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Minnesota Mineral Diversification

an interim Status Report



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MINNESOTA MINERALS
COORDINATING COMMITTEE
MDNR MGS MRRC NRRI

February 1990

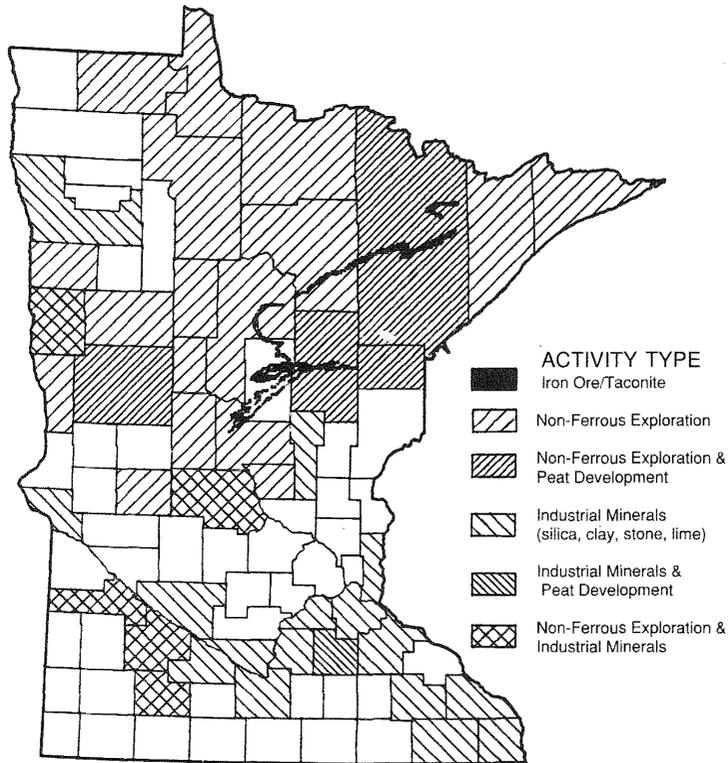


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Minnesota Mineral Diversification

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MINNESOTA MINERAL DIVERSIFICATION



Minnesota Mineral Activities

MESSAGE FROM GOVERNOR RUDY PERPICH

I congratulate the Legislature and the Minerals Coordinating Committee on the progress made in the Mineral Diversification Program. The goal of the program —to promote beneficial mineral development in greater Minnesota through diversified use of the state's mineral resources —is a sound one.

The structure for mineral management and research created by the formation of the Minerals Coordinating Committee is a model for intergovernmental, academic, and private sector cooperation. The accomplishments of this program are already considerable and provide a firm basis for future environmentally-sound mineral development in Minnesota.

PURPOSE

In creating the Minnesota Mineral Diversification Program in 1987, the Legislature declared it state policy "To provide for the diversification of the state's mineral economy through long-term support of mineral exploration, development, production, and commercialization" (Minn. Stat. sec. 93.001).

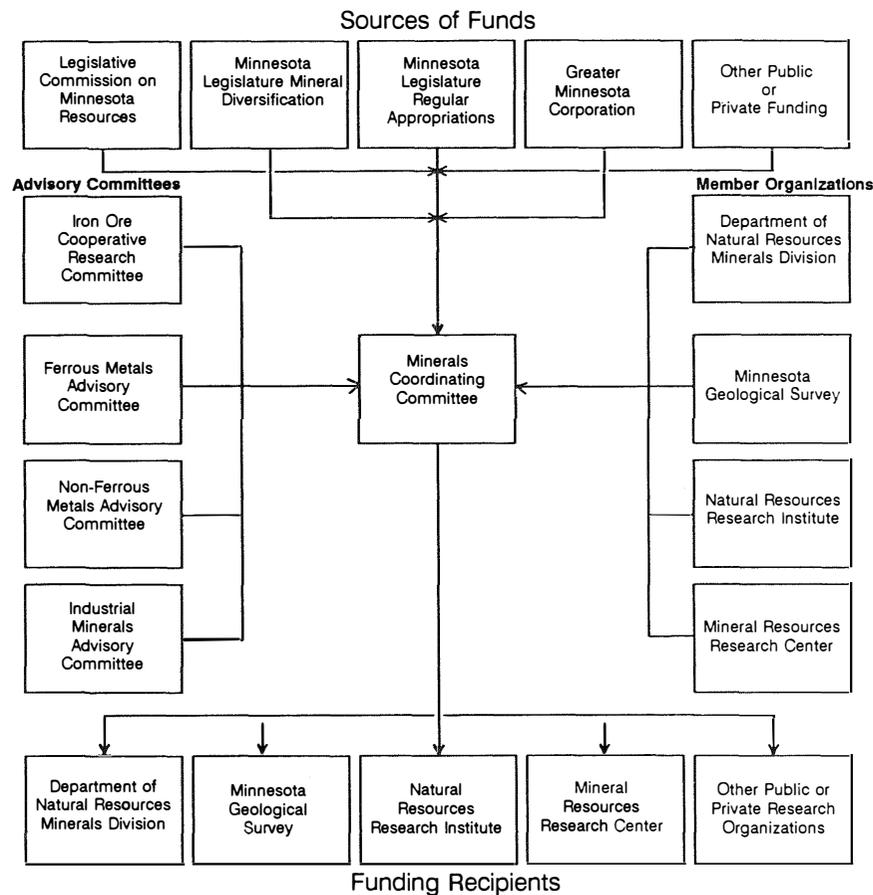
MINNESOTA MINERAL DIVERSIFICATION

ORGANIZATION

The Legislature also directed the founding of the Minerals Coordinating Committee, comprised of the directors of the Division of Minerals, Department of Natural Resources (Chair), the Minnesota Geological Survey, the Mineral Resources Research Center, and the Natural Resources Research Institute.

The Coordinating Committee is responsible by law for diversification planning and for selecting research projects to further mineral diversification. The committee is assisted in this by three private sector advisory committees, representing iron ore, non-ferrous minerals, and industrial minerals.

ORGANIZATIONAL STRUCTURE



MINNESOTA MINERAL DIVERSIFICATION

MESSAGE FROM THE CHAIR

The Legislature acted with foresight and imagination when it founded the mineral diversification program in fiscal year 1988 and 1989. Positive benefits have already begun to flow from its enactment. Chief among them is the establishment of a structure for minerals management encompassing state government, the University system, and private industry. Through this structure, Minnesota's mineral economy is being cooperatively encouraged to balance minerals development and environmental quality.

Particularly fruitful are new and renewed relationships with industry, which provide insight and advice on research emphases and useful views on our evolving state minerals program. These new partnerships — state government with the University, industry, and the public — will help maintain and ensure a wise and steady course for mineral diversification.

The cooperative approach adopted by the Legislature through the Minerals Coordinating Committee is able to respond quickly to emerging minerals issues. Two important issues that will be highlighted in the next biennial plan for diversification are *1) mining and the environment, and 2) integrating minerals information systems and sources.* In the first instance, the Coordinating Committee realizes that it is critical to safeguard the environment from mining impacts. Research to further understanding of impacts and mitigation approaches is central to promoting mineral diversification in Minnesota. In the second instance, the Coordinating Committee has identified the acute need for a central, comprehensive minerals information database; providing simple access to the public and to mineral exploration clientele.

FUNCTIONS

Planning

The Legislature's intent in establishing the mineral diversification program was given substance in a ten year plan for mineral diversification; ordered by the Legislature and published in January 1988. The plan details a comprehensive vision for the state's minerals future, outlining objectives for Minnesota's three chief mineral industry groups and for basic research. The objectives stated in the plan are:

- To improve and extend the iron ore industry;
- To encourage exploration and development of non-ferrous metallic minerals;
- To enhance Minnesota's industrial minerals production;
- To conduct basic research that will lay the foundation for stimulating Minnesota's mineral economy.

MINNESOTA MINERAL DIVERSIFICATION

MINERALS COORDINATING COMMITTEE Long Range Planning for Mineral Information Needs

These objectives are pursued through an aggressive research program for which projects are selected by the Minerals Coordinating Committee with the aid of industry advisory groups. At the heart of the selection process is rigorous peer review of research proposals and, upon completion, demanding evaluation of results.

In the current biennium, mineral diversification is funded by the Legislative Commission on Minnesota Resources (\$1.3 million), the Iron Ore Cooperative Research Program (\$410 thousand), DNR Industrial Minerals Development Program (\$244 thousand) and the Mineral Diversification general fund appropriation (almost \$2 million).

Ferrous Minerals	Non Ferrous Minerals	Industrial Minerals
1. Iron Ore Cooperative Research: Short-term, quick payout projects with matching funds from private industry	1. Provide a "window" to the geology under the glacial till:	1. Regional mineral potential surveys:
2. Longer term, higher risk projects: primary fragmentation superconcentrates high temperature properties of pellets	geochemistry aeromagnetics remote sensing drilling and mapping	carbonate survey dimension stone survey clay surveys sand and gravel inventory
3. New uses for Minnesota iron ore: Direct Reduced Iron pig iron or steel Iron Carbide	2. Environmental research: waste characterization mitigation technology	2. Establish a clearing-house function for state and local permit coordination
4. Environmental, reclamation research To provide stable, non-hazardous sites during and after mining	3. Cataloging and analyses of past work: private data acquisition drill core library drill core analysis minerals data base	3. Process research on known deposits: clay for ceramics and paper-making chemically-bonded bricks dolomite for fluxed pellets
	4. Process research on known deposits: ilmenite, titanium, manganese	4. Environmental / Reclamation research: sand and gravel reclamation manual

Basic Research

Projects that lay the foundation for later work which will stimulate Minnesota's mineral economy:

manganiferous ores
automated material balance
PGM beneficiation / appraisal

diamond bearing kimberlites
mineral resource appraisal
fire assay spectrometry

ACCOMPLISHMENTS

Projects, conducted to provide the basis for diversification, are central to the success of the minerals diversification program. The program now has more than a biennium of research results to report.

THE IRON INDUSTRY

Iron ore cooperative research is directed at short-term objectives to improve the quality and lower the production costs of Minnesota taconite pellets. Project selection is guided by the needs of mining companies. Total project funding includes the combined industry contribution and state matching funds. The success of the Cooperative Research Program is demonstrated by: 1) the adoption by the taconite industry of some of the findings, and 2) by the industry's expressed interest in continuing the program.

Since its inception in FY86, the Cooperative Research Program has received appropriations totaling \$1.2 million for the state funded share of cooperative research projects. Industry has provided equivalent matches, and additional funding matches have been received from the U.S. Bureau of Mines.

The Projects

Iron ore cooperative research projects initiated since 1986 fall into two categories: those that focus on achieving cost savings through equipment or process modifications, and those that focus directly on taconite pellet characteristics and quality.

Examples of project objectives for the first type include:

- investigate the feasibility of milling equipment changes that might lower milling costs;
- control grate corrosion so that grate replacement frequency may be lessened;
- achieve fuel savings through oxygen injection during pellet induration.

Examples of project objectives for the second type include:

- achieve lower silica content pellets, responding to process and steel plant requirements;
- investigate quality and process control through computer imaging;
- improve pellet metallurgical characteristics;
- seek alternative pellet binding material;
- improve high temperature properties of pellets.



Partially Melted Pellets

ACCOMPLISHMENTS

NON-FERROUS MINERALS PROJECTS

These projects are presently focusing on establishing the framework for significant precious or base metals discoveries by private exploration companies. The state's role within the diversification program is to develop the regional-scale geologic data that will attract companies to Minnesota, and provide the basis for selecting exploration targets.

This is an effective strategy. A decade ago, when the interest in precious metals was much lower, it would have been difficult to point to a location with gold values of 1/10 ounce of gold per ton of rock; today we know of sites with values approximating 3/10

ounce. This fact demonstrates the importance of encouraging private mineral exploration through regional geologic research conducted by the University and state government. Also, it has been shown that increased leasing activity can be a direct result of geologic research.

Making state mineral rights available for private exploration leasing is another important focus of nonferrous minerals activity. In FY89, a project was initiated to improve access to surface and mineral rights ownership records in St. Louis County, which

The Projects

The three principal categories of research projects in the non-ferrous minerals area are:

1. Geologic data to promote and support private exploration
2. Minerals information acquisition, analysis, and storage
3. Mineral processing

Examples of projects in category 1 are:

The LCMR-funded aeromagnetic survey and the airborne spectral radiometry project, both of which employ techniques for remotely sensing geologic features of interest to exploration;

Geologic drilling and mapping, which verify and refine broader scale surveys such as the above and provide more accurate maps of structure and rock type; and

Geochemical investigations, which use the tools of sampling and chemical assay to identify potential for precious or strategic minerals.

Category 2 includes projects that seek to make minerals data more accessible to the public and to make use of existing information. Examples are:

A master minerals database project, which will seek eventually to catalog and interrelate all types of information of use to mineral exploration, geologic investigations, reclamation, and siting;

Reexamination and reassay of drill core samples from the Duluth Complex for precious metals;

A project to simulate the impacts of gold mining on Minnesota's economy; and

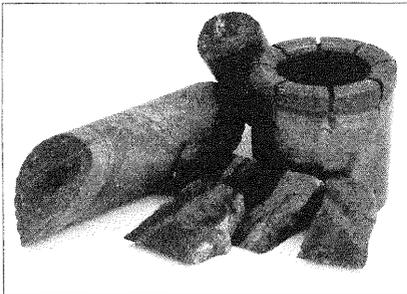
A minerals deposit seminar, gathering scientists and geologists to discuss new theories and approaches to identifying mineral deposits.

Last biennium the only Category 3 project investigated ilmenite (titanium ore) processing. In the current biennium, the LCMR has supported a mineralogic investigation focusing on platinum group elements and the use of a novel methodology called QEM-SEM.

ACCOMPLISHMENTS

is the state's largest county and the one with the greatest mineral leasing potential. This project is being continued in the current biennium with LCMR funding.

In addition, title examination is being conducted to determine the state's ownership of mineral rights, particularly for tracts where the mineral rights may have been severed from the surface interests. Over 193,000 acres have been researched during the last five years. These data are used in the state's metallic minerals lease sales, mineral potential evaluation research and decisions on land exchanges and sales.



Drill Core

INDUSTRIAL MINERALS

Industrial minerals projects are aimed at identifying locations of high-value resources and marketing Minnesota resources and products. The emphasis in FY88-89 was on kaolin clay (and the potential of Minnesota clays for paper-making), peat, and carbonate resources (limestone).

Minnesota is also rich in dimension stone resources and is home to quarrying firms that trade world-wide. That industry has begun to participate in cooperative research with state and federal agencies to locate new resources and improve technology.

Sand and gravel (aggregate) resource evaluation is another emphasis. County by county surveys are being conducted, beginning in the metro area where resources are the most endangered by development. In addition, following Governor Perpich's convening of a Sand and Gravel Task Force, cooperation between producers, and

county and state government is leading toward agreement on standards for sand and gravel pit restoration.



The Projects

Carbonate resource regional assessment, a project that has cataloged resources in existing quarries to determine their value for lime production, flux, fillers, and other products;

Peat marketing, which has created wider markets for Minnesota horticultural peat and has led indirectly to expanded production;

Kaolin clay, a project that has assessed clay resources statewide, pursued processing options related to producing paper-grade kaolin, and identified some of the environmental and marketing aspects of a potential kaolin industry;

Industrial clay, a project to examine the potential for ceramics, brick, and tiles from lower quality clays.

ACCOMPLISHMENTS

MINERALS BASIC RESEARCH

The function of basic research is to set the stage for diversification, through identifying and characterizing resources, depicting processing technologies and identifying production options.

In recognition of the importance of basic research to mineral diversification, the Minerals Coordinating Committee delegated to the University of Minnesota a basic research project review and funding mechanism. About 10 percent of Minerals Diversification funding is allocated to the University's Earth Resources Subcommittee, an arm of the University Council for Natural Resources. The subcommittee solicits proposals for minerals basic research from both the University and other Minnesota academic institutions. Submitted proposals are given peer review and forwarded to the Coordinating Committee for final approval.

The Projects

- An assessment of the potential of felsic rocks for precious and base metals;
- The use of fluids in rocks as indicators of gold mineralization;
- Investigations into grinding media to improve the recovery of base metals from gabbroic rocks;
- Improved recovery levels of platinum group metals in Minnesota rocks;
- A mineralogic study to define exploration targets for platinum group metals in northeast Minnesota;
- Mathematical modeling of mineral resource occurrences;
- Refinement of methods for analyzing gold, silver, and platinum group metals;
- Minnesota graphite resource potential assessment;
- Kimberlite (diamond) resource assessment;
- Mineralogic investigation of the manganese ores of the Cuyuna Range;
- Micro-computer adaptation of an automated material balances program.

MINERAL DIVERSIFICATION AND ENVIRONMENTAL QUALITY

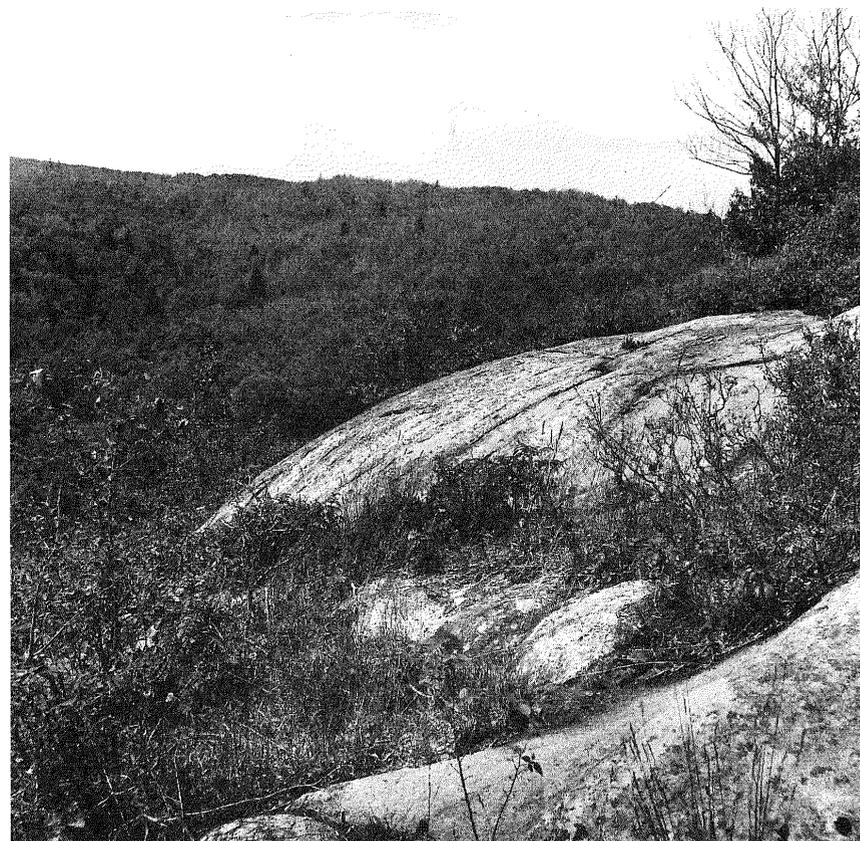
ENVIRONMENTAL QUALITY

Balancing mineral diversification objectives and environmental quality is a fundamental mission of the program. To ensure that new mining proposals may be evaluated both thoroughly and efficiently, the Department of Natural Resources, the Pollution Control Agency, environmental groups, and representatives of the mining industry recently completed a regulatory simulation. The project addressed the question:

"What are the regulatory pathways along which a new mining proposal would travel to reach the development stage?"

The project conclusions not only lead to better understanding of mining regulations but to useful discussion and cooperation by the parties involved.

Future proposals in this area will address mining site management and reclamation, particularly waste management and water impacts mitigation. The findings of this proposed research will help assure the viability of future mining proposals and our quality of environment.





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