATE		"				HIGH QUALITY BLACK SLATE
BARAGA CO. 9 MILES SOUTH-EAST OF L'ANSE EAST OF TAYLOR MINE	NORTHERN GRAPHITE CO.	EARLY 1900's	GRAPHITIC SLATE		"				
MARQ. CO. T47N – R29W SEC 22		ACTIVE IN 1928 (TOTAL PERIOD?)	FELDSPAR	DIKES IN GRANITES	OPEN PIT		40		

SAND AND GRAVEL

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Physical Size Areal, Depth	Total Production / Reserve	General Remarks
ALGER CO. T45N-R22W SW SEC 33	ALGER CO. ROAD COMM.	ACTIVE	SAND AND GRAVEL	GLACIAL DRIFT	OP				
BARAGA CO. T49N-R33W SEC 7	BARAGA CO. ROAD COMM.	ACTIVE	SAND AND GRAVEL	GLACIAL DRIFT	OP				
BARAGA CO. T48N-R33W SEC 15	BARAGA CO. ROAD COMM.	ACTIVE	"	"	"				
BARAGA CO. T51N-R31W NW SEC 23	BARAGA CO. ROAD COMM.	"	"	"	"				
DICKINSON CO. T41N-R28W SW-SW SEC 25	CASPIAN CONSTRUCTION CO.	"	"	"	"				
DICK. CO. T39N-R30W NE-NW SEC 12	CASPIAN CONSTRUCTION CO.	"	"	"	"				
DICK. CO. T40N-R30W NE-NE SEC 19	CASPIAN CONSTRUCTION CO.	"	"	"	"				

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Physical Size Areal, Depth	Total Production / Reserve	General Remarks
DICKINSON CO. T40N-R30W NE-NE SEC 19	CHAMPION INC.	ACTIVE	SAND AND GRAVEL	GLACIAL DRIFT	OP				
DICK. CO. T40N-R30W SW-SW SEC 5	LINDBERG AND SONS	"	"	"	"				
DICK. CO. T40N-R30W NW-SW SEC 7	MILLER PRODUCTS AND SUPPLY CO.	"	FILL SAND	"	"				
IRON CO. T43N-R35W NW-NE SEC 31	CASPIAN CONSTRUCTION CO.	"	"	"	"				
IRON CO. T43N-R35W S1/2-SW SEC 22	CASPIAN CONSTRUCTION CO.	"	"	"	"				
IRON CO. T43N-R34W SEC 22	IRON CO. ROAD COMM.	"	"	"	"				
IRON CO. T43N-R32W NE-NE SEC 18	IRON CO. ROAD COMM.	"	"	"	"				

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Physical Size Areal, Depth	Total Production / Reserve	General Remarks
IRON CO. T42N-R35W NE-NW SEC 14	IRON CO. ROAD COMM.	"	"	"	"				
IRON CO. T44N-R34W SE-SW SEC 25	IRON CO. ROAD COMM.	"	"	"	"				
IRON CO. CITY OF IRON RIVER	McMAHON BROS.	ACTIVE	SAND AND GRAVEL	GLACIAL DRIFT	OPEN PIT				
MARQUETTE CO. T47N-R26W SEC 33 & 34	BACCO'S	"	"	"	"				
MARQ. CO. T47N-R26W SW-SW SEC 5	CASPIAN CONSTRUCTION CO.	"	"	"	"				
MARQ. CO. T45N-R25W NW-NE SEC 28	CASPIAN CONSTRUCTION CO.	"	"	"	"				
MARQ. CO. T45N-R25W NE-SW SEC 29	CASPIAN CONSTRUCTION CO.	"	"	"	"				

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type Open Pit	Type Under-Ground	Physical Size Areal, Depth	Total Production / Reserve	General Remarks
MARQUETTE CO. T48N-R26W SE-SW SEC 32	A. LINDBERG AND SONS	ACTIVE	SAND AND GRAVEL	GLACIAL DRIFT	OPEN PIT				
MARQ. CO. T48N-R25W NE-SW SEC 9	CITY OF MARQUETTE	"	"	"	"				
MARQ. CO. T48N-R25W NE-NW SEC 10	CITY OF MARQUETTE	"	"	"	"				
MARQ. CO. T47N-R28W NE-NW SEC 3	MARQUETTE CO. ROAD COMM.	"	"	"	"				
MARQ. CO. T46N-R23W N½-SW SEC 5	STATE OF MICHIGAN	"	"	"	"				
MARQ. CO. T48N-R30W NW-NE SEC 26	MILLS BROS. CONSTRUCTION CO.	"	"	"	"				
MARQ. CO. CITY OF NEGAUNEE	CITY OF NEGAUNEE	"	"	"	"				

Location	Name of Mine / Mining Comp.	Activity	Minerals Mined, Ore	Associated Host Rock	Type: Open Pit	Type: Under-Ground	Physical Size Areal, Depth	Total Production / Reserve	General Remarks
MARQ. CO. T48N-R30W NW-NE SEC26	CHAMPION INC.	"	"	"	"				
MARQ. CO. T47N-R26W SE-NE SEC16	FOX VALLEY CONSTRUCTION CO.	"	"	"	"				
MENOMINEE CO. T37N-R28W SE-SW SEC14	STATE OF MICHIGAN	ACTIVE	SAND AND GRAVEL	GLACIAL DRIFT	OPEN PIT				