

Determining the Primary Iron Precipitate in Algoma-Type Banded Iron Formation: Mineralogy and Geochemistry of the Sherman Mine, Temagami, ON

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Abstract

Banded Iron Formation (BIF) is the most widely mined source of iron ore, yet is poorly understood in terms of its genesis and depositional history. This project examines Algoma-type BIF, an Archean chemical sediment associated with sequences of volcanic rocks and greywacke, considered to be a direct product of hydrothermal venting on the seafloor. Despite decades of mining at the Sherman Mine in Temagami during the 1970s and 80s, little is known about the ore types and their origins other than their classification as Algoma-type BIF. More than 10 million tons of iron ore from the Sherman Mine was excavated from three large open pits. Around 300 massive blocks of ore were left at the edges of the pits from which they were removed, providing an excellent archive of the ore types in the mine. An outcrop of Algoma-type BIF outside the mine also has provided samples for many studies of Archean ocean chemistry. Ore types will be categorized by the trace element geochemistry, sedimentary features and mineral composition of more than 200 samples. Of particular interest is whether hematite, magnetite or ferrous

hydroxide was the primary iron oxide precipitate and how those minerals have been transformed into the present-day assemblage. These conditions have particular bearing on the redox state of the Archean ocean. We will approach this question using petrographic methods to establish the mineral paragenesis, including links to silicate alteration (e.g., epidote), trace geochemistry (e.g., trace metals and REE as indicators of hydrothermal activity) and isotopic compositions (e.g. sulfur isotopes to determine euxinic character of the Archean ocean). Our field mapping in the Sherman Mine has yielded a general ore classification based on the common mineral assemblages observed. Mapping will provide insight into the area's tectonic history when considered alongside archived data from the Geological Survey of Canada.