

2019 Project Abstract

For the Period Ending June 30, 2022

PROJECT TITLE: Minerals and Water Research - Subproject 2: Western Mesabi Iron Resource Futures

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APPROPRIATION AMOUNT: \$275,000

AMOUNT SPENT: \$275,000

AMOUNT REMAINING: \$0

Sound bite of Project Outcomes and Results

This study initiated a long-term characterization program of the iron resources in Minnesota. Analysis of two sections of the iron formation produced a better understanding of the variability and potential for developing new iron-based products. With continued support, this program will provide a foundation for the future iron industry in Minnesota.

Overall Project Outcome and Results

Iron mining has been an important part of the economy of northern Minnesota for over a century. Today, mining companies process magnetite-rich taconite ore. Magnetite is important due to its chemical, magnetic, and thermal properties. All iron mining companies encounter magnetite that has been oxidized to various degrees. Minor amounts of oxidation can negatively impact the economic processing of iron ore, so oxidized material is either not mined or mined and stockpiled. Significant unoxidized parts of the iron formation are also stockpiled because they cannot be economically processed with current technology.

The purpose of this study was to initiate a long-term comprehensive characterization program of the remaining iron resources of the Mesabi Iron Range to provide a foundation for future iron industry in Minnesota. This data is being used to direct research in the areas of reducing reliance on fossil fuels, reducing emissions, and to identify and develop value-added iron products that could be produced from under-utilized portions of Minnesota iron resources. This approach can also be applied to understanding and processing waste iron stockpiles. This study has been leveraged to obtain additional State and Federal support for other mineral related studies in Minnesota.

Two complete sections of the iron formation were analyzed in this study. The results have contributed to a better understanding of the mineralogical variability within the iron formation; the impacts of oxidation on iron product quality; the potential for new iron-based products; and the presence of trace elements. Furthermore, this study also indicated that there may be a significant resource of siderite, an iron carbonate mineral, on the Mesabi Range. While siderite is unlikely to be a primary source of metallic iron, there may be other applications for siderite. Future research will focus on opportunities to reduce environmental impact while creating value-added iron products in Minnesota.

Project Results Use and Dissemination

- Presentations
 - Minnesota Minerals Coordinating Committee 2021 Virtual Cloquet Workshop Agenda Lightning Talks (4/23/2021)

- SME Minnesota Conference 2022 Presentations (4/13/2022)
- Minnesota Iron Ore and the Green Economy webinar (3/16/2022)
- Articles
 - Business North: *'Iron of the Future' program looks to new iron making technologies*, Lee Bloomquist Sep 16, 2021 Article.
 - Business North: *A bright future for mining*, Lee Bloomquist Dec 27, 2021 Article.
- Technical Report
 - Johnson, R.C., Mlinar, M.A., Spigarelli, B.P., Post, S. *Western Mesabi Iron Resource of the Future*. Natural Resources Research Institute. September, 2022. Report NRRI/TR-2022/11.