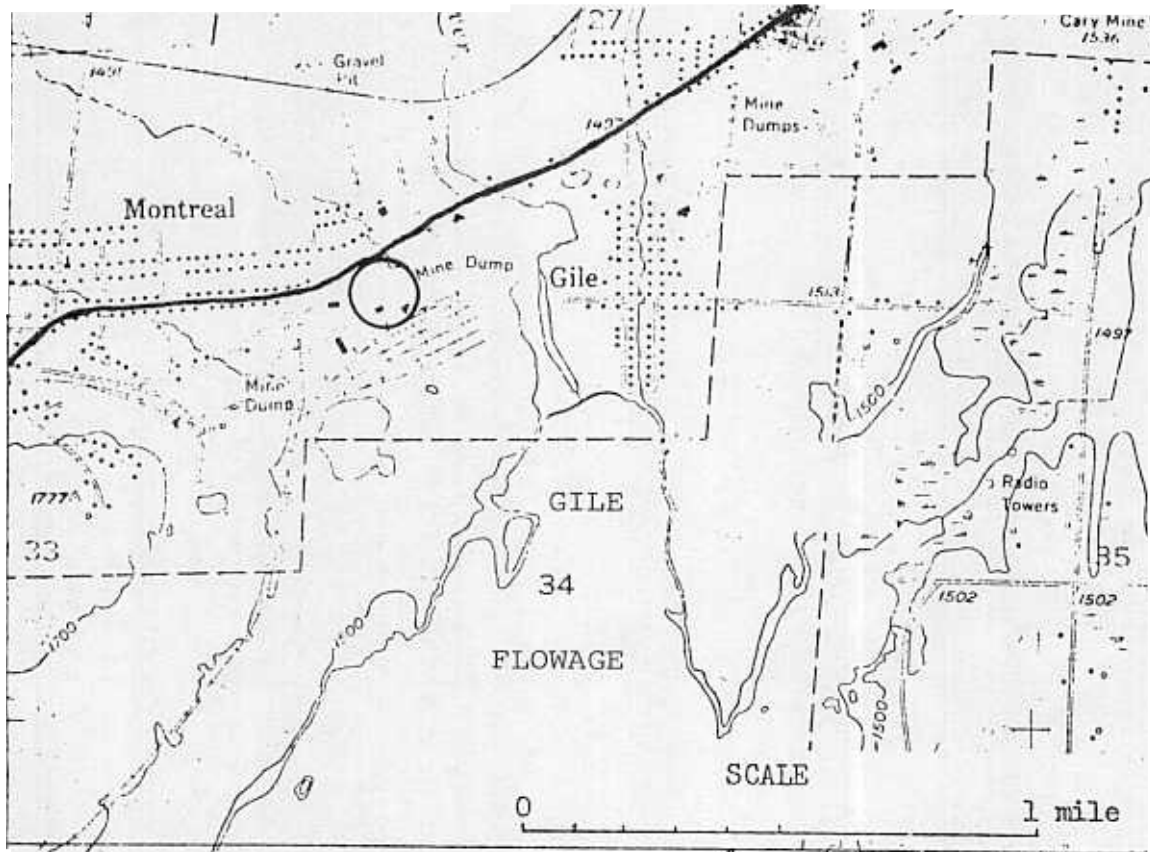


Title: Natural Iron Ore

Location: NE $\frac{1}{4}$, NE $\frac{1}{4}$, Sec. 33, T.46N., R.2E., Montreal Mine
(Ironwood, Wis.-Mich. 7 $\frac{1}{2}$ Minute Quad.)



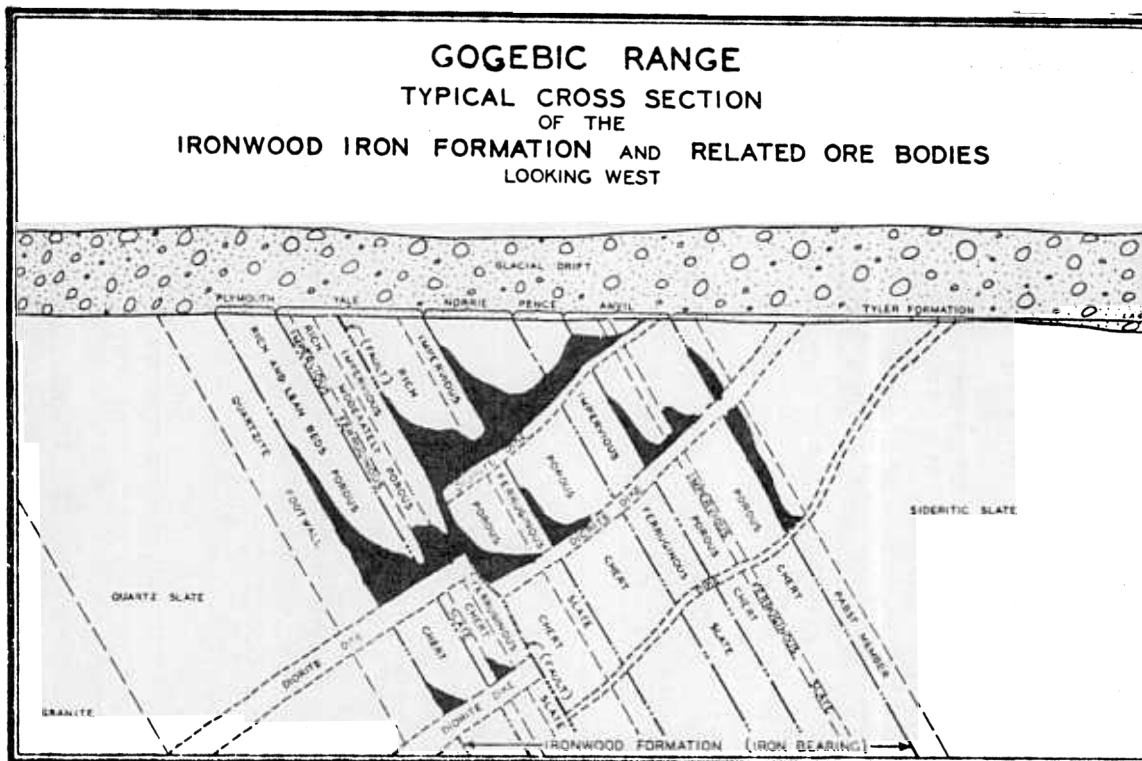
Author: Gene L. LaBerge

Description: The waste piles here are typical of the natural "soft" iron orebodies throughout the Lake Superior region. The ore consists mainly of fine earthy mixtures of hematite, goethite, and "limonite," with nodular masses of botryoidal goethite. The waste pile is composed of highly oxidized iron formation containing too much silica to be used for iron ore.

Natural iron ore is formed from iron-formation by dissolving the silica from the rock and leaving the iron behind to accumulate. This involves dissolving and transporting almost 50% by volume of the rock! In northern Minnesota this leaching was accomplished by surface weathering. Here on the Gogebic Range and on the Marquette Range the leaching was done by rising hydrothermal solutions since many orebodies have no connection with the surface (Bailey & Tyler, 1960). As shown in the accompanying diagram, diabase dikes and impervious slate layers within the iron formation were important in channeling the flow of water that produced the natural iron ores.

Significance: Iron ore was first discovered in the Lake Superior region at Negaunee, Michigan, in 1844, and mining operations commenced shortly thereafter. Ore was discovered on the Gogebic range at Bessemer, Michigan, in 1873, and over 300 million tons of ore was mined before operations ceased in 1966 (Schmidt & Hubbard, 1972). Vast quantities of iron is still available from the iron formations if we can upgrade them by removing the silica (taconite operation).

Several intriguing questions arise concerning the natural ores. Where did the hundreds of millions of tons of silica dissolved from the orebodies go? Was it carried in solution to the sea? How long did it take to form the orebodies? When did the orebodies form? During the Precambrian? Paleozoic? Mesozoic? Tertiary? All four? There are reports of cobbles of iron ore in Keweenaw rocks north of here, so at least some ore is pre-Keweenaw.



From Schwartz (Ed.), 1956, G.S.A. Guidebook, Field Trip 1
"Precambrian of Northeastern Minnesota."

References:

- Bailey, S. W. and Tyler, S. A., 1960, Clay Minerals Associated with the Lake Superior Iron Ores, Econ. Geol., Vol. 55, pp. 150-175.
- Schmidt, R. G. and Hubbard, H. A., 1972, "Penokean Orogeny in the Central and Western Gogebic Region, Michigan and Wisconsin," Field Trip A, 18th Annual Institute on Lake Superior Geology, Houghton, Mich.