Mineral Leasing, Mineral Occurrence and Public Land Ownership Trends in Minnesota

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Minnesota Department of Natural Resources
Lands and Minerals

Trends 101

Photo Image – A University Trust parcel in Itasca County
Minnesota Department of Natural Resources serves as administrator of several public land estates, in total representing 329,000 parcels of land and covering some 11.6 million acres statewide. These land estates include -

- Permanent School Fund lands
- Permanent University Fund Lands
- Tax Forfeited Lands (surface is county administered)
- Lands acquired for Natural Resources Programs
- Other classes of state-owned natural resource lands
Lands Granted for Schools

“That sections numbered sixteen and thirty-six in every township of public land in said State... shall be granted to said State for use of schools”

[where not subject to prior reservation or claim]

2.5 million acres original
Lands Granted for Schools

“...and where either of said sections, or any part thereof, has been sold or otherwise been disposed of, other lands, equivalent thereto and as contiguous may be, ...”

[indemnity selections]

560 thousand acres original
Lands Granted redesignated for Schools

“There is granted, for purposes of internal improvement, to each new State admitted into the Union... 500,000 acres.”

[internal improvement selections]

91,000 acres transferred to permanent school trust

17,000 acres transferred to permanent university trust
Lands Granted redesignated for Schools

“...the whole of the swamp and overflowed lands... are granted and belong to the several states respectively...”

[swamp lands act of 1850, extended to Minnesota in 1860]

4.8 million acres granted

1.9 million acres transferred to permanent school trust
Lands Granted for University Purposes

“Seventy-two sections of land shall be set apart and reserved for the use and support of a state university, to be selected by the governor of said State...” [1857]

Morrill Land Grant - 120,000 acres for an agricultural college

MI, WI, IA - “Seventy-two sections of land, set apart and reserved for the use and support of a University by an Act of Congress approved on .....day of ..... are hereby granted and conveyed to the state.” [basis for a second grant]
Granted Lands
Summary

Present-day surface estate:
2.5 million acres

Present-day mineral estate:
3.6 million acres
+ Forfeited Lands

“...the title to every parcel of land acquired by the state as provided by this act shall be held by the state in trust for the respective taxing districts...”

[Minnesota laws, 1935]

+ Consolidated Conservation Lands

+ Federal Lease, Volstead Act Lands

+ Acquired Lands
Mineral Leasing Status
Present-Day
[as of April 1, 2014]
Historical Pattern

of State metallic mineral leases and Canadian Au mineral occurrences
Aeromagnetic Context

for Minnesota metallic mineral leasing, and Canadian Au mineral occurrence inventory

[nonrandom pattern]
Satellite Imagery Analogue

for granite-greenstone terrane in Minnesota

Pilbara Craton NW Australia
(w/90 degree rotation)

[white granites, sandwiched volcanic belts]

Pilbara area Landsat imagery courtesy Australian Center for Remote Sensing and Warren Hamilton
Mineral Deposit Models

Identify geologic environmental settings capable of producing mineral resources

[for example, a modern-day ocean-floor “black smoker” hot water vent system, analog for greenstone-belt volcanic-hosted massive sulfide (VhMS) copper-zinc-lead deposits]
Magmatic Ore Deposits in Layered Intrusions—Descriptive Model of Reef-Type PGE and Contact-Type Cu-Ni-PGE Deposits
By Michael L. Zientek

Concise Description
Layered, ultramafic to mafic intrusions are uncommon in the geologic record, but host magmatic ore deposits containing most of the world’s economic concentrations of platinum-group elements (PGE) (figs. 1 and 2). These deposits are mined primarily for their platinum, palladium, and rhodium contents (table 1). Magmatic ore deposits are derived from accumulations of crystals of metallic oxides, or immiscible sulfide, or oxide liquids that formed during the cooling and crystallization of magma, typically with mafic to ultramafic compositions.

“PGE reefs” are stratabound PGE-enriched lode mineralization in mafic to ultramafic layered intrusions. The term “reef” is derived from Australian and South African literature for this style of mineralization and used to refer to (1) the rock layer that is mineralized and has distinctive texture or mineralogy (Naldrett, 2004), or (2) the PGE-enriched sulfide mineralization that occurs within the rock layer. For example, Viljoen (1999) broadly defined the Merensky Reef as “a mineralized zone within or closely associated with an unconformity surface in the ultramafic cumulate at the base of the Merensky Cyclic Unit.” In this report, we will use the term PGE reef to refer to the PGE-enriched mineralization, not the host rock layer. Within a layered igneous intrusion, reef-type mineralization is laterally persistent along strike, extending for the length of the intrusion, typically tens to hundreds of kilometers. However, the mineralized interval is thin, generally centimeters to meters thick, relative to the stratigraphic thickness of layers in an intrusion that vary from hundreds to thousands of meters.

PGE-enriched sulfide mineralization is also found near the contacts or margins of layered mafic to ultramafic intrusions (Iljina and Lee, 2005). This contact-type mineralization consists of disseminated to massive concentrations of iron-copper-nickel-PGE-enriched sulfide mineral concentrations in zones that can be tens to hundreds of meters thick. The modes and textures of the igneous rocks hosting the mineralization vary irregularly on the scale of centimeters to meters; autoliths and xenoliths are common. Mineralization occurs in the igneous intrusion and in the surrounding country rocks. Mineralization can be preferentially localized along contact with country rocks that are enriched in sulfur-, iron-, or CO2-bearing lithologies.
### Outside of Iron Ranges – Statewide

**Nonferrous Mineral Occurrence Status**

<table>
<thead>
<tr>
<th>Deposits with Reserves (1):</th>
<th>Polymet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposits (10): (w/grade and tonnage)</td>
<td>Spruce Road, Maturi, Birch Lake, Serpentine, Mesaba, Mesaba Local Boy, Longnose, Titac South, Tamarack</td>
</tr>
<tr>
<td>Prospects (23): (3+ intercepts area) [~forty contains 4+ drill holes]</td>
<td>South Filson Creek, Dunka Area, Wetlegs, Titac North, Waterhen, Skibo, Virginia Horn, Raspberry, Lost Lake, Tilson Creek, Shagawa NE, Mud Creek, Gale Brook, Kalevala, Denham, YGWA, Arrowhead, Hero, Bogberry Lake, Nickel Lake, Nickel Lake Northeast, East Shore, Wyman</td>
</tr>
<tr>
<td>Intercepts (numerous): (length + grade)</td>
<td>representing at least six deposit types</td>
</tr>
<tr>
<td>Showings (numerous): (grade)</td>
<td>grab samples and lesser intercepts</td>
</tr>
</tbody>
</table>
Aeromagnetic Context

for Minnesota metallic mineral leasing, and Canadian Au mineral occurrence inventory

[nonrandom pattern]
Ownership Context

- intermingled land estates
- program acquisitions
- exchange history
- severance history

[nonrandom pattern]
Further Information

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