



Environmental Study of Mineral Dust in Population Centers on Mesabi Iron Range: Progress Report



Biwabik Iron Formation outcrop at Peter Mitchell Mine in Babbitt, MN.

OBJECTIVE: Characterize mineral dust produced by mining taconite in northeastern Minnesota with emphasis on elongated mineral particles

Key Questions:

What are the long-term mean particulate matter characteristics in Mesabi Iron Range population centers and are they significantly different from the particulate matter characteristics in non-Mesabi Iron Range towns/cities in northeast Minnesota?

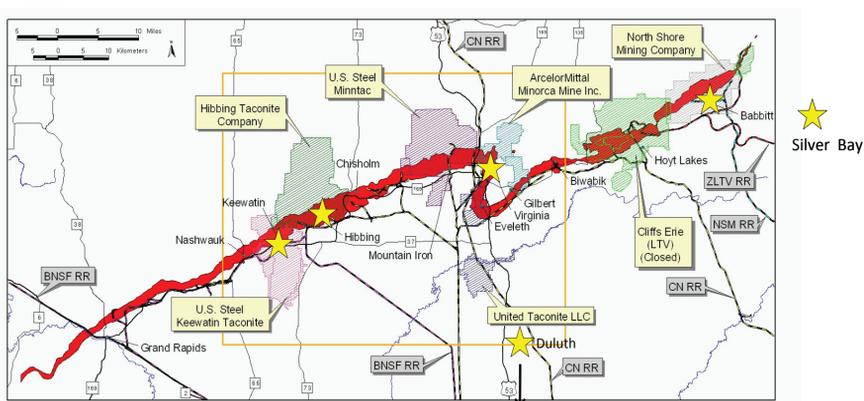
What are the ambient long-term average elongated mineral particle (EMP) concentrations in population centers on Mesabi Iron Range?

How do episodic events, such as blasting, at nearby taconite operations effect sporadic EMP concentrations in population centers across the Mesabi Iron Range?

Have the mineral particles, and potentially fibers, emitted from taconite operations changed over time in response to increased regulation, and the implementation of more effective dust control procedures?

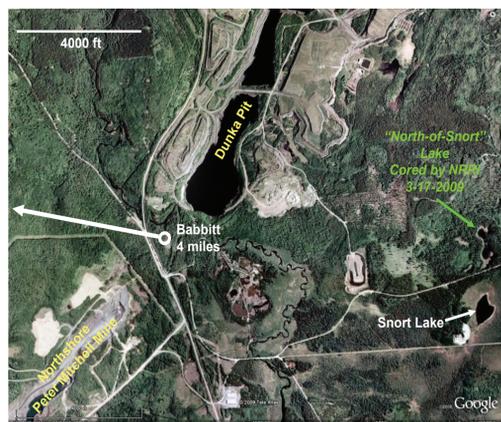
APPROACH

Air Sampling Along the Mesabi Iron Range ★ Ely



Air sampling locations along Iron Range communities and processing plants (stars) as well as in Duluth and Ely for comparison. Samplers are placed in public locations: Keewatin Elementary School, Hibbing High School, Virginia City Hall, Babbitt Municipal Building, Ely Forest Service Station, Silver Bay High School, and Duluth NRRI.

Lake Sampling



Dated lake sediment cores from the west and east range will be used to evaluate how historic conditions compare with the present. North-of-Snort Lake (above) was cored in March, 2009.

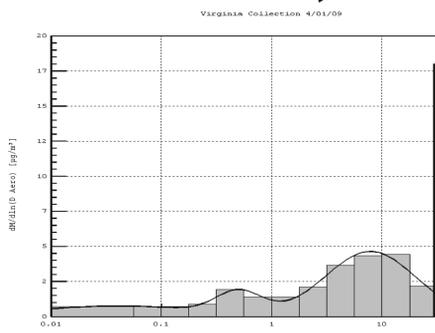
Air Sampling Strategy



Air samples are collected using Micro-Orifice Uniform Deposit Impactors (MOUDI) and are housed at sampling stations. Example of impactors at University of Minnesota's Particle Calibration Lab (Prof. Virgil Marple, Dept. of Mechanical Engineering, left) and sampling station Babbitt Municipal Building (right).

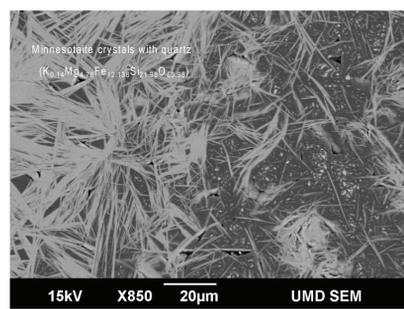
EXAMPLE DATA FROM VIRGINIA HORN AREA

Gravimetric Analysis

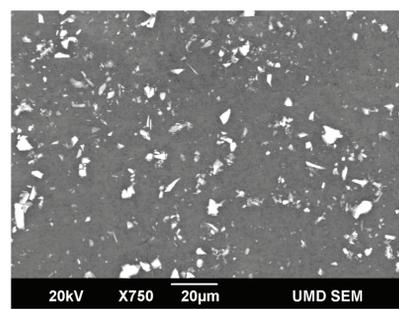


Particle weight distribution graph taken from an environmental sample collected at the Virginia City Hall sampling station. This graph suggests a bimodal distribution of particle size.

Scanning Electron Microscopy Analysis Strategy

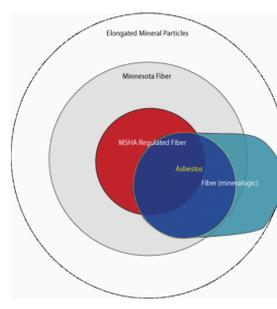


Backscatter Electron Image of Mesabi Iron Range drill core sample UPP030 in thin section. Crystal mineralogy is obtained as a reference for potential environmental particles.



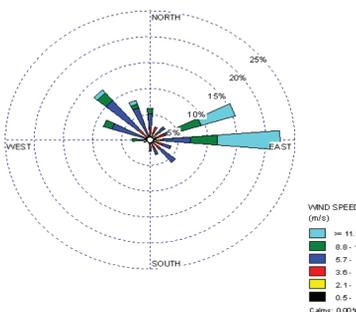
Mesabi Iron Range drill core sample UPP030 finely crushed and deposited on filter substrate at the NRRI laboratory.

What is Asbestos?

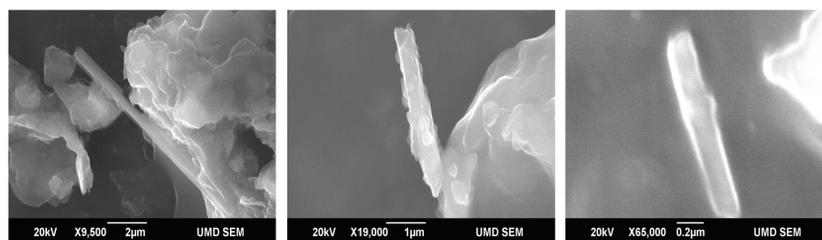


Asbestos: Asbestiform variety of six minerals (chrysotile and five amphibole minerals).
Minnesota Fiber: Chrysotile and amphibole mineral particles with 3-to-1 or greater aspect ratios.
MSHA-regulated Fiber: Chrysotile or regulated amphibole particle with an aspect ratio of 3:1 or greater, length of greater than 3 microns and a width greater than 0.25 microns.
Fiber: Crystal or polycrystalline aggregate displaying "fibrous" growth habit.
Elongated Mineral Particle (EMP): "single crystal or similarly elongated polycrystalline aggregate particle with a length to width ratio of 3 to 1 or greater" (Bruce Vento Ban Asbestos and Prevent Mesothelioma Act of 2007)

Wind Distribution Compass

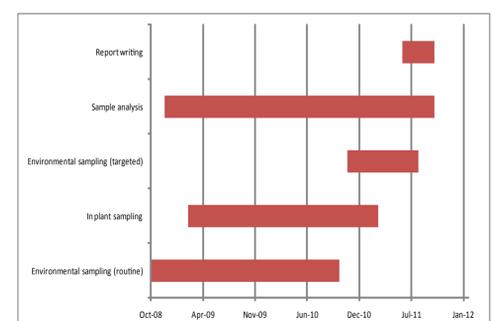


Compass graph displaying the direction and intensity of meteorologic wind during sample collection at the Virginia City Hall sampling station.



Scanning Electron Images of particles collected at the Virginia City Hall Sampling Station.

Taconite Particulate Project Timeline



Every reasonable effort has been made to ensure the accuracy of the factual data of which this poster interpretation is based; however, the University of Minnesota does not warrant or guarantee that there are no errors. Users may wish to verify critical information. In addition, every effort has been made to ensure that the interpretation conforms to sound geologic and cartographic principles, however, no claim is made that the interpretation is rigorously correct.
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