Metallic Mineral Exploration in Minnesota:
A Look at 46 Years of State Mineral (Nonferrous) Leasing Data 1966 to 2012

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Let’s look at the historical data of exploration activity from 46 years of state metallic mineral leasing from 1966 through 2011.

This data summarizes some of the common exploration activities a surface owner or neighbor would have seen.
State Mineral Lease Transactions:

3,379 State Metallic Mineral Leases Total
• 387 active (11%)
• 2,992 terminated (89%)
Looking at forty-acre parcels and government lots provides a meaningful perspective for proximity to local landowners. Government lots may be larger or smaller than forty acres in size, but we will generalize here and call this count the “number of forty-acre parcels”.

A single state lease may contain up to sixteen 40-acre parcels within a typical single mining unit, but the mining unit acreage varies based upon ownership.

State Mineral Leases, 1966-2012
1. Phase I = Exploration Phase
   • Goal is to Discover an Economic Deposit
   • 99% of state leases did not get past this Phase and terminated at or before year 10 of the lease

2. Phase II = Evaluation Phase
   • Delineation of the Discovery
   • Economic Feasibility & Mine Planning
   • Four companies on State Leases that appear to be in Evaluation Phase – Twin Metals, Teck American, Kennecott Exploration and Encampment (PolyMet and Cardero do not have state mineral leases)
A phased approach to mineral exploration allows for cost-effective evaluation of many targets.

A grass-roots metallic mineral exploration program in Minnesota may be described as a four-step process that can take anywhere from 1 to 20 years to complete.

1. Business Plan & Financing [1 – 5 yrs]
2. Land Package [1 – 5 yrs]
3. Exploration [1 -10 yrs]
4. Decision
A grass-roots metallic mineral exploration program in Minnesota is a four-step process that can take anywhere from 1 to 20 years to complete.

1. Planning [1 – 5 yrs]
2. Land Package [1 – 5 yrs]
3. Exploration [1 -10 yrs]
4. Evaluation

Acquire a Land Package

- Secure the rights to explore for minerals over a buried geological target feature
- Land package may include:
  - State mineral leases
  - Private mineral leases
  - Federal prospecting permits

This is the primary source of the historical data: State Mineral Leases
Example of Exploration Land Package

Exploration Land Package
Prime Meridian Resources
Winterfire Prospect
Koochiching County, MN
State Mineral Leases: 1966–2012

3,379 State Mineral Leases
- 387 active (11%)
- 2,992 terminated (89%)

Some active state leases are in the Exploration Phase, while others are in the Evaluation Phase.

(Longest Active Lease = 24 yrs.)
State Mineral Lease Transactions:

3,379 State Metallic Mineral Leases Total
• 387 active (11%)  
• 2,992 terminated (89%)

Length of 2992 Terminated Leases

89% 0-5 yrs
10% 6-10 yrs
1% >10 years

(Longest Terminated Lease = 23 yrs)

The Exploration Phase is usually completed in 10 years
(99% of leases were terminated at 10 years or less)
120,659 forty-acre parcels have been offered by the State of Minnesota for mineral exploration since 1966.

Note: many parcels have been offered repeatedly over the years, but are only counted once for this purpose.

State Mineral Leases, 1966 to 2012; See Disclaimer in Notes Below
20% of the forty-acre parcels offered by the State for mineral exploration have been leased.

All figures are the “40-acre parcel count” described in the notes. The 23,752 parcels are within 3,379 State leases.
Exploration Phase
Activity: Geochemistry & Geophysics
Estimated 19% of the forty-acre parcels leased had at least one geochemical sample taken.
Evaluation Phase
after Exploration and Discovery

3 to 10 years

Delineate Areal Extent & 3D of Deposit by Drilling

Test % Recovery Metals, Process Methods, etc. Create Models

Final Mine Design Plan, Aux. Lands, Environmental Control Design, etc

Metal price trends; cost of capital; energy supply; business partnerships & sale of future metal; technology improvements
Evaluation Phase for Cu + Nickel

Active Projects on State Mineral Leases

Four exploration companies have Evaluation Phase Projects on State-Leased Lands.

The 22 State leases associated with these 5 deposits represent 6% of the active State leases.
Estimated 0.5% of the forty-acre parcels leased had evaluation phase drilling.

State Mineral Leases, 1966-2012
All Exploration Phase & Evaluation Phase Activities Combined: Drill Holes Per Parcel

Number of drill holes within a 40 acre parcel | Number of 40 acre parcels | Percentage
--- | --- | ---
0 | 23197 | 97.6%
1 | 380 | 1.6%
2 - 5 | 116 | 0.5%
6 - 10 | 41 | 0.2%
11-21 | 13 | Less than 0.1%
22-128 | 5 | Less than 0.1%
Total | 23752 | 100%

1 drill hole/parcel
1.6% (n=380)

No Drill Holes in 97.6% of the parcels leased

555 parcels with 1 or more drill holes
n=1477 total drill holes

State Mineral Leases, 1/1/1966-1/1/2012; Drill Hole Data 1/1/1966-3/30/2011
Each red pipe is a drill hole. There are 6 drill holes in a small area on this parcel. Not all drilling can be done in a small area like this. 59 state lease parcels had 6 or more drill holes out of 23,752 parcels leased over a 46 year period.
Exploration Phase vs. Evaluation Phase

Drilling History

Exploration Phase
Drilling tends to be small numbers of holes and widely spaced

Estimate 595 Drill Holes on 444 forty-acre parcels

Evaluation Phase
Drilling tends to be higher numbers and closer spacing over a target deposit

Estimate 882 Drill Holes on 111 forty-acre parcels within 22 active State Mineral Leases for five deposits

General Trend from 46 Years
Classification of # of Drill Holes: Exploration 40% vs. Evaluation 60%

A sum of 1477 drill holes on 555 forty-acre parcels within State Mineral Leases from both Phases of exploration. These are estimates.
2.4% of the forty-acre parcels leased had at least one drill hole on it during 46 years.

- 23,752 leased parcels
- 97.6% no drilling
- 555 leased parcels with at least 1 drill hole
- 23,197 leased parcels with no drilling

State Mineral Leases, 1966-2012
Ownership: Minerals rights vs. surface rights
Subset: All parcels with Exploration Drilling

20% (110) of these 555 parcels have different surface & minerals owners (State owns the minerals rights, not the surface)

10% (55) of these 555 parcels are Active leases with severed minerals

State Mineral Leases, 1966-2012

97.6% no drilling

555 leased parcels
23,752 leased parcels
23,197 leased parcels with no drilling
State Mineral Lease Activity Historical Summary

1 out of 5 = ratio of number of 40-acre parcels actually leased compared to number of parcels offered

1 out of 5 = ratio of estimated number of 40-acre parcels leased and had at least one geochemical sample taken

1 out of 43 = ratio of number of 40-acre parcels leased and had at least one exploratory boring

1 out of 132 = ratio of number of 40-acre parcels leased and had more than one exploratory boring

Note: It has taken 46 years to accumulate the activity to these ratios. These activities did not happen after any single state lease sale event.
**State Mineral Lease Activity Historical Summary**

**Exploration activity**
Exploration starts with a large area and the process selects small areas to do more detailed work.

Fairly continuous through 46-year history, but levels do vary.

Average of 13 (min.=0; max=58) drill holes per year (n=595) on an average of 10 forty-acre parcels (min.=0; max=47) per year (n=444).

Geochemical & geophysical surveys, which have minimal and short term impacts, were commonly done prior to drilling and were done on more parcels.

Different metals were sought in different time periods and different exploration methods applied.

**Evaluation Activity**
Evaluation occurs on very small areas.

Occurs in 5 to 10 year periods of high level of activity, separated by long time periods of no activity.

Currently within a time period with a high level of activity.

A ratio of approximately 1 out of 200 forty-acre parcels leased have had evaluation activity after 46 years.
Exploration activity varies according to metal business cycles, as reflected in metal prices.
The exploration data from the past 46 years provides an excellent picture of the past activity on state mineral leases. However, it does not predict the future exploration activity.
Minnesota Wells and Boreholes Completed During the Years 2000 - 2010

<table>
<thead>
<tr>
<th>Well/Boring Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water Supply Well</td>
<td>108,201</td>
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<tr>
<td>Mineral Exploration Drill Hole</td>
<td>1,031</td>
</tr>
<tr>
<td>All Other</td>
<td>20,436</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>129,668</td>
</tr>
</tbody>
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Data Source: Minnesota Dept. Health, DNR Drill Core Database
The End