NLSAP

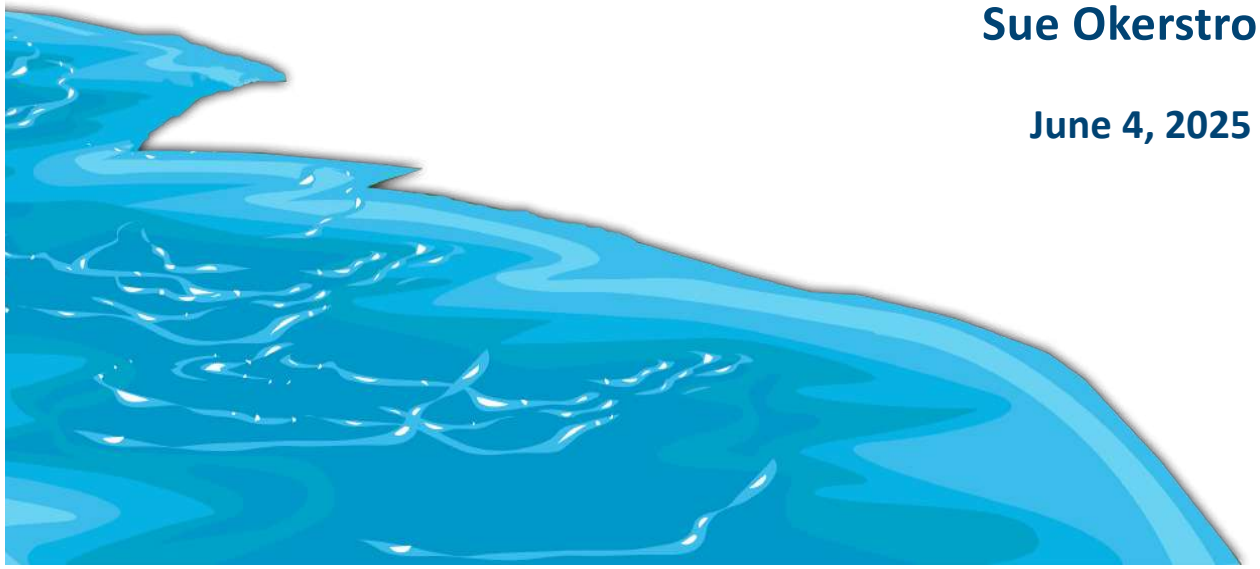
Northern Lakes Scientific Advisory Panel

Tamarack Water Alliance Presentation

by

Sue Okerstrom

June 4, 2025



Contact us at: info@nlsap.org

Saving NE MN Lakes from Pollution

- BWCA
- Voyager National Park
- Lake Superior

Sue Okerstrom Photo

NLSAP
Northern Lakes Scientific Advisory Panel

Mission statement:

The purpose of the Northern Lakes Scientific Advisory Panel is to provide data to Minnesota state agencies and policymakers that support the development of environmentally sound and economically productive guidelines for managing water resources in Minnesota's Northern Lakes and Forests ecoregion.

Sue Okerstrom Photo

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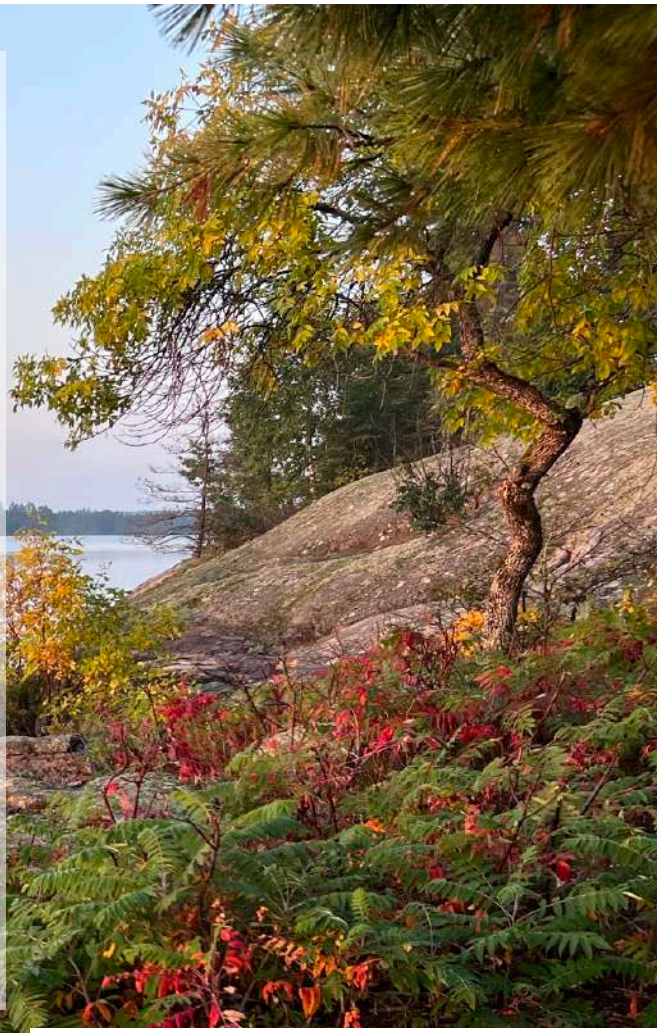
List of accomplishments

1. Accredited by the Minnesota Pollution Control Agency (MPCA) to analyze water and have the results uploaded to the MPCA Surface Water Quality database and web application.
2. Monitored sulfate concentration in Langley Creek and the Dunka River since 2015.
3. The earliest modern method of testing sulfate levels for some BWCA lakes.
4. The earliest modern method of testing mercury levels in major Voyageurs Park lakes.
5. Traced the downstream flow of sulfate pollution for 175 miles from Virginia through Voyageurs National Park lakes to International Falls
6. The first study to demonstrate that excessively high mercury levels in Voyageur Park walleyes are attributable to elevated sulfate concentrations.
7. Traced downstream flow of sulfate pollution for 50 miles from Babbitt through the BWCA to Crooked Lake.
8. Earliest external technical analysis of the PolyMet surface water discharge permit, including locations and number of surface discharge sites, and quantification of limits on pollutants, including mercury and sulfate.



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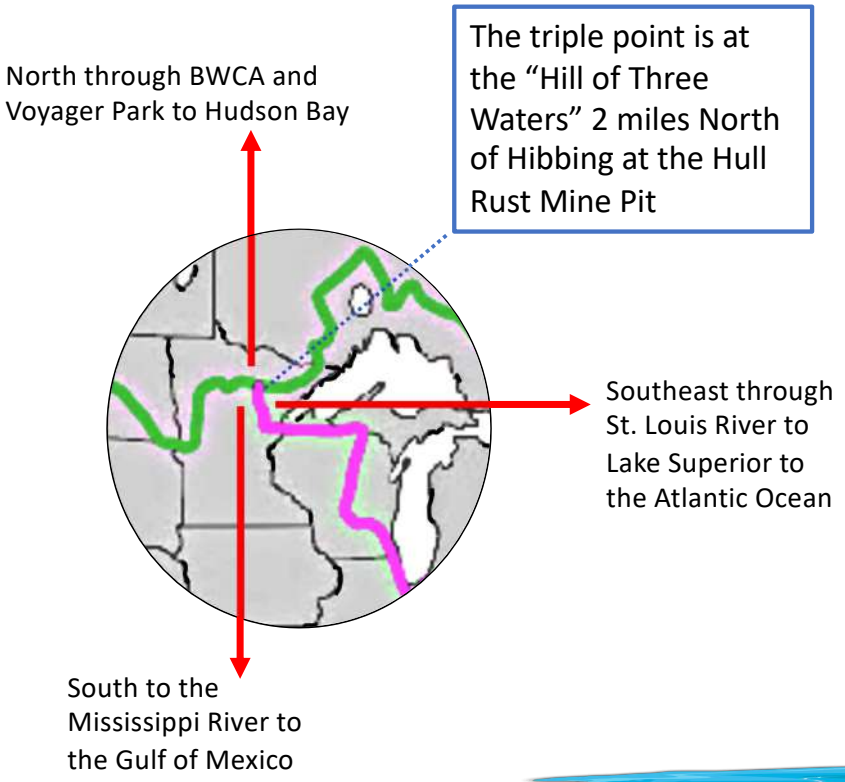
Water Flow Direction



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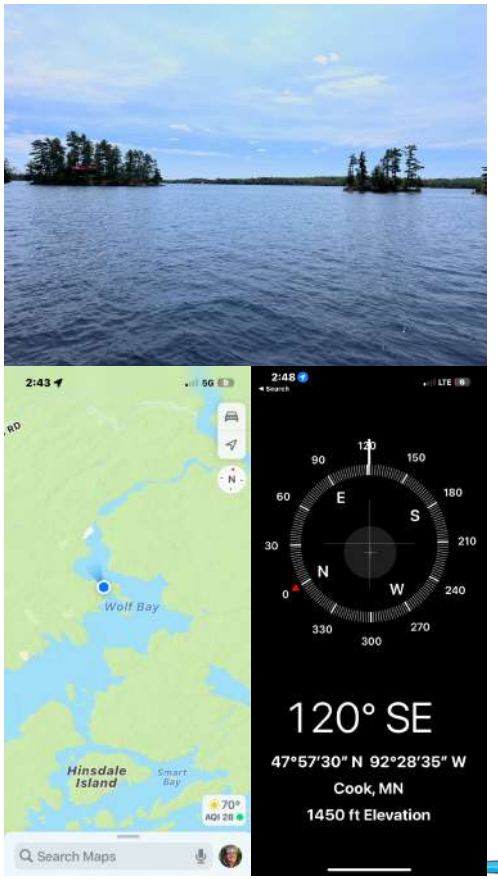
https://clui.org/ludb/site/hill-three-waters

Water sampling, testing, and results reporting



Following sulfates from mine tailings discharge through watersheds to Voyager National Park and BWCA.

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Water sampling, testing, and results reporting



Following sulfates from mine tailings discharge through watersheds to Voyager National Park and BWCA.

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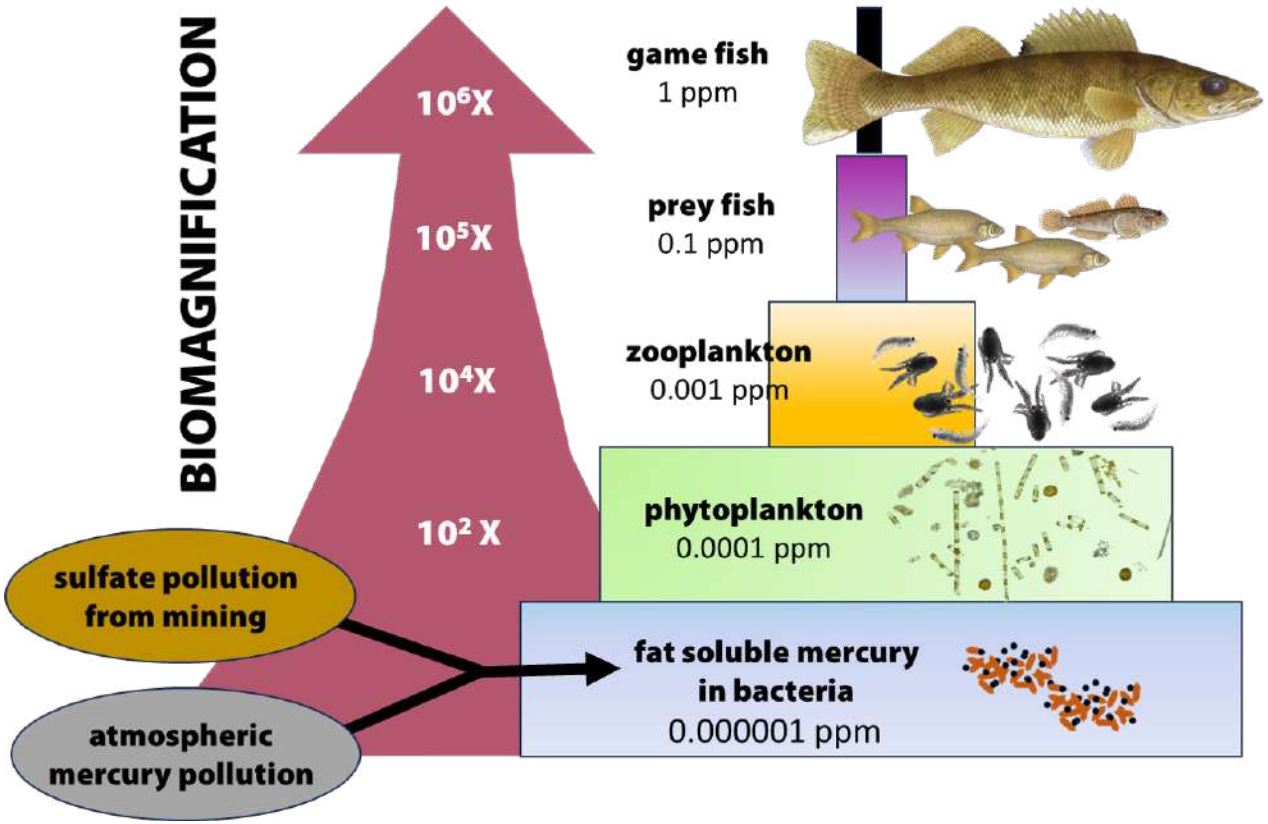
Results: Sulfate Pollution of the BWCA & Voyageurs Park

- Mines are releasing sulfate pollution into Voyageurs Park and the BWCA watersheds
- Sulfate pollution is increasing and causing alarming levels of mercury in game fish*
- Voyageurs Park and the BWCA are protected Wilderness Areas highly prized for game fishing, recreation and tourism
- Minnesotans consume these contaminated fish, increasing health risks
- Legislative action is required to stop sulfate pollution

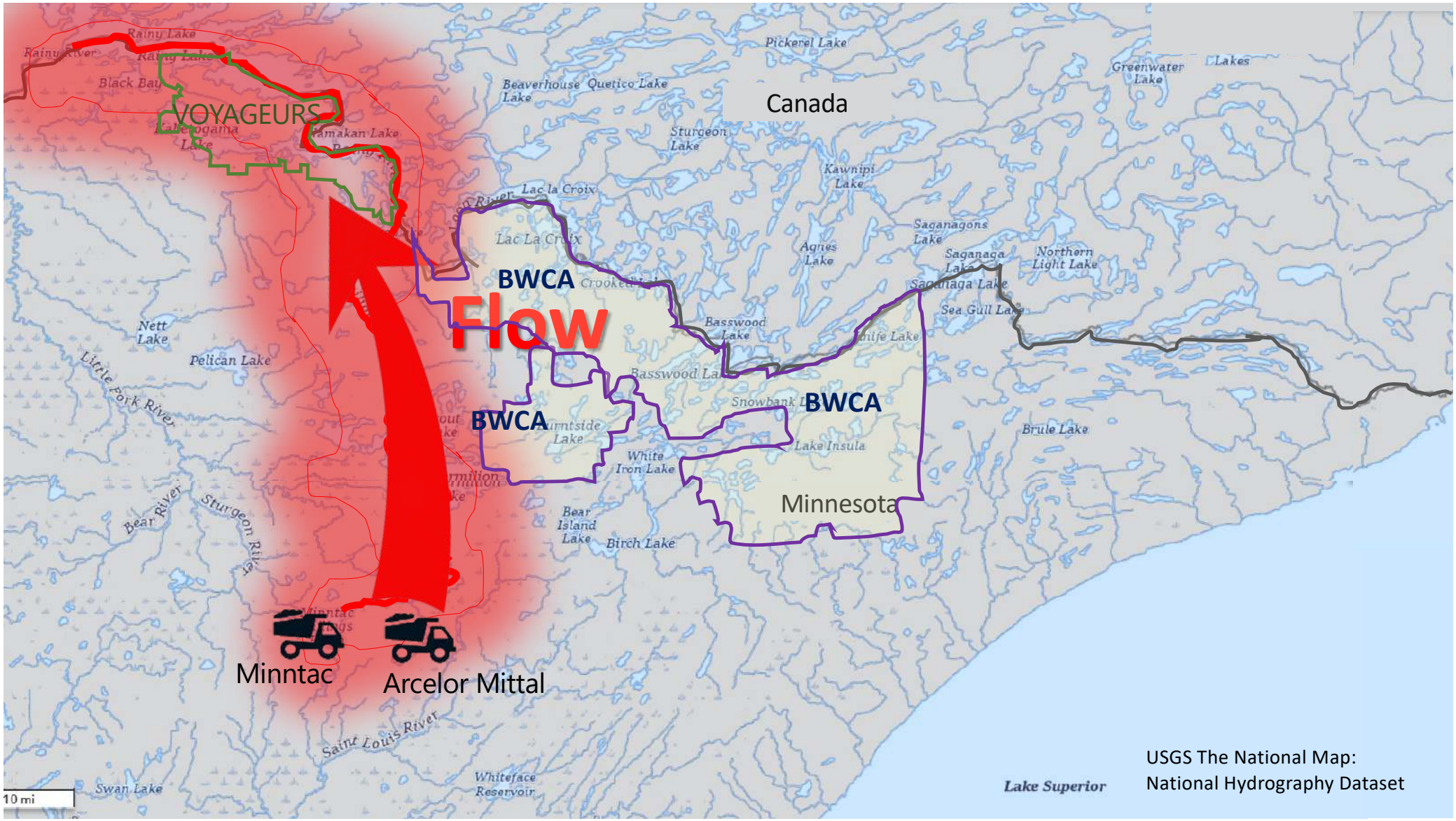
*For the BWCA and Voyageurs Park, sulfate is the most concerning mine pollutant because of the large amount entering the environment and the low threshold for harm. In 2024, three thousand tons of sulfate mine waste flowed into Voyageurs Park via the Vermilion River, where only seven parts per million is enough to cause mercury concentrations in walleyes to quadruple, as compared to lakes with no sulfate pollution.

Mercury Contamination of Fish: Voyageur's Park Lakes Study

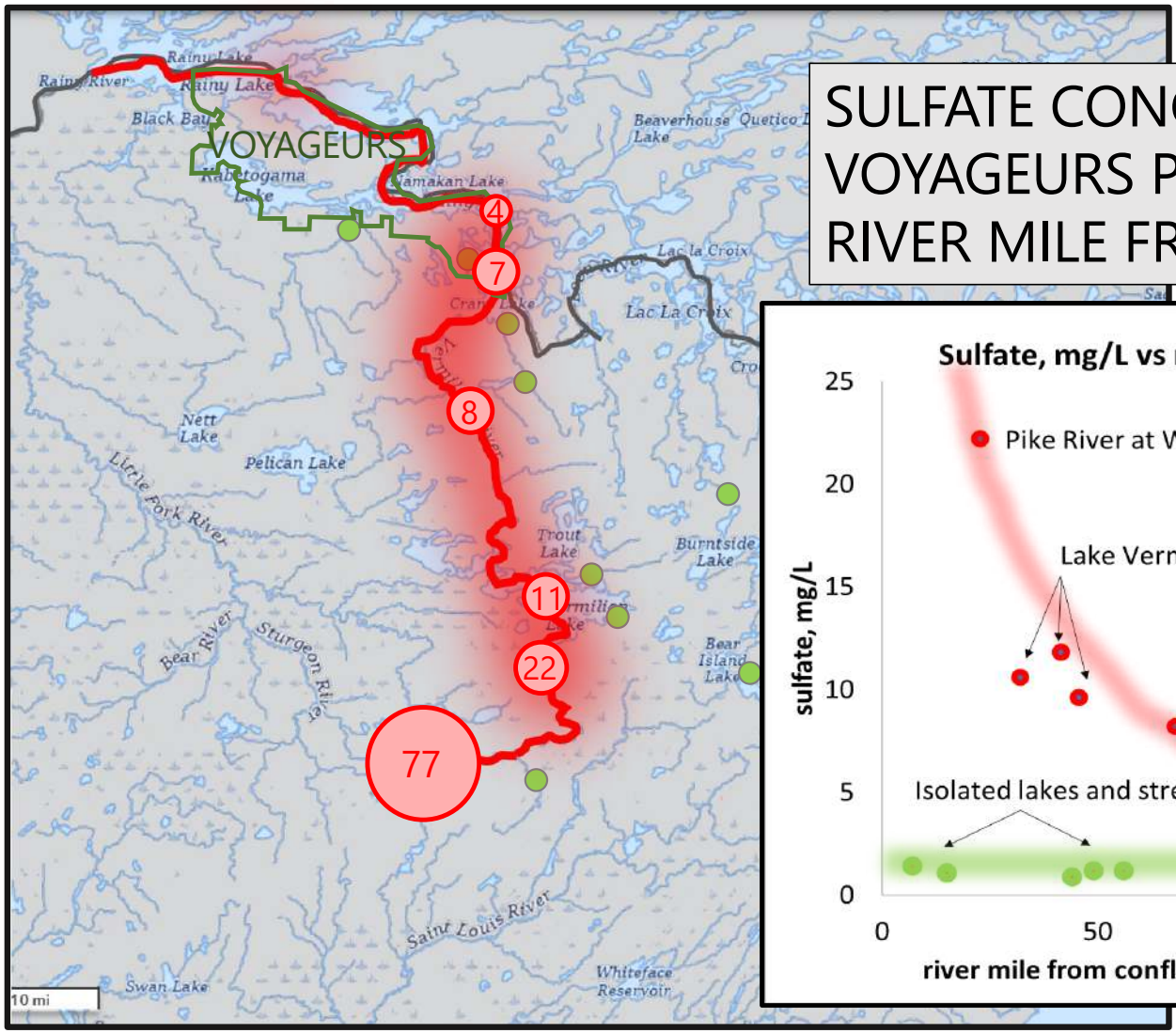
SULFATE → MERCURY METHYLATION
FOOD CHAINS BIOMAGNIFY METHYL MERCURY > 1 MILLION FOLD

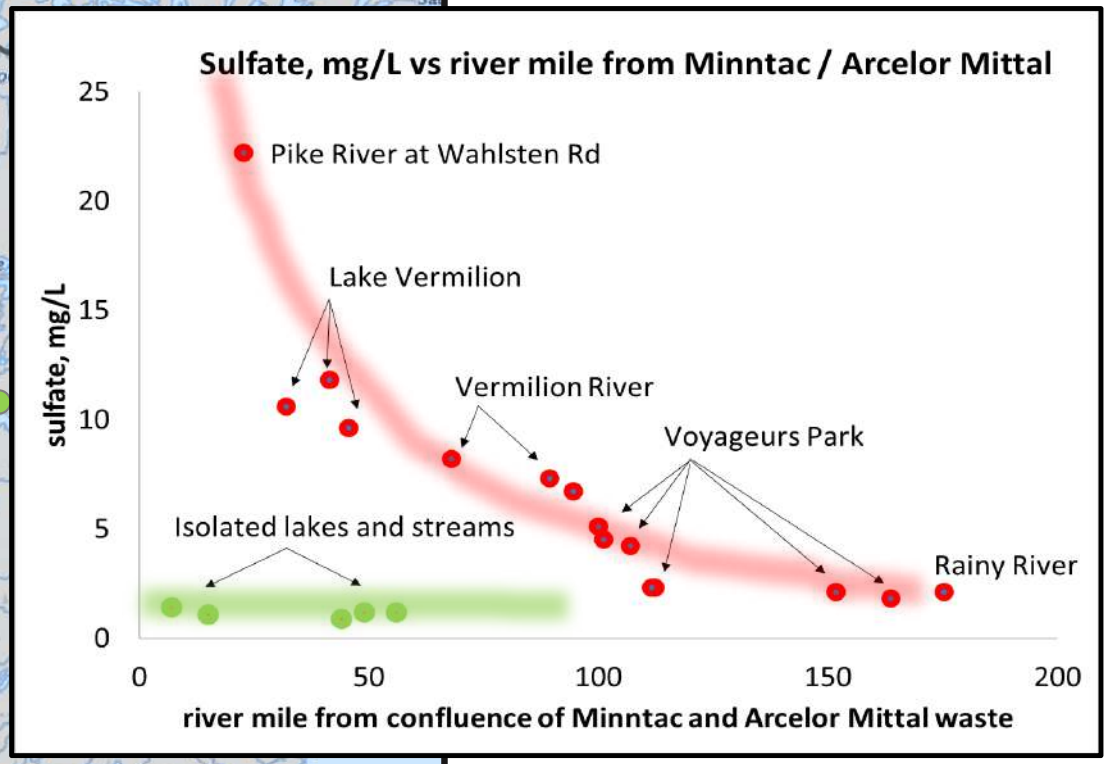


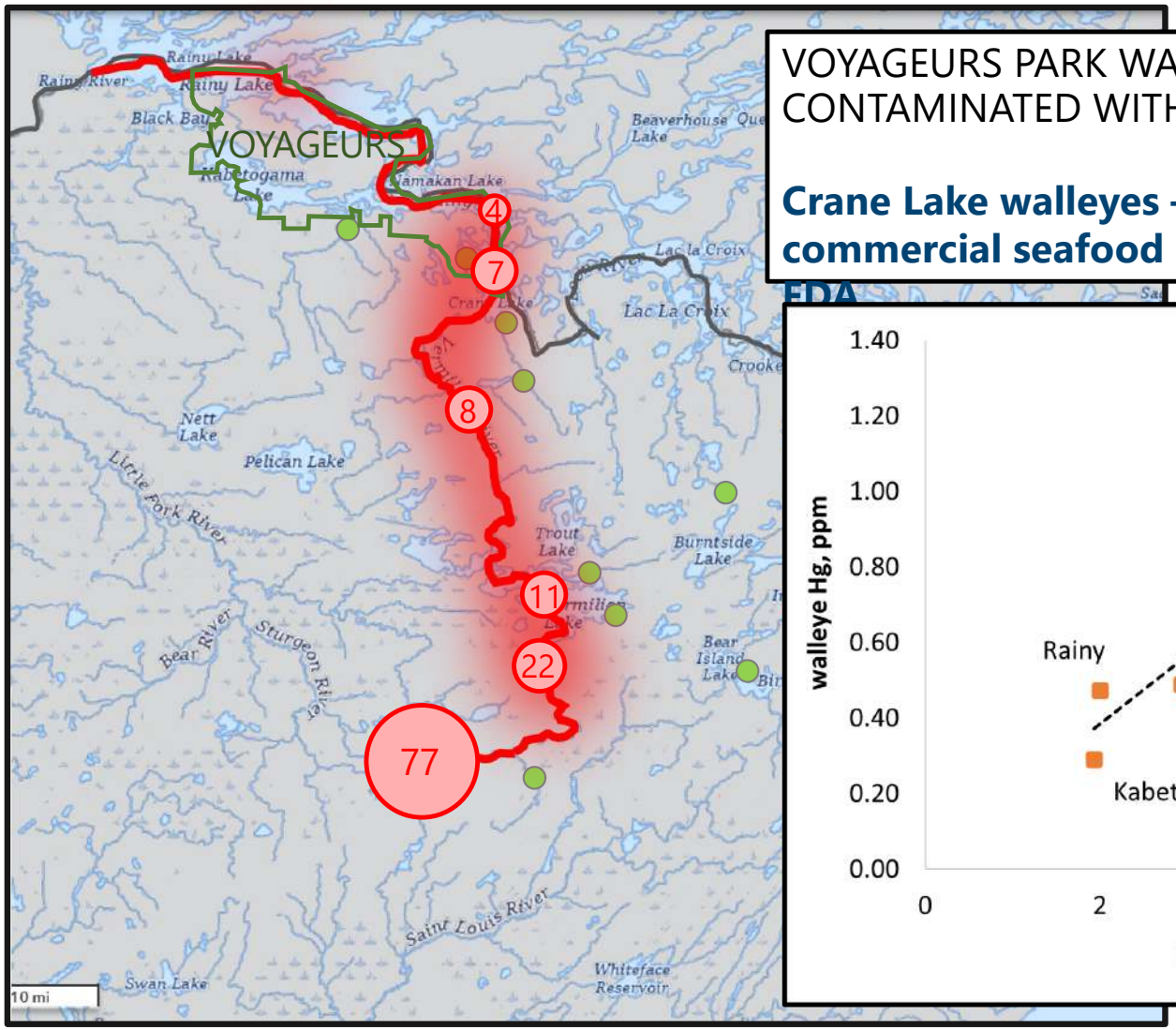
Fat soluble toxins including perfluorinated alkylated substances (PFAS), polychlorinated biphenyls (PCBs), and methyl mercury biomagnify in food chains.


VOYAGEURS
Canada
BWCA
Flow
BWCA
BWCA
Minnesota
Minntac
Arcelor Mittal
Rainy Lake
Rainy River
Black Bay
Beaverhouse Lake
Quetico Lake
Pickerel Lake
Greenwater Lake
Lakes
Sturgeon Lake
Kawnipi Lake
Lac la Croix
Lac La Croix
Agnes Lake
Saganagons Lake
Saganaga Lake
Northern Light Lake
Sea Gull Lake
Basswood Lake
Snowbank Lake
Lake Insula
Brule Lake
White Iron Lake
Bear Island Lake
Birch Lake
Nett Lake
Pelican Lake
Little Fork River
Bear River
Sturgeon River
Saint Louis River
Whiteface Reservoir
Swan Lake
Lake Superior
10 mi
USGS The National Map:
National Hydrography Dataset

SULFATE CONCENTRATIONS IN VOYAGEURS PARK LAKES VS RIVER MILE FROM SOURCE

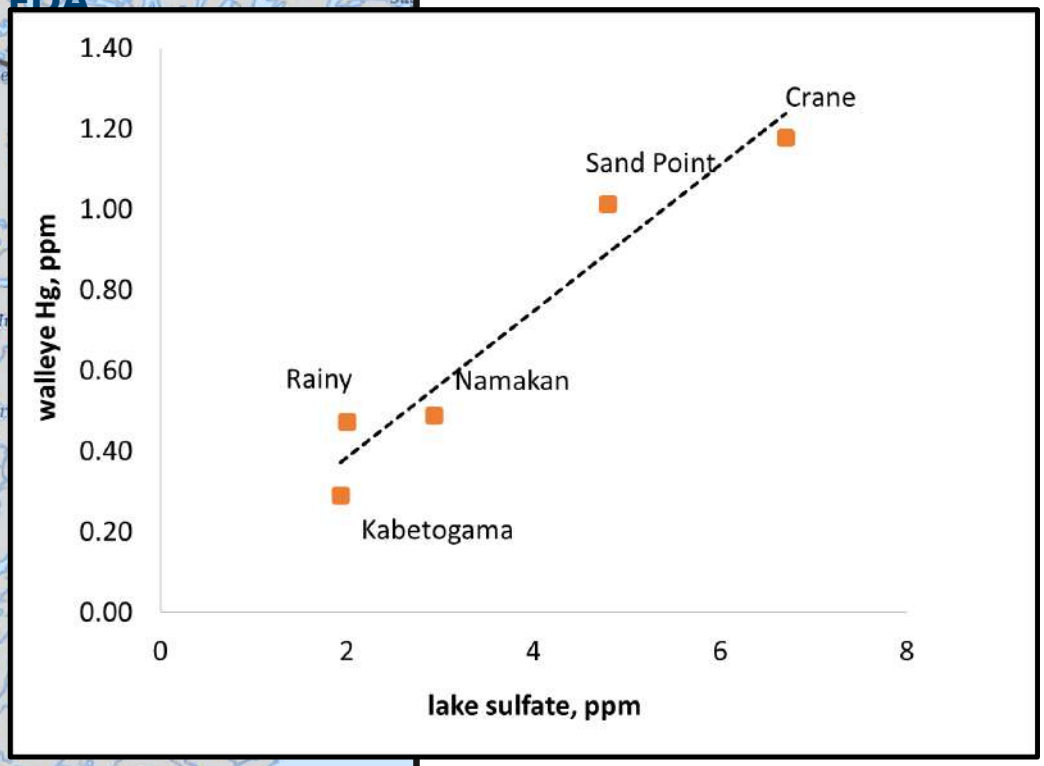






VOYAGEURS PARK WALLEYES ARE SEVERELY CONTAMINATED WITH MERCURY BECAUSE OF SULFATE

Crane Lake walleyes – WORSE than 64 of 65 commercial seafood species monitored by the US EDA



It is time to act:

Regulate the amount of sulfate discharge from iron mine tailings ponds, resulting in high mercury in fish and danger to our health.

- 3,000 tons of sulfate flow down the Vermilion River into Voyageurs Park each year
- 10,000 tons of sulfate flow down the St. Louis River to Lake Superior each year
- Fish in Voyageurs Park lakes and the St. Louis River Estuary are heavily contaminated with mercury

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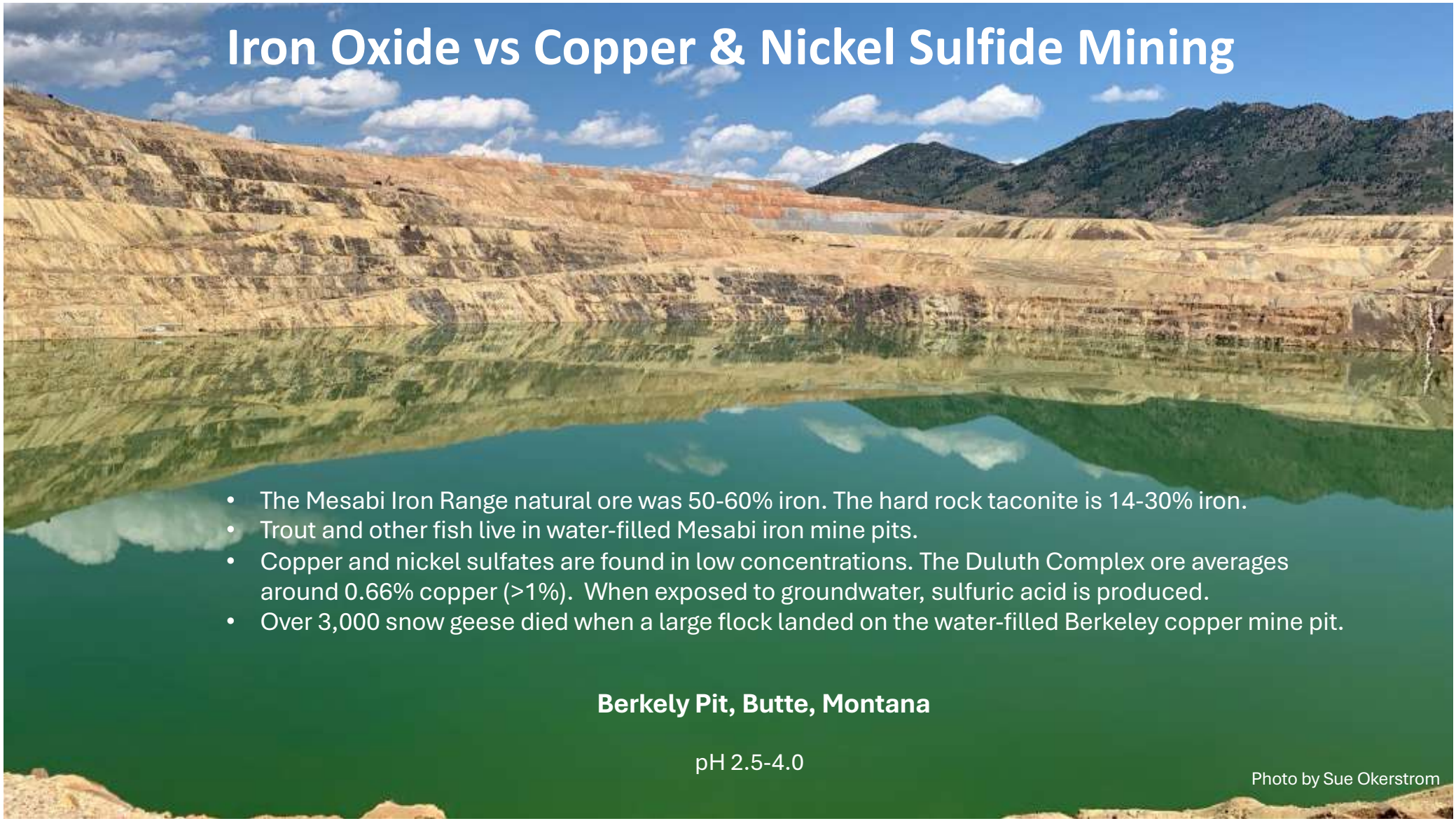
Iron Oxide vs Copper & Nickel Sulfide Mining



- The Mesabi Iron Range natural ore was 50-60% iron. The hard rock taconite is 14-30% iron.
- Trout and other fish live in water-filled Mesabi iron mine pits.
- Copper and nickel sulfates are found in low concentrations. The Duluth Complex ore averages around 0.66% copper (>1%). When exposed to groundwater, sulfuric acid is produced.
- Over 3,000 snow geese died when a large flock landed on the water-filled Berkeley copper mine pit.

Berkely Pit, Butte, Montana

pH 2.5-4.0

Photo by Sue Okerstrom

Video details - YouTube Stud | Berkeley Pit History | 1955 -

pitwatch.org/learn/history-of-berkeley-pit-water/

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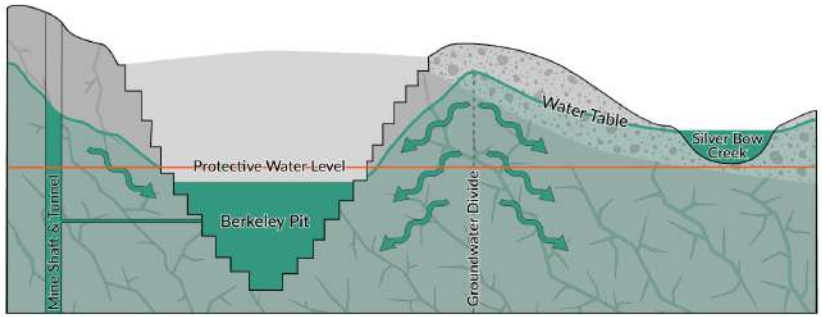
Groundwater

Butte's groundwater system consists of two aquifers, the bedrock aquifer (hard rock) and alluvial aquifer (sandy gravel near the earth's surface and below the soil layer). Water found in alluvial aquifers collects in the spaces between the grains of sand and gravel. Water in bedrock aquifers collects in naturally occurring fractures. Bedrock aquifers are typically found deep below the surface under layers of soil and sandy gravel. Alluvium is a mixture of sand and gravel found on top of bedrock and below the soil layer. A good example of alluvium are the sands that lie on the banks and beds of rivers and streams.



This illustration depicts the bedrock aquifer and alluvial aquifers in Butte. The Berkeley Pit is within the bedrock aquifer and captures and contains acid mine drainage from the mine shafts and tunnels located in the bedrock aquifer. Area surface waters pass through the alluvial aquifer and are separate from contaminated groundwater so long as the water in the Berkeley Pit remains below the protective water level. Rendering courtesy of Clark Fork Watershed Education Program for PitWatch.

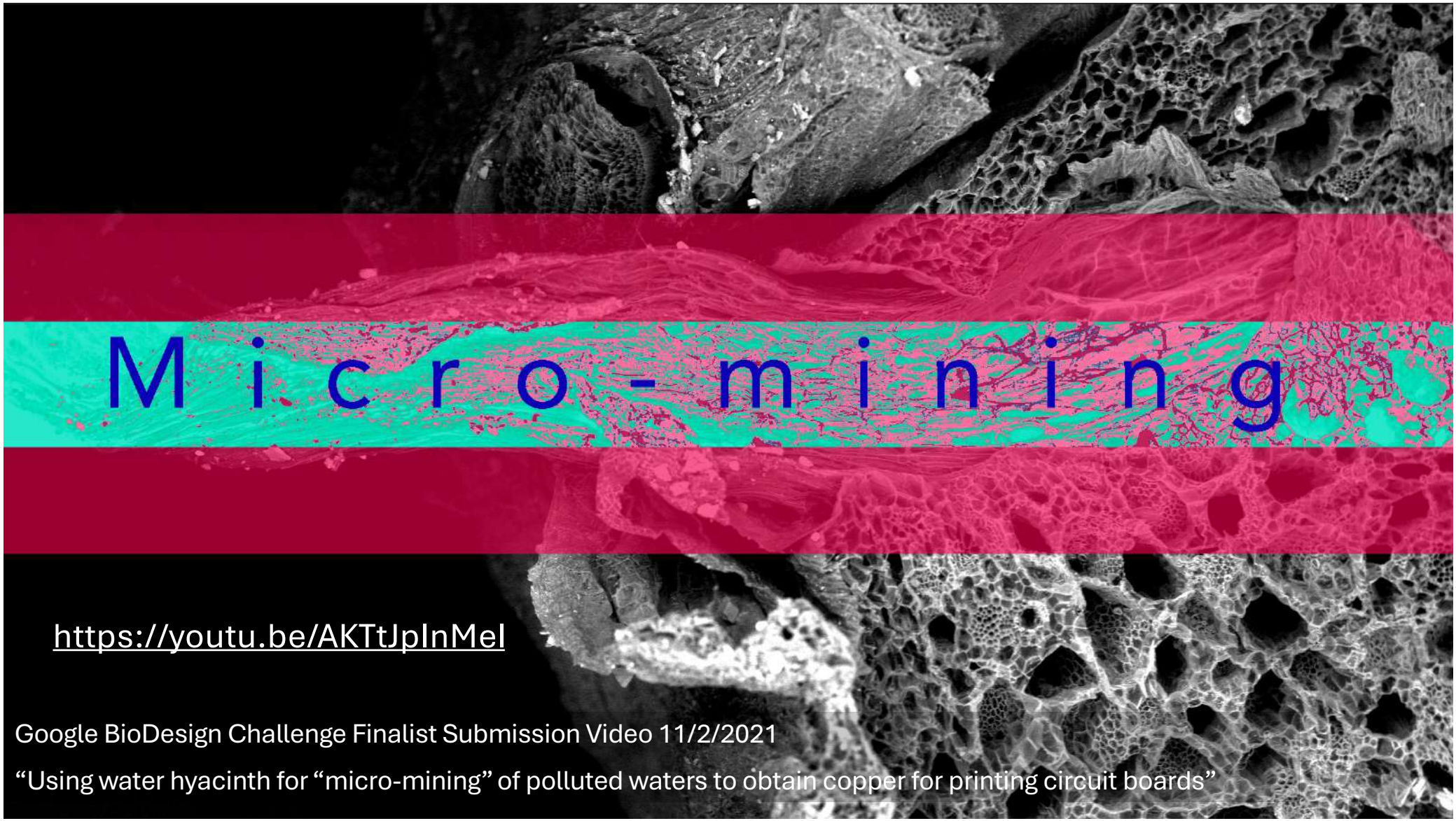
Underground Mining

When it comes to mining, water is both an asset and a liability. In Butte, the presence of groundwater relatively close to the surface created an imposing challenge for underground mining operations. In order to

Click to go to
"Pit Watch" site

Polymet Site


Part II – Reclaiming Critical Metals (RCM)
From
Electronic Waste (E-waste)
Sue Okerstrom photo

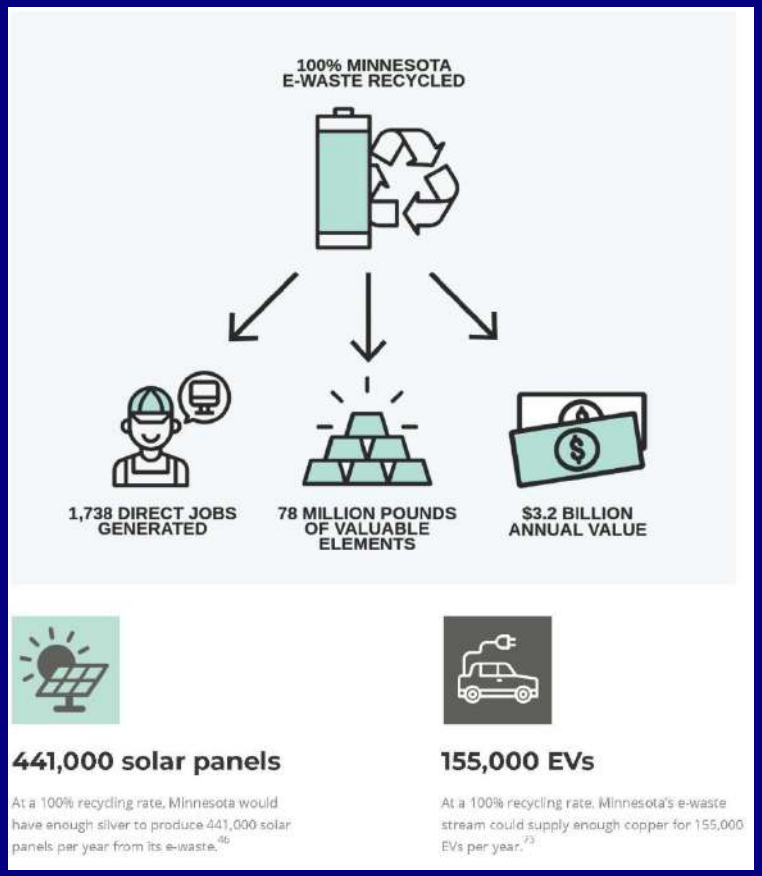


https://youtu.be/AKTtJpInMeI

Google BioDesign Challenge Finalist Submission Video 11/2/2021

“Using water hyacinth for “micro-mining” of polluted waters to obtain copper for printing circuit boards”

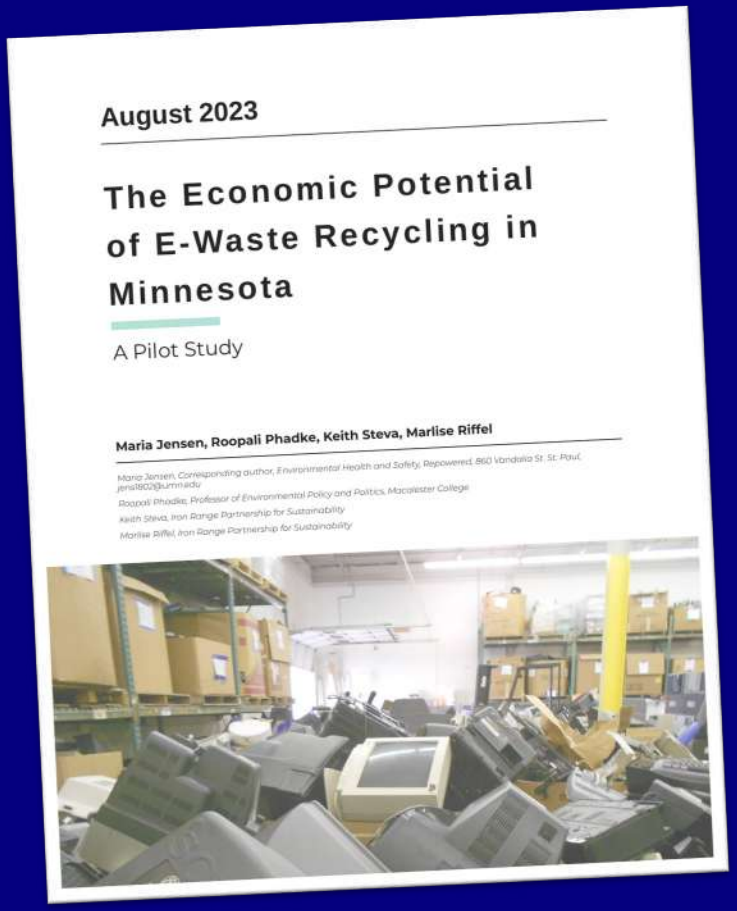

PROTECT THE BOUNDARY WATERS !
RECYCLE COPPER
A 20% increase in USA copper recycling will eliminate the need for
13 PolyMet mines
The RECA 20% Campaign
We will work with energy & environment NGOs; industry; governments and Tribes to increase USA copper recycling from 33% to 53%.
Europe is already at 60%



IRON RANGE PARTNERSHIP FOR Sustainability
COMMUNITY · ECONOMY · ENVIRONMENT

RECA
RECYCLING ELECTRONICS FOR CLIMATE ACTION

MACALESTER


August 2023

The Economic Potential of E-Waste Recycling in Minnesota

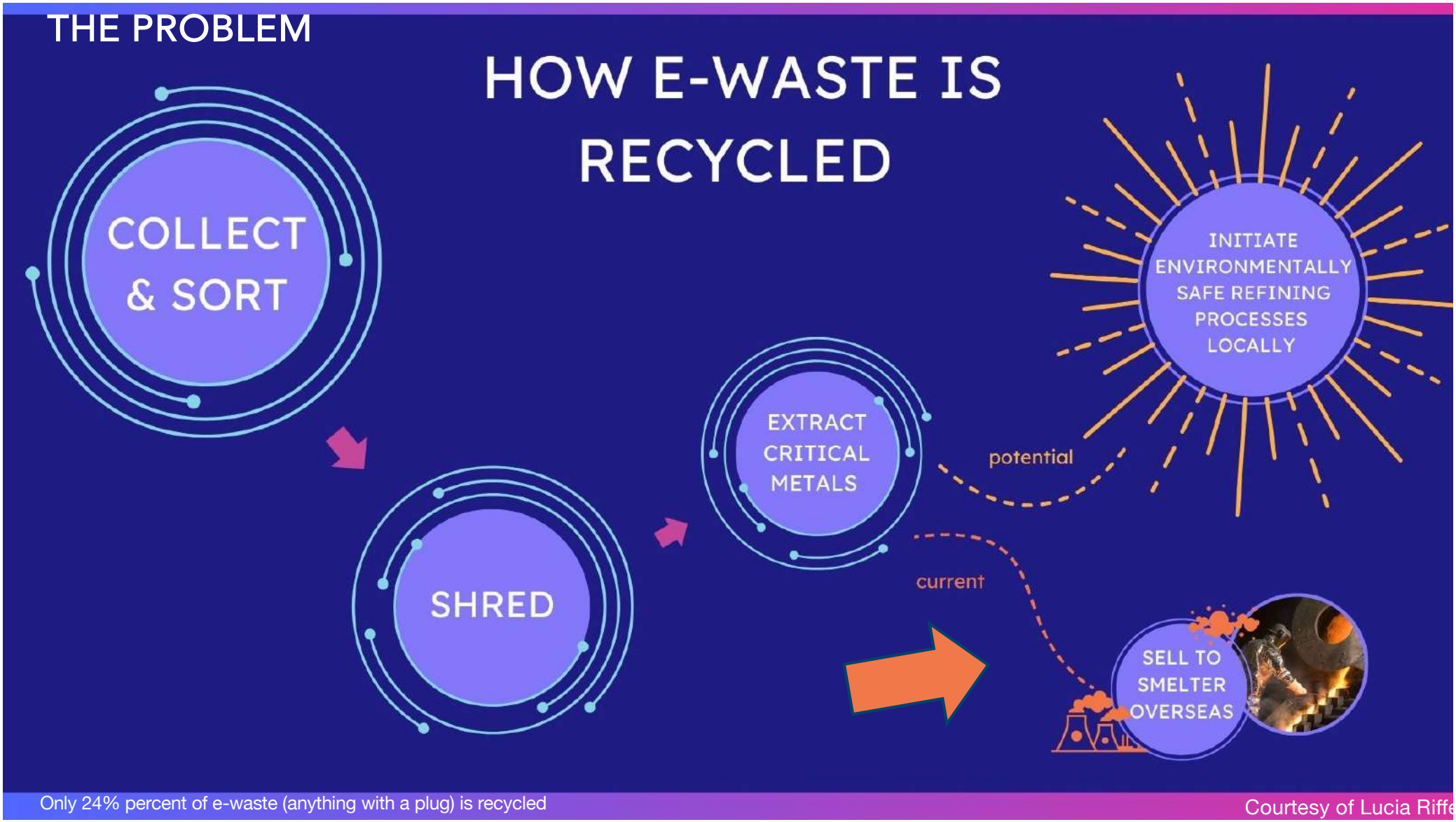
A Pilot Study

Maria Jensen, Roopali Phadke, Keith Steva, Marlise Riffel

Maria Jensen, Corresponding author, Environmental Health and Safety, Repowered, 860 Vandalia St. St. Paul, jensi860@umn.edu
Roopali Phadke, Professor of Environmental Policy and Politics, Macalester College
Keith Steva, Iron Range Partnership for Sustainability
Marlise Riffel, Iron Range Partnership for Sustainability

chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://static1.squarespace.com/static/5829dc7ad482e98c45949d85/t/650894db6a67e450478a432f/1695061214915/8-31-23_e-waste_report_final_withreferences.pdf

THE PROBLEM



Only 24% percent of e-waste (anything with a plug) is recycled

Courtesy of Lucia Riffe

Nature’s Miners

Heavy metal accumulators

Orange Lichen Thallus

Water Hyacinth Roots

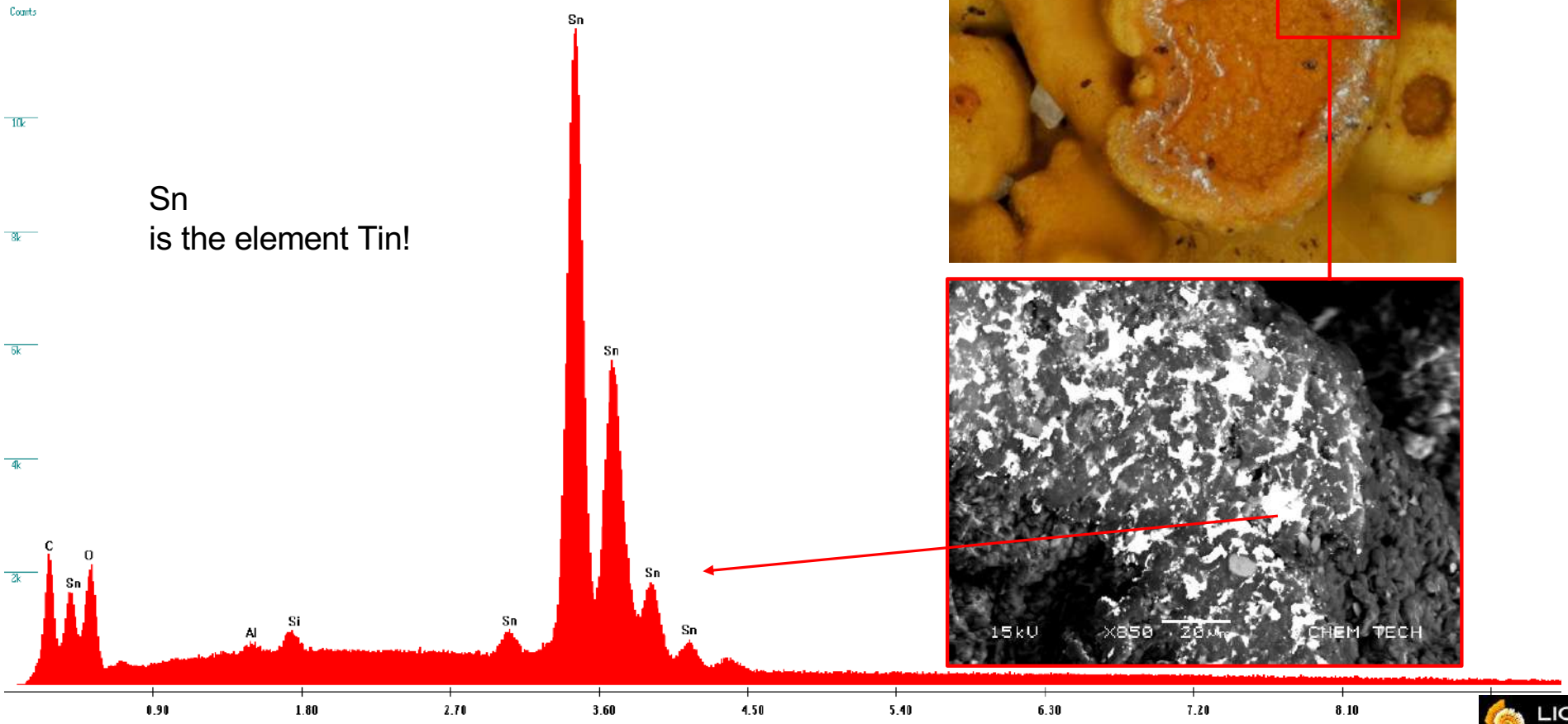
Fishing Spider Fangs

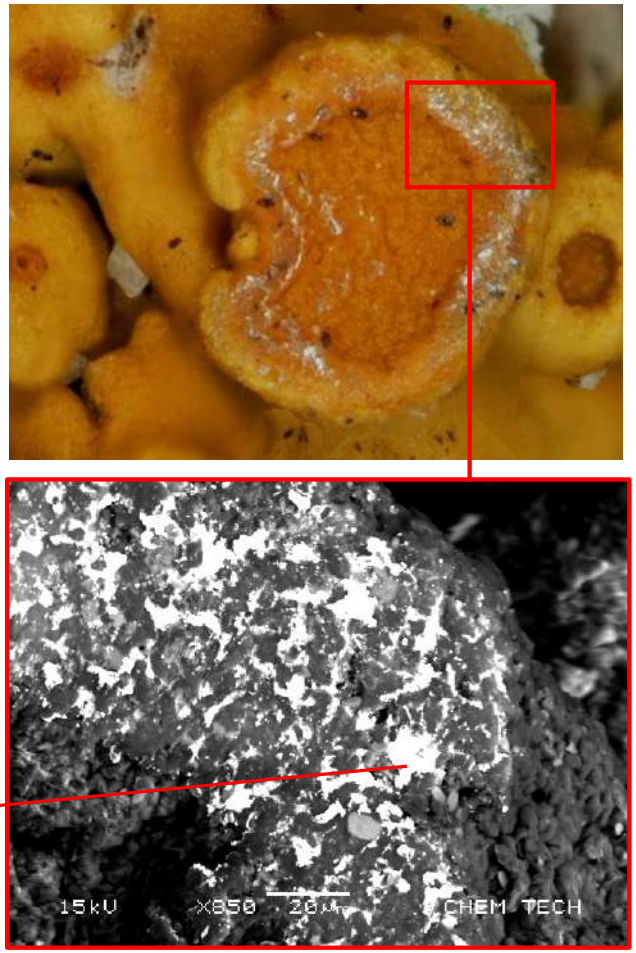
LICHEN LABS

Orange Lichen

- Heavy metal accumulator - Atmosphere

Sn
is the element Tin!

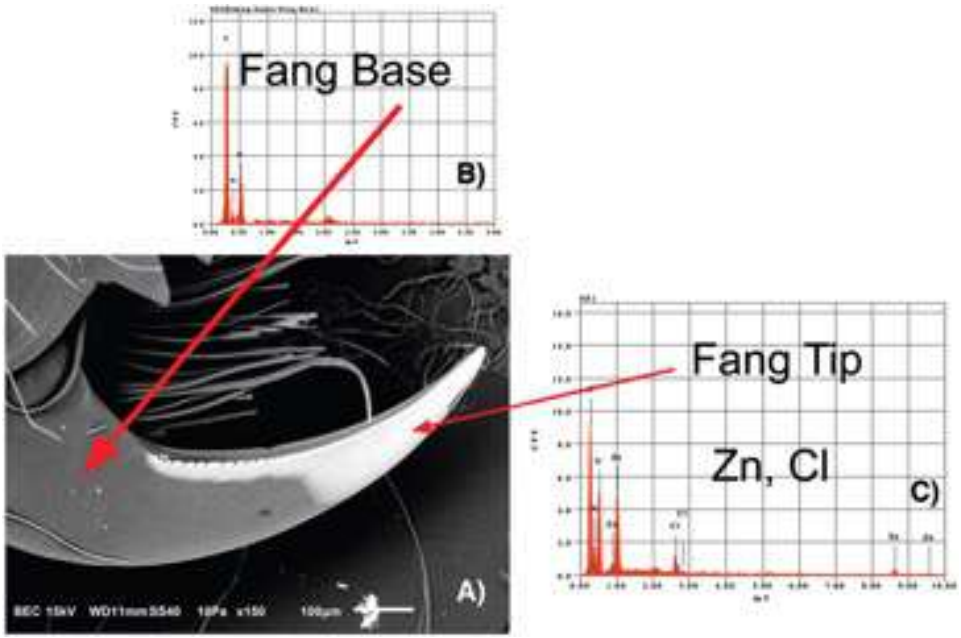




LICHEN LABS

Fishing Spider

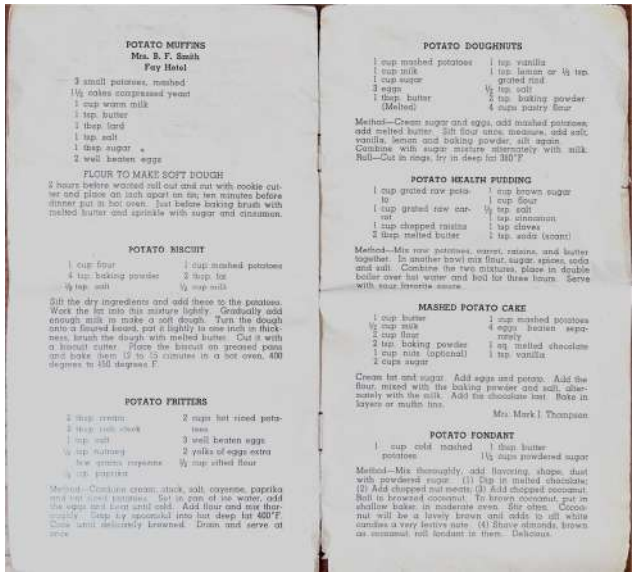
- Heavy metal accumulator - Diet
  - Zinc tipped fangs



LICHEN LABS

Potatoes

- Heavy metal accumulator - Soil
  - – Mineral Rich



POTATO MUFFINS
Mrs. B. F. Smith
Fay Hotel

3 small potatoes, mashed
1½ cakes compressed yeast
1 cup warm milk
1 tsp. butter
1 tbsp. lard
1 tsp. salt
1 tbsp. sugar
2 well beaten eggs

FLOUR TO MAKE SOFT DOUGH

2 hours before wanted roll out and cut with cookie cutter and place an inch apart on tin; ten minutes before dinner put in hot oven. Just before baking brush with melted butter and sprinkle with sugar and cinnamon.

POTATO BISCUIT

1 cup flour
4 tsp. baking powder
½ tsp. salt
1 cup mashed potatoes
2 tbsp. fat
½ cup milk

Sift the dry ingredients and add these to the potatoes. Work the fat into this mixture lightly. Gradually add enough milk to make a soft dough. Turn the dough onto a floured board, pat it lightly to one inch in thickness, brush the dough with melted butter. Cut it with a biscuit cutter. Place the biscuit on greased pans and bake them 15 to 25 minutes in a hot oven, 400 degrees to 450 degrees F.

POTATO FRITTERS

2 tbsp. cream
2 tbsp. milk chalk
1 tsp. salt
½ tsp. nutmeg
few grains cayenne
½ tsp. paprika
2 cups hot riced potatoes
3 well beaten eggs
2 yolks of eggs extra
½ cup sifted flour

Method—Combine cream, stock, salt, cayenne, paprika and hot riced potatoes. Set in pan of ice water, add the eggs and beat until cold. Add flour and mix thoroughly. Drop by spoonful into hot deep fat 400°F. Cook until delicately browned. Drain and serve at once.

POTATO DOUGHNUTS

1 cup mashed potatoes
1 cup milk
1 cup sugar
3 eggs
1 tbsp. butter (Melted)
1 tsp. vanilla
1 tsp. lemon or ½ tsp. grated rind
½ tsp. salt
2 tsp. baking powder
4 cups pastry flour

Method—Cream sugar and eggs, add mashed potatoes; add melted butter. Sift flour once measure, add salt, vanilla, lemon and baking powder, sift again. Combine with sugar mixture alternately with milk. Roll—Cut in rings, fry in deep fat 360°F

POTATO HEALTH PUDDING

1 cup grated raw potato
1 cup grated raw carrot
1 cup chopped raisins
2 tbsp. melted butter
1 cup brown sugar
1 cup flour
½ tsp. salt
1 tsp. cinnamon
1 tsp. cloves
1 tsp. soda (scant)

Method—Mix raw potatoes, carrot, raisins, and butter together. In another bowl mix flour, sugar, spices, soda and salt. Combine the two mixtures, place in double boiler over hot water and boil for three hours. Serve with sour lemon sauce.

MASHED POTATO CAKE

1 cup butter
½ cup milk
2 cup flour
2 tsp. baking powder
1 cup nuts (optional)
2 cups sugar
1 cup mashed potatoes
4 eggs beaten separately
1 sq. melted chocolate
1 tsp. vanilla

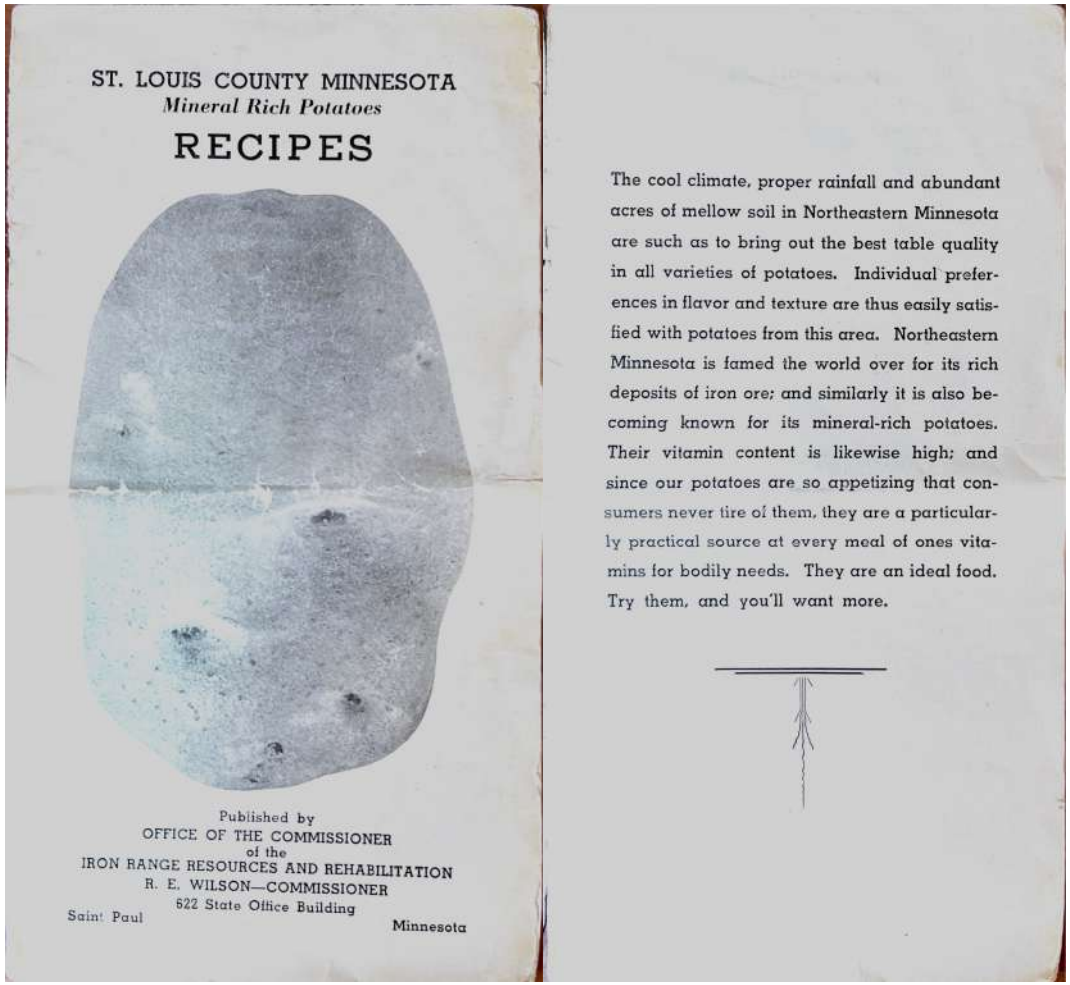
Cream fat and sugar. Add eggs and potato. Add the flour, mixed with the baking powder and salt, alternately with the milk. Add the chocolate last. Bake in layers or muffin tins.

Mrs. Mark I. Thompson

POTATO FONDANT

1 cup cold mashed potatoes
1 tbsp. butter
1½ cups powdered sugar

Method—Mix thoroughly, add flavoring, shape, dust with powdered sugar. (1) Dip in melted chocolate; (2) Add chopped nut meats; (3) Add chopped cocoanut. Roll in browned cocoanut. To brown cocoanut, put in shallow baker, in moderate oven. Stir often. Cocoanut will be a lovely brown and adds to all white candies a very festive note. (4) Shape almonds, brown as cocoanut, roll fondant in them. Delicious.



ST. LOUIS COUNTY MINNESOTA
Mineral Rich Potatoes
RECIPES

Published by
OFFICE OF THE COMMISSIONER
of the
IRON RANGE RESOURCES AND REHABILITATION
R. E. WILSON—COMMISSIONER
622 State Office Building
Saint Paul
Minnesota

The cool climate, proper rainfall and abundant acres of mellow soil in Northeastern Minnesota are such as to bring out the best table quality in all varieties of potatoes. Individual preferences in flavor and texture are thus easily satisfied with potatoes from this area. Northeastern Minnesota is famed the world over for its rich deposits of iron ore; and similarly it is also becoming known for its mineral-rich potatoes. Their vitamin content is likewise high; and since our potatoes are so appetizing that consumers never tire of them, they are a particularly practical source at every meal of ones vitamins for bodily needs. They are an ideal food. Try them, and you'll want more.

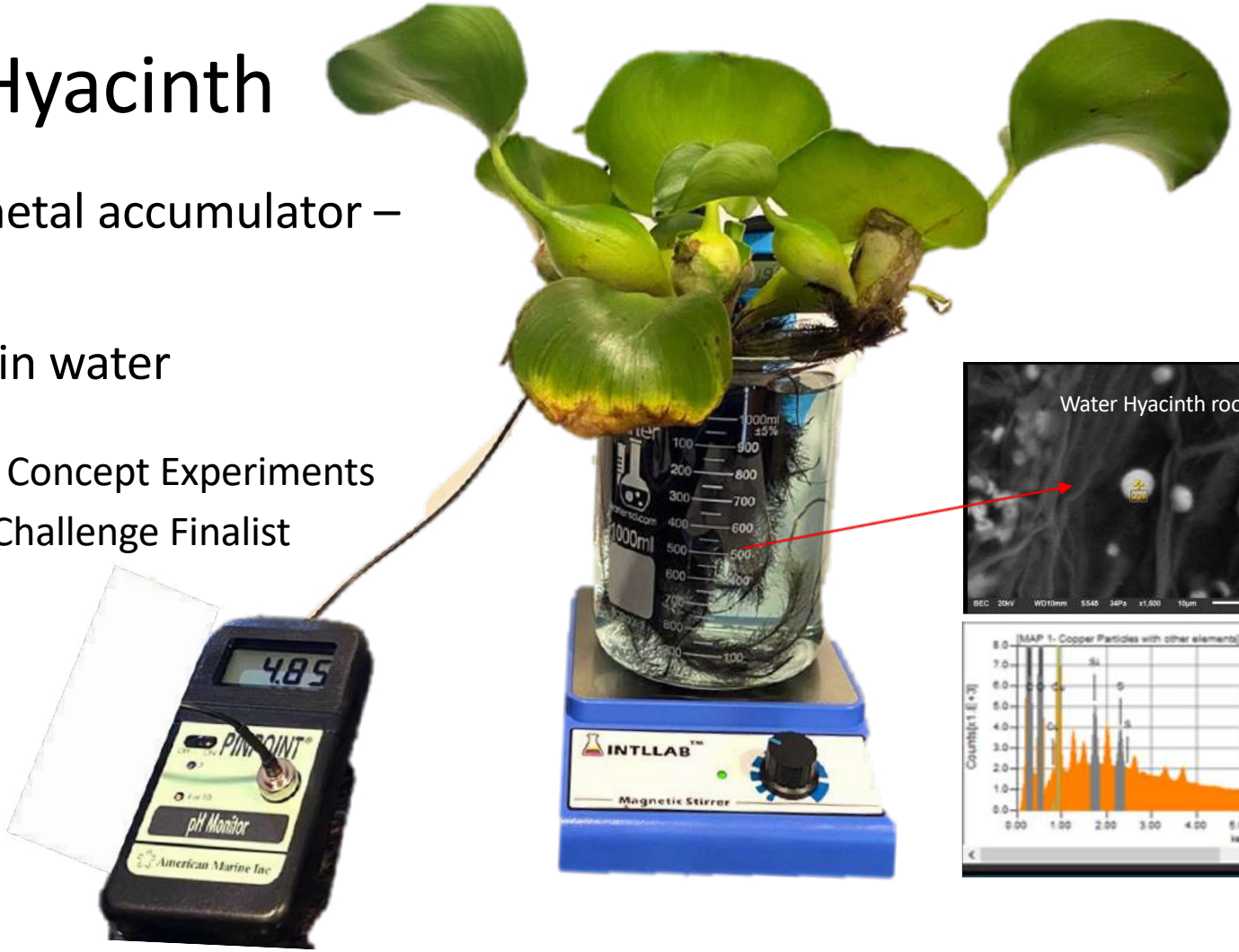
Booklet published by IRRR during WWII (1942-47)

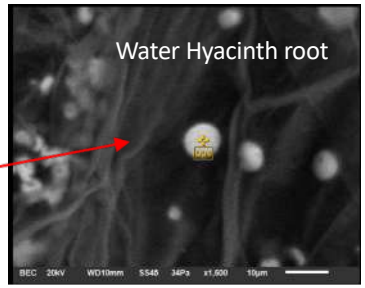
Water Hyacinth

- Heavy metal accumulator – Water

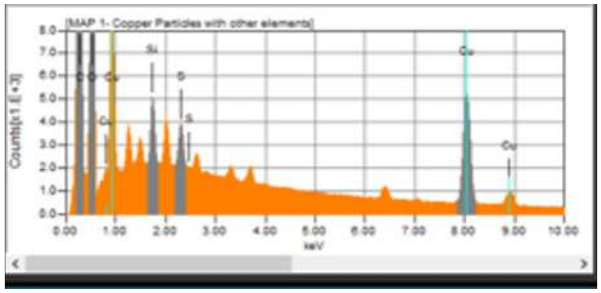
Roots-float in water

- Proof of Concept Experiments
- Google Challenge Finalist





Copper (Cu) Particles



The Water Hyacinth can cheaply extract a competitive % of copper while cleaning the environment of heavy metal sulfide contamination and organic and inorganic pollutants.

LICHEN LABS

In Summary

- NLSAP – bill in legislature to stop mine waste effluent from entering the environment.
- Copper is not iron; Copper is a low-grade, toxic ore with a short mine life and poses a risk of sulfuric acid flowing into the environment for thousands of years after the mines close, if water treatment stops for any reason.
- Copper already in use can be recycled on the Iron Range, providing more jobs for an infinite time period.
- Drawing inspiration from nature can provide non-toxic, sustainable mining solutions.

Copper is Not Iron !!!


Thank You
Sue Okerstrom
https://www.lichenlabs.net/
Sue Okerstrom Photo