

*Here's The 'Truth And Consequences'  
Of Copper-Nickel Mining . . .*

Whether or not to mine copper-nickel ores in Minnesota is typical of many environmental issues today, simply because there is no consensus of opinion among the "experts" or the public as to the economic and environmental impacts of this type of land use.

Fears of another controversy similar in scope to the Reserve Mining case or of environmental degradation on the scale of Sudbury, Ontario's operations, have led to extreme caution on the part of the public officials. Although state environmental regulations would never allow another Sudbury to occur in Minnesota, concern for the natural and human environment remains.

In January, 1972, Governor Wendell Anderson directed the Department of Natural Resources to study all economic and environmental aspects of the copper-nickel mining process, and ordered the creation of an "Inter-Agency Task Force" for that purpose.

The task force was comprised of representatives from various state agencies that would be required to regulate the industry or deal with its economic consequences. The Governor also asked that a minerals subcommittee be appointed to the Natural Resources Advisory

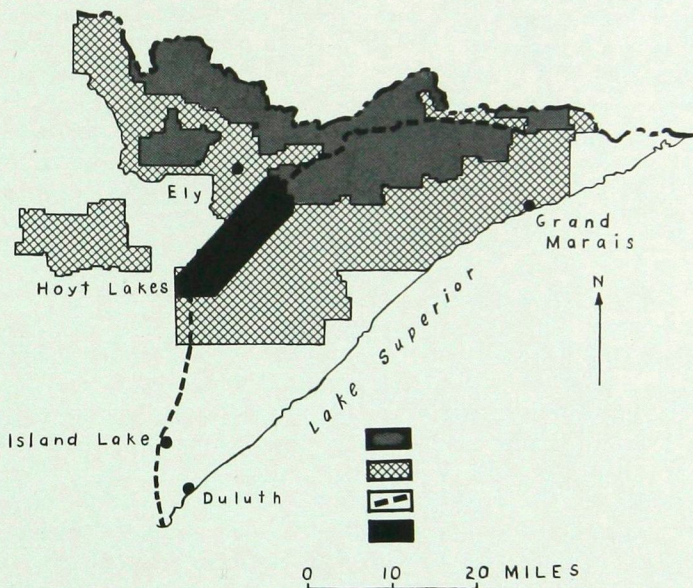
# THE COPPER-NICKEL

*Or*

*Can We Mine Without A Mess?*



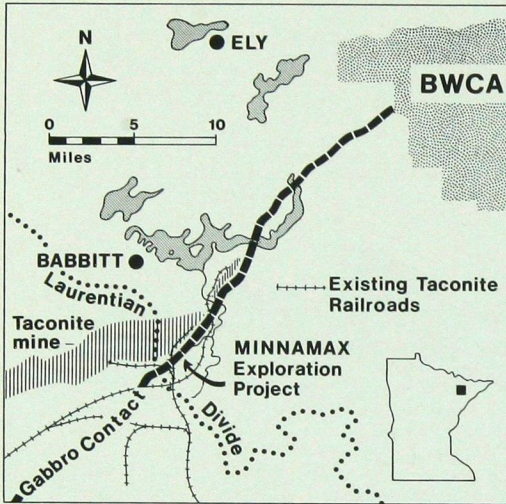
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# CONTROVERSY

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*Minnamax, its name derived from Minnesota and Amax, a U.S. based corporation, has been granted permits by the Pollution Control Agency and MDNR to proceed with its copper-nickel exploration shaft near Babbitt.*

Council and that representatives of citizen groups, mining companies and local government should act as advisers to the task force.

One year later the task force submitted its report. Pointing out that the Duluth Gabbro complex (a geologic formation) is the largest known nickel sulfide resource in the United States, the report concludes that "it is only a matter of time" before a definite proposal to mine the area is announced by a copper-nickel company. In addition, it noted that vast areas of northern, central and north-western Minnesota are underlain with Greenstone formations—another geologic strata often containing copper, nickel and other base metals.

Concerning Greenstone belts, the report says, "... it can be asserted that economic ore deposits will eventually be discovered. These deposits can be expected to contain one or more of the following base metals and precious metals: copper, zinc, lead, nickel, gold and silver.

"Deposits, if discovered in the Greenstone, would be significantly higher grade than those already known to exist in the Gabbro."

In assessing the environmental effects of a copper-nickel industry in Minnesota, the report separates the various steps in the mining process and discusses the problems associated with each.

### Exploration

Modern mineral exploration techniques produce virtually no lasting environmental effects in Minnesota. Drill sites are relatively small,



usually less than 50 square feet, and there is usually little disturbance other than brushing and clearing of survey lines, drill sites and access roads.

### **Development, Mining and Beneficiation**

If an ore body is discovered of sufficient size and grade to justify mining, the following major projects must be undertaken: Opening the ore body to mining, construction of facilities, preparation of disposal sites, stockpiling waste materials and construction of a water reservoir.

Environmental factors that must be considered include possibilities of air pollution, protection of water resources and disposal of waste materials and land use.

Air pollution problems are important and must be controlled. If the mining is underground, great care must be taken to protect the lives and health of miners. In addition, dust must be controlled on roads, on piles of overburden and tailings, and during the initial crushing stages in the beneficiation process. Blasting must be done with care to avoid undue noise and vibrations that could damage adjacent property.

Metal mining could have a significant effect on water resources. Considerable quantities of water are used in the beneficiation, extraction and refining of base metals: about 100 gallons per ton of crushed ore processed, assuming the plant water is recycled.

Ore deposits must be mined where you find them, and they may be discovered near or beneath lake and stream beds. Conflicts of use must be resolved over these public waters. Open pit mining, tailings disposal and water reservoir construction would probably be the major areas of concern. The dimensions of these problems vary from site to site.

Mines, whether of the open pit or underground type, collect both surface and ground water and must be continually pumped. Water collected in abandoned mines could prove a source of pollution, and there could also be escape from tailings basins. In some cases water would have to be treated to remove metal ions or suspended solids.

In addition, there could be problems of runoff and erosion of overburden, which is removed to expose the ore body, and stored for later replacement after the ore body is mined out. This material could, unless controlled, wash into streams causing sedimentation problems. Further, there could be runoff from stockpiles of low grade ore and leaching of metal ions into the surface and ground water unless





*Amax environmental monitoring is extensive. Hundreds of surface and ground water samples are being analyzed. These will be compared with samples taken during and after exploration.*

facilities were designed and operated to prevent it.

Revegetation and contouring of slopes of stored material are an essential feature of an environmentally-sound mining operation. Abandoned open pits can sometimes be converted into lakes for recreational use, depending upon water quality and other factors.

One of the most difficult problems encountered with mining operations is disposal of solid waste. With open pit mining, several thousand tons per day of tailings must be disposed of in addition to the stockpiling of overburden, low grade ore and waste rock.

In the case of underground mining, some two-thirds of the tailings could be redeposited underground. But with open pit mining, all tailings must be deposited on the surface.

Furthermore, if an extraction facility (smelter) was constructed, several hundred tons per day of slag would have to be stockpiled.

Since many of the stockpiles of lean ore and slag and all of the tailings basins will remain after mining, location of these sites has a decisive impact on land use. Although there is some opportunity for



the specific site selection, the location of the ore body and other factors will dictate the region in which the sites are located. In addition, planning and reclamation must be relied upon to minimize environmental effects.

As for the amount of land actually taken up or occupied by a typical model copper-nickel mining operation, an estimated 2,600 to 5,800 acres would be required for an open pit facility in the Gabbro complex while 255 to 420 acres would be needed for an underground operation in the Greenstone.

### **Metal Extraction**

After the ore is concentrated, the next step is metal extraction. Of the three processes known, only one is presently economically feasible for the treatment of copper-nickel sulfide ores. This is known as "pyrometallurgical" and involves roasting, smelting and converting the concentrates using intense heat to recover the metals.

The task force report rates the pyrometallurgical extraction facility as "one of the most environmentally notorious links in the base metal mining production chain." The major problem is chimney smoke—comprised of dust and gases—generated during roasting, smelting and converting.

There are no current plans by any of the companies active in Minnesota to develop a smelter. However, Inco has in the past proposed a smelter for Minnesota and other such proposals will undoubtedly be forthcoming. The State must anticipate the problems associated with such facilities and incorporate them into the decision making process.

Regardless, if a smelter is built in Minnesota, says the report, it will be substantially different than those that have traditionally been operated elsewhere on the continent.

Pyrometallurgical processes utilize intense heat to recover the metal. The metals are found in sulfide-rich ores and the sulfur must be burned off, leaving only the pure metals. The resulting sulfur oxide gases ( $SO_2$ ) produce the major environmental impact; however, some other gases released such as nitrogen, carbon monoxide, water vapor and oxygen, also play a role in the overall impact.

Pollution control efforts are currently being focused on attempting to remove  $SO_2$  since efficient and effective techniques are generally available to remove the dust in the discharge.

If one assumes no controls, a typical extraction facility using Gabbro complex ore would discharge about 450 tons of  $SO_2$  per day.





This can be compared to NSP's Alan S. King generating plant on the St. Croix River which emits 286 tons per day. By recovering 90 percent of the sulfur during metal extraction, the emissions could be reduced to about 45 tons of  $\text{SO}_2$  per day.

A number of smelters have now been constructed, particularly in Japan and Finland that utilize new technology such as continuous smelting and flash smelting. These smelters combine traditional steps of smelting, resulting in higher concentrations of  $\text{SO}_2$  in more uniform volumes, and have improved gas handling systems. Recovery of  $\text{SO}_2$  and dust from these plants is better than 95 percent, a tremendous improvement over existing smelting operations in the United States or the facility at Sudbury, Ontario.

Slag is basically an inert material and is not expected to cause a pollution problem, the main impact on the environment being one of land use. Slag is often marketed as a building material.

Large amounts of cooling waters will be required for the operation of an extraction facility: from one to three million gallons daily, depending upon the system used.



*Wilderness values of the North Country are immeasurable. Accordingly, years of intensive study must be completed before mining can begin. Later, stringent policies regulating copper-nickel mining must be implemented.*

If hydro-metallurgical extraction (now in the pilot-plant stage of development) were used, greater quantities of water would be required; however, most of this water would probably be recycled. This new type of extraction process, if perfected, could virtually eliminate air pollution problems but would create new water pollution concerns. This could occur if the water used in the process were discharged or recycled through tailings basins. Such water could contain soluble salts and become a source of pollution both during and after operation of the mine and smelter.

### **Refining**

The refining process, usually a closed electrolysis system, poses little environmental problems since all acids should be regenerated and recycled.

### **Termination**

This step takes place during and after the final stages of mining. It involves the removal of facilities, reclamation and restoration of the surface. Contouring, revegetation, and other measures would be aimed at returning the land to near its original state. Control of dust, prevention of erosion and protection of water quality would have to be considered, and planning to achieve these goals should be undertaken before and during the mining operation.

In addition to potential environmental problems, opponents of copper-nickel mining maintain that the industry would only operate for 50-80 years before mineral reserves are depleted. Further, they claim that hundreds or thousands of persons will then be unemployed and the lost tax revenues will cause fiscal convulsions in state and local governments.

However, an estimate of the mining district life, based upon ore reserve projections by the Minnesota Geological Survey, is about 150-200 years, based upon a reasonable rate of extraction of 27 million tons of ore per year. Unemployment problems upon mine closing do remain, in the same manner as with any industrial closing.

Many believe that it is possible to conduct a modern, base-metal





*Copper-nickel can be mined in large open pits, similar to this iron ore mine. However, it is expected that any Minnesota copper-nickel mining will be of the underground type.*

mining operation without doing violence to other natural resources. They contend that the alterations of the environment deemed irreversible are not of a magnitude or severity to preclude mining operations. Further, they point out that America is a modern industrial nation that depends upon copper-nickel and other metals for the continued manufacture of goods essential to our standard of living.

An important question, proponents say, is whether we are forced to depend more and more heavily upon foreign sources which could conceivably be cut off at any time, or whether we continue to develop our own known resources.

As a result of the great potential value of copper-nickel mining to Minnesota, both the legislative and executive branches of government are extremely interested in it.

In an effort to more thoroughly explore the social, economic, and environmental factors associated with proposed copper-nickel mining, the Minnesota Environmental Quality Council (MEQC), on October 8, 1974, ordered a regional Environmental Impact Statement (EIS) to be prepared. The regional EIS is to address these issues in the Duluth Gabbro complex, which has greater development potential in the near future than does the Greenstone formation.

The three-year, \$3.6 million EIS project includes a large-scale air, water, and terrestrial monitoring program which will provide a baseline of information on the area. The overall objective of the EIS is



to provide information to the public and policy-makers upon which to base their decisions.

The MEQC also resolved not to accept an EIS on any specific proposed operation until the regional EIS is completed in mid-1978. This action indicated that a regional examination of copper-nickel mining must be completed before any specific proposals are evaluated in terms of an EIS.

However, both branches of government indicate that appropriate safeguards will be required to protect other natural resources. One such safeguard is an interested, informed, and active public.

Government officials are working openly with the public and industry. This represents a new type of cooperation—a partnership of the public working both directly and through its governmental agencies, and the company. Each partner represents different clients with varying interests, but both must be satisfied and willing to accept the risks and, hopefully, share the benefits.

If we are to have copper-nickel development in Minnesota, it can only be after we have made careful studies and set policies and regulations that will give the strongest possible protection to our environment. This procedure, with public input, is the only course of action that makes sense. By following this procedure we can establish a model for the rest of the nation, which is important.

But what is more important is that we, in Minnesota, make our decisions on the basis of facts. We must do the best job possible—as the possible benefits and detriments can last for many years. □

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