Mining Information Sheet

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Potential Metallic Mining Development in Northern Wisconsin

Issue

What is the likelihood for significant metallic mining development in northern Wisconsin? Will northern Wisconsin become a mining district; that is, will there be many mines operating or wanting to operate in northern Wisconsin? How can one project for mining be evaluated without considering what the potential is for other mines to be operating, as well?

Introduction

The permitting, construction, operation and phase-out of the Flambeau Mine in Ladysmith (Rusk County) has focussed public attention on the issues and emotions related to mining metallic mineral deposits in northern Wisconsin. Will the operation of the Flambeau Mine signal the renewal of major metallic mining activities in the state? Are there other concentrations of minerals in quantities warranting consideration for mining?

In 1976, the State of Wisconsin published a forecast of future mining in the North in "The Impact of Mineral Resource Development in Wisconsin: Toward a State Policy" prepared by an interagency committee of state officials. This report stated that:

> *"Based on current estimates of base metal reserves and on current trends, the potential exists for the development of 20 new metallic mines over the next 20 to 30 years with 10 copper and iron ore mines possible in northern Wisconsin and 10 lead and zinc mines possible in southwestern Wisconsin."*

Further, the report stated that six copper mines and two iron mines could be operational by 1996 with a new copper mine coming into production every four years. Obviously, the anticipated pace of metal mining since the date of these forecasts has been significantly different. A single copper mine has been permitted in the 21 years since the forecast. The following paragraphs describe what has happened to affect the anticipated pace of mineral development.

Factors that influence the assessment of Wisconsin's mining potential

The potential and pace for metal mining in northern Wisconsin is affected by the geology of the region, by the prices for metals on national and international commodities markets, and the time involved in completing the state's environmental review and permitting processes.

... geology

Within the bedrock of northern Wisconsin, beneath the tens to hundreds of feet of glacial deposits at the land surface, there are complex assemblages of igneous and metamorphic rocks that contain metal-bearing minerals. In localized areas, these minerals may occur in concentrations of sufficient tonnage (size) and grade (richness of the metal content) so as to warrant further evaluation as a potential mining project. Such occurrences are commonly known as orebodies. Northern Wisconsin's geology may include dozens of local mineralized areas, but the presence of metals in sufficient tonnage and grade for *possible* development is extremely rare and these rare occurrences are known as mineral deposits.

Figure 1 - Known mineral deposits in Wisconsin *(opt = ounces per ton)

Deposit Name	Bend (Found: 1985)	Crandon (Found: 1975)	Flambeau Mine (Found: 1968)	Lynne (Found: 1990)
Location	Taylor County (Chequamegon National Forest)	Forest County (private land)	Rusk County (private land)	Oneida County (County-owned land)
Holder of Mineral Rights	Jump River Joint Venture	Crandon Mining Co. (Exxon Minerals and Rio Algom)	Flambeau Mining Co.	Noranda Minerals-Wisconsin Corp
Ore Body Tonnage	>3.7 million tons	30 million tons (first phase); 25 million tons in more copper-rich 2nd phase	1.9 million tons	5.8 million tons
Mineral Composition of Ore	Copper: 2.8% Gold: 0.28 opt*	First phase: Zinc: 9.4%, Copper: 0.4% Lead, gold & silver: minor	Copper: 10.5% Gold: 0.1 opt	Zinc: 8.9% Lead: 1.7% Silver: 2.3 opt Gold: minor Copper: minor
Development Status	Exploration drilling ceased mid-1992	DNR reviewing mining permit application; drafting E.I.S.	Reclamation was completed in late 1998.	Review began 1992; Currently suspended

opt[1] = ounces per ton

The *Flambeau Mine* extracted about 1000 tons per day of copper-rich ore. Reclamation of the pit began in early 1997 and was completed in late 1998. The *Crandon deposit* is presently being evaluated for the required environmental impact analyses and the mining permit and other related permits, licenses, and approvals necessary before mineral extraction could begin. If permitted, the mine

Figure 2 - Other known mineral occurrences in Wisconsin (no expectation for development):

Name	Location	Description	Comments
Richie Creek	Price County	copper, gold, lead, zinc	insufficient tonnage and grade known
Reef	Marathon County	gold	too costly to mine at foreseeable prices
Thornapple River	Rusk County	copper, zinc	insufficient tonnage and grade known
Pelican River	Oneida County	copper, zinc	insufficient tonnage and grade known
Round Lake	Sawyer County	iron, titanium, vanadium	metal recovery too low due to complex mineralogy
Duval	Marinette County	iron pyrite	low grade; no real market for pyrite
Horseshoe	Lincoln County	zinc, lead, copper, gold	insufficient tonnage and grade known
Thunder River	Price County	zinc	insufficient tonnage and grade known
Horseshoe	Lincoln County	zinc, copper	insufficient tonnage and grade known
Catwillow Creek	Forest County	base and precious metals	insufficient tonnage and grade known
Mole Lake	Forest County	base and precious metals	no current interest in development
School House, Clear Creek, G-23, Hawk , Spirit, Somo, Prentice East	Various counties	base and precious metals	considered to be occurrences only; no potential to develop
Mercer	Iron County	gold	potential unknown

would begin operation by the year 2000, at the earliest. The *Lynne deposit* is no longer under active consideration for development. The *Bend deposit* is still being explored and economic evaluation is continuing.

It is possible that other areas of mineralization will be located because exploration is proceeding in some northern Wisconsin counties. Whereas the likelihood of finding an orebody at any one exploration site is remote, it is possible that an occurrence not known at this time could be sufficiently large and contain enough recoverable metal to be called an orebody. It is unlikely, however, that there will be dozens of additional orebodies discovered.

Since records have been kept, beginning in 1978, just under 400,000 acres of land have been leased for exploration and over 1200 drill holes have been constructed in the search for metallic mineralization. In that time, only the Lynne and Bend deposits have been discovered and nearly all of the acreage originally leased for mineral exploration is no longer under any lease agreement. On a worldwide basis, studies of mineral exploration programs show that out of 1000 local areas of mineralization discovered, only 10 are eventually determined to be orebodies and only 1 of these is developed into a profitable mining operation.

The Department of Natural Resources estimates that there could be no more than five metallic mineral mines developed in Wisconsin over the next twenty years. This includes the Flambeau Mine now in operation, the Crandon Project being evaluated at this time, the Lynne Project no longer being considered, the Bend Project known but not yet under consideration, and one additional orebody not now known. This estimate is based on the current state of knowledge about the geology of northern Wisconsin and the steps necessary to discover an orebody and the time it takes to complete the regulatory requirements.

... metal prices and world commodities markets

Prices for metals are the key determinants of whether a mineral occurrence can be considered economically viable, and thus termed an orebody. If metals prices increased significantly and held their levels, mineral occurrences could become more valuable, and some of the economically marginal prospects in northern Wisconsin might then be valuable enough to be mined. Mineral economists do not expect significant long-term increases in metals prices and, therefore, the Department does not expect potential mineral development in northern Wisconsin will be based upon metal price increases to any significant extent.

The prices mining companies receive for metals recovered from orebodies tends to be a reflection of world demand for the metal in question and the supply, or availability, of the metal to satisfy that demand. Copper, for example, is an important metal for a wide variety of manufacturing applications, and its price is sensitive to the supply of raw copper in the world. The more copper that becomes available on the world market the lower will be the price for which it can be sold. Gold prices, however, tend more to reflect world-wide speculative influences and respond more to concerns with international economic stability than to changes in the manufacturing markets.

The cost of mining is generally a knowable cost determined by the nature of the mineralized material itself, the manner in which it must be extracted, and the degree to which it must be processed before it can be used in making other products. These costs once determined for the mineral deposit in question tend to be fixed, subject mainly to inflation, with the cost of labor also known to be a generally rising cost of doing business. Changes in the prices of metals being recovered, however, tend to be beyond the control, or even the predictive capabilities of the mining company.

Thus, large deposits of metal-bearing minerals may never become orebodies simply because the cost of recovering the metal is too high relative to the metal prices available. Mining companies decide on investments in mining projects using projections of metal prices and costs of mining and processing and then comparing the anticipated rate of return they might receive on any one investment to other investment opportunities or mining projects available.

... time involved in evaluating a proposed mining project

In Wisconsin, it takes a minimum of four years from the determination that a mineral occurrence is truly an orebody (and the decision is made by the mining company to proceed with permitting activity) to the completion of the state's environmental and socio-economic evaluations and the review of permit applications. This span of time tends to spread out the effects of any cumulative mining impacts that may be hypothesized, as the likelihood of several mines being in operation at any one time is very small.

The history of mining in Wisconsin indicates that metal mining projects develop slowly. The Flambeau Mine began its operations in 1993, nearly 25 years following its discovery. The Crandon deposit, currently under evaluation by the Department, was discovered in 1975. These long time periods result from many factors including changing metal prices, environmental analyses of potential project effects, changes in a mining company's commitment to pursue a potential mining proposal, and changes in the state's regulatory programs.

Currently, and in the most recent four years, the extent of exploratory drilling and the leasing of private and public lands for mineral evaluation is significantly below the level of such activities in the 1970s and 1980s. Recent announcements of reductions in exploration interest by once-active mining companies indicate that this reduced level of activity will not be different in the near future. Announcements of new discoveries or progress in permitting known orebodies could stimulate renewed interest in mineral exploration in Wisconsin.

Will There Be Significant Mining Development in Northern Wisconsin?

For there to be significant mining development in northern Wisconsin, there has to be a sufficient number of orebodies. These, in turn, must be permitted and become operating mines. In addition, the operating mines in the region must achieve a certain level of economic importance in the overall economy of the region. Since we have already discussed the low number of

orebodies and the slow pace of mining expansion to date, let's consider other factors which could determine how mining could affect the North.

Historically, mining was an important part of regional economies in southwestern Wisconsin, as a result of zinc and lead mining, and in northwestern Wisconsin as a result of iron mining. In the zinc and lead district there were literally hundreds of small mining operations from its beginnings in the early 1800s through its heyday in the middle part of the nineteenth century. The settlement of that part of the state was a direct result of mining development. In the Hurley and Montreal areas, iron mining began in the 1880s with dozens of corporations formed to extract iron ore from the Gogebic Range. Here, too, the economy of the region was dominated at first by the extensive mining activity.

These examples of past mining dominance of regional economies cannot be repeated in today's economy for two basic reasons: (1) the extent of mineral resources in northern Wisconsin relative to other resources present in the area is not large enough to be dominant; and (2) the breadth and diversity of the northern Wisconsin economy in the twentieth century is far greater than what was available in frontier southwestern Wisconsin or in the woodlands of northwestern Wisconsin more than a hundred years ago.

Another way to assess the significance of mining in northern Wisconsin is to evaluate the potential economic importance by the number of jobs that might be created. For example, if mining occurred simultaneously at all four known orebodies in the North at once (an impossibly extreme situation), the total direct and stimulated (indirect) employment would be an estimated 1300 jobs. Even this significant number of jobs, however, would represent only about 3.5% of the combined total employment in the four counties of Taylor, Oneida, Rusk, and Forest. Within a local area, however, mining employment effects may be more noticeable and local economies may need to consider the costs and benefits of expanded employment on local services and revenues, as well.

Summary

Potential mining development in northern Wisconsin is ultimately determined by the geology of the region. Although the bedrock in this area is considered to be "mineral rich" in comparison to other regions in the state and to neighboring states having similar geology, the number of orebodies discovered over the last 30 years or so is four. Of these four, only two could be active at the end of this century, including one—the Flambeau Mine— that is already active. However, mineral exploration continues in northern Wisconsin and based on the experience of the recent past, the Department believes that one additional orebody is likely to be discovered over the course of the next one or two decades. Because of the length of time it takes for a mineral deposit to be evaluated and then permitted, as well as the rate at which new orebodies have been discovered in northern Wisconsin, the development of metallic mineral deposits is expected to play only a limited role in the resource management issues and economics of the region.

For More Information

If you would like additional information or want to discuss any mining-related issues, please contact:

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This mining information sheet is one in a series prepared by the Department of Natural Resources to explain how metallic mining in Wisconsin is regulated and to explore other aspects of mining. Copies of the following mining information sheets are available from Department offices in Madison and Rhinelander, and the Internet:

- *The Permitting Process for a Metallic Mineral Mine*
- *How the Department of Natural Resources Regulates Metallic Mining*
- *Protecting Groundwater at Metallic Mining Sites*
- *Reclamation and Long-Term Care Requirements for Metallic Mining Sites in Wisconsin*
- *Local Decisions in Metallic Mining Projects*
- *Addressing Public Concerns With Wisconsin's Laws Governing Metallic Mining*
- *Wisconsin's Net Proceeds Tax on Metallic Mining and Distribution of Funds to Municipalities*
- *Cumulative Impacts of Metallic Mining Development in Northern Wisconsin*
- *Potential Metallic Mining Development in Northern Wisconsin*

The Mining Regulations (Administrative Code) can be viewed at the Department's Mining Web site: http://www.dnr.state.wi.us/org/aw/wm/mining/metallic/index.htm.