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"Those who do not have power over the story that dominates their lives—the power to retell it, rethink it, deconstruct it, joke about it, and change it—truly are powerless."
-Salman Rushdie

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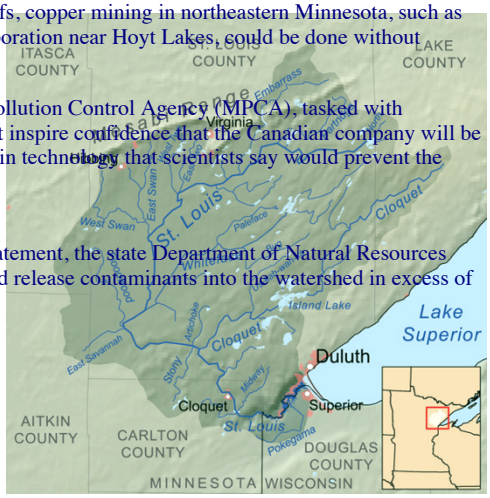
Science insulting to nature

How copper mining on the Iron Range could be done safely-but probably won't be

by Jennifer Martin–Romme
Zenith City Weekly

Source: US Geological Survey and the US Census Bureau
The St. Louis River watershed



ontrary to cherished environmentalist beliefs, copper mining in northeastern Minnesota, such as that proposed by the PolyMet Mining Corporation near Hoyt Lakes, could be done without polluting the St. Louis watershed.

However, the response of the Minnesota Pollution Control Agency (MPCA), tasked with environmental review of PolyMet, does not inspire confidence that the Canadian company will be required to implement and properly maintain technology that scientists say would prevent the release of dangerous and inevitable mining by–products.

In its 2009 Draft Environmental Impact Statement, the state Department of Natural Resources indicated the mine, as then proposed, would release contaminants into the watershed in excess of state standards.

In February 2010, the federal Environmental Protection Agency deemed this "unsatisfactory" and essentially sent the project back to the drawing board for a supplementary proposal to "evaluate alternatives to avoid mine pit overflow and explore additional mitigation for discharges and waste rock management."

Such mitigation technologies do exist, according to Len Anderson, a retired Cloquet biology teacher with a Master of Science in Aquatic and Terrestrial Ecology. But they are costly to implement and must be maintained "in perpetuity" to effectively prevent contamination.

According to Anderson, copper mining "produces more sulfates than any human activity I know of. It has to, because it's mining such low–grade ore," which involves separating large volumes of sulfur from small amounts of precious metal.

When exposed to oxygen, sulfur becomes *sulfate*, a charged particle of one sulfur atom surrounded by four oxygen atoms.

When released into waterways, sulfates encounter sulfate–reducing bacteria, which occur naturally in aquatic systems worldwide and are best known locally as the culprit "eating" 50,000 pounds of steel a year in the Duluth–Superior harbor.

When the bacteria and sulfates encounter carbon and mercury in an *anaerobic*, or oxygen–less, environment, the elemental mercury—which is comparatively harmless—becomes the elemental compound *methyl mercury*, a dangerous waste product of the bacteria.

Methyl mercury does not pose a risk from drinking water nor from immersion, but from *bioaccumulation*, working its way up the fish food chain in ever–increasing concentrations, disrupting the brain development in children and the fetuses of exposed women—even if they were exposed years before pregnancy.

Methyl mercury poses an amplified environmental threat due to its self–perpetuating dispersal and the location of the mine itself.

PolyMet sits on the uppermost portion of the St. Louis watershed, which begins near Hoyt Lakes, 80 miles north of Duluth, and sprawls over 3,500 square miles, fed by a vein of streams and rivers.

The bulk of the watershed sits within St. Louis County, but spans six counties and two states before ending in the largest solely freshwater estuary in North America, just above the Twin Ports' tip of Lake Superior.

Sulfate–reducing bacteria thrive in water containing sulfates within a range of four to eight milligrams per liter. "Once it reaches nine," says Anderson, "the bacteria can't do any more than they could do at eight.

"This is used as justification by the mining industry to go ahead and add sulfates to the water because the bacteria can't methylate anything more than nine milligrams per liter anyway."

But the trouble only begins there, spreading through the rivers and floodplains of the watershed, hurtling towards the estuary as the sulfates–per–liter dilute—starting the methylation process all over every time the milligrams–per–liter drop back down below nine, giving the bacteria something to do again.

Rather than decreasing, as contaminants typically do when diluted, the problem feeds on itself unless the supply of sulfates is cut off.

Floodplains, for example, are bathed in sulfates only every few years. As long as the sulfate supply is maintained, this contributes to the spreading–by–dilution problem. Once the supply stops, the flooding cycle would bring sulfate levels back down.

The exact amount of sulfates PolyMet would produce, which varies over time and location, is unknown until the Supplemental Environmental Impact Statement (SEIS) comes out this fall.

In the meantime, the company has "more clearly defined" their plans for treating wastewater from the tailings basin and "the EIS will show we can meet the sulfate standard," says Latisha Geitzen, PolyMet's Vice President of Public, Environmental, and Government Affairs. "It's not just a treatment plan. It's how you mitigate while you're in operation."

For example, waste rock will be stored underwater, "so you don't have to treat it…Most of the sulfur in our process, we'll recover and send it to the autoclave," which works like a large pressure cooker.

Oxygen is added while the temperature and pressure are raised, leaving behind a weak sulfuric acid that can be neutralized with lime.

"Sulfur is actually a fuel in the exothermal process in the autoclave…At the end of the day, it gets converted to calcium sulfate," which they hope to collect and sell for use in things like chalk and sheetrock.

Otherwise, the "worst–case scenario" is to store the waste in a double–lined facility with "interstitial monitoring," which Geitzen acknowledges must be done "forever."

"Eventually, you cap it, so there should be no water going through it at closure," much like a municipal landfill.

Richard Clark, a hydrologist with the MPCA, tasked with reviewing projects like PolyMet for compliance with water quality standards, says the mine's currently proposed treatment method is "a very complicated system."

When contacted for an interview, Clark said he could only do so if the MPCA's Public Information Officer, Ralph Pribble, was also present "because PolyMet is controversial."

Once Pribble was present, they both denied this was the reason, saying it was "for [Pribble's] own information…It always helps me to hear the questions."

Pribble emphasized he was not there "to be Richard's minder," however, they whispered to each other throughout the interview and Clark either could not or would not be interviewed one–on–one.

Clark or Pribble (it wasn't always clear who was speaking) said, "The proposal they have in front of us can meet all water quality requirements," even though PolyMet is "currently going through a detailed water quality review" by the MPCA.

"They propose to collect the water as it runs off their waste rock stock piles and that water will be treated in advance through a wastewater treatment system." The company plans to transport water from the mine site to the plant site, so "there will be no discharge from the mine site."

Nonsense, according to Anderson. "The amount that would be allowed to 'escape' into the ground

—which isn't a very scientific word for it—but quite quickly, it'll be in the stream.

"You have such a large area that will be turned into the actual mine pits, tailings ponds, and waste heaps [all of which generate sulfates], that the natural precipitation will carry it into the Partridge and Embarrass Rivers," situated at the very top of the watershed.

"A lot of it will get in through groundwater…They kind of pretend it'll all go away, but it always, always winds up in streams."

Clark says the MPCA wants PolyMet to "move from active treatment to something more passive in the long–term…meaning [the treatment method] operates on its own as opposed to someone operating it."

Clark/Pribble identified such methods as "source reduction, wetlands, and biological treatment."

More nonsense, according to Anderson. "The only treatment that can operate without long–term maintenance is to just let it seep into the groundwater. That is what most of the Iron Range waste is doing now."

Biological, or constructed wetlands, treatment is currently in use at the now–defunct Dunka taconite mine near Ely. Owner Cliffs Erie was sued in January 2010 under the Clean Water Act by the Center for Biological Diversity.

Cliffs Erie settled the suit for a $58,000 fine to the MPCA and a promise to stop, which Marc Fink, lead attorney for the plaintiffs, doesn't find particularly credible. "This has been going on for years. If the state had been concerned about it, they'd have done something a long time ago.

"The MPCA has a really bad track record of enforcing pollution control on the Iron Range and this was evidenced by the existing pollution that they didn't address [at Dunka].

"Heavy metal mines are the leading cause of water pollution in the western US and there's no known mitigation, nothing that's been effective before. We'd rather have them experiment someplace else."

But there are known ways to keep the water clean; they're just very expensive and require supervision far longer than anyone can reasonably commit to.

Anderson identifies four treatment methods, each with its own benefits and drawbacks and some better at dealing with certain contaminants than others.

Biological treatment—the method Cliffs Erie just got sued over and which the MPCA identifies as a "long–term" and "passive" solution for PolyMet—involves the creation of large wetlands covered with mats of woven reeds and grasses.

"It is so profound and huge, it's kind of exciting," says Anderson. "But you can't just set these up and walk away from them."

The grasses consume oxygen as they decay, producing carbon. When wastewater contaminated with mercury and sulfates is then added, all the elements for methylation are present and the mats must be continually disposed of as hazardous waste.

This successfully gets rid of mercury—but by producing methyl mercury instead.

Clark and Pribble at the MPCA hedged on the question of whether mercury standards are considered met if mercury is disappearing because it's becoming the much more dangerous methyl mercury.

"Our water quality standards include mercury," says Clark, "so that would be our absolute standard…The standard [1.3 nanograms per liter] is built on the process that if you reduce the mercury, you'll reduce the methyl mercury."

When pressed as to whether mercury methylation would, technically, count as a reduction in elemental mercury itself, Pribble responded, "No. We're considering what comes out of the pipe or stack. If you're cutting off the mercury, then it's not there to convert to methylated mercury."

The biggest whopper so far, judging by Anderson's information. "The methylation downstream has virtually nothing to do with the small amount of mercury they will be releasing. It has to do with the large amount of sulfate they will be releasing. The mercury is legacy mercury in the sediments from the last 100 years."

In the short–term, Clark says PolyMet is proposing a chemical precipitation treatment at the mine site and reverse osmosis for discharge at the tailings site, both of which are "capital and labor intensive."

Chemical precipitation, which Anderson describes as "do–able," involves introducing a chemical specific to each contaminant, causing them to *precipitate*, or drop out of the solution.

"Then you can scoop that up and take it to a landfill. The sulfate is going to be as harmless as Epsom salts." Some contaminants could be safely re–used.

However, the system "needs to be monitored 24 hours a day, forever" and some of the chemicals,

before they're introduced, are highly toxic.

Reverse osmosis, proposed for tailings discharge, is a combination of two methods effective for sulfates—ion exchange and membrane treatment.

Being an ion, sulfate has an electrical charge. Electricity can be introduced to collect the sulfates for removal and disposal. However, the electricity (and the coal to generate it) is costly and this method, too, must be continued indefinitely.

In membrane treatment, contaminated water is passed through polymer sheets, which is "good for sulfates, but not as good for other contaminants. That's going to be pretty bad water coming out of that membrane."

Then there's the matter of natural precipitation, which Anderson says is difficult—though not impossible—to contain, as rain and snow fall on hundreds of acres of open mine pits, tailings ponds, and waste rock piles, washing sulfates into the groundwater.

But the MPCA doesn't seem particularly concerned about this. "As far as the scale of the project," says Pribble, "that's not a limitation. As far as the precipitation, there would be a system to handle that."

"They're proposing temporary stock piles before it's taken care of completely," says Clark, "liners under their temporary stock piles that prevent runoff from infiltrating into the ground.

"The way the project is designed, any precipitation, any water that touched that rock, will be captured and treated." He says the system is based on "peak flows and worst–case scenarios."

But, noting that PolyMet "will be dumping boulders the size of trucks on top of these liners," Anderson says the real worst–case scenario will come long after the mine has closed.

"All liners of this size, anywhere in the world, leak. They are very important, but not a complete solution…Any of the solutions look good if we believed there would be someone around 200 years from now to do it."

Even if there were, Anderson would be reluctant to support the PolyMet project. "I'd hate to see thousands of acres of prime wetlands and critical habitat destroyed. That's still going to happen."

He believes the public has a responsibility to demand copper mining be done safely and critics are doing a disservice to that goal when making exaggerated claims that safety is completely impossible.

"Because this is probably the first of many metallic sulfide mines to apply for a permit, it is important that we do it right, because whatever we give away on this permit will be demanded by all that follow.

"The public has an opportunity to comment…Just stating opposition during the public comment period will accomplish absolutely nothing. Comments have to be science–based and clearly address relevant law."
