Industrial Minerals

Current Trends and Future Opportunities

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British Columbia
Ministry of Energy and Mines
Outline

- Industrial Minerals and the Economy
- Trends
- British Columbia’s Geological Potential
- Assessment of Mineral Projects
Any rock, mineral, or other naturally occurring substance of economic value, exclusive of:

- metallic ores
- mineral fuels
- gemstones

Dual minerals
Industrial Minerals and Metal Production in Canada

B.C.

Non-metals
(Industrial Minerals and Structural Materials)

Metals

Year
0
4
8
12
16

Billion Can $
Industrial Minerals in B. C.

- Mine - Quarry
- Processing Plant
- Prospect/Development
- Mainly Aggregates
- Other Occurrence
### High-Low Principle

- **High value:** world market
- **Low value:** local market

<table>
<thead>
<tr>
<th>Mineral</th>
<th>US$/tonne</th>
<th>Mineral</th>
<th>US$/tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wollastonite</td>
<td>200 - 300</td>
<td>Crushed stone</td>
<td>≤6</td>
</tr>
<tr>
<td>Graphite</td>
<td>230 - 750</td>
<td>Natural aggregate</td>
<td>≤4</td>
</tr>
<tr>
<td>Mica</td>
<td>210 - 1200</td>
<td>Gypsum</td>
<td>≤7</td>
</tr>
</tbody>
</table>
High-Low Principle

- **High value:**
  - world market
  - Developed / Developing countries
  - Security of land tenure
  - Trade barriers & government initiatives
  - Land sterilization
  - Value-added processing
  - Energy cost differences

- **Low value:**
  - local market
Land Sterilization / Urbanization

Consumption - 2000

Scale:
50,000,000 Tonnes

Legend:
- Crushed stone
- Aggregate

Source: USGS and BC Ministry of Energy and Mines
Land Sterilization / Urbanization

Consumption - 2000

Scale: 50 000 000 Tonnes

Legend:
- Crushed stone
- Aggregate

Source: USGS and BC Ministry of Energy and Mines
Value-added Processing

Raw Industrial Mineral

Processing Method

- Milling, Micronisation, and Classification
- Flotation
- Surface Modification
- Bleaching
- Expansion
- Delamination
- Calcining
- Fusion

Value-Added Product

Modified from: Simandl et al, 1996
Value-added Processing of CaCO$_3$

1. Aggregates / Agricultural lime
2. Glass, Carpet, Shingles
3. Adhesives, Caulks, Putty, Rubber, Stucco, Floor tiles
4. Fine ground fillers

Source: Harben & Kužvart, 1996
## Energy-intensive Value-added Products

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Product</th>
<th>US$/tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesite</td>
<td>Raw</td>
<td>( \approx 50 )</td>
</tr>
<tr>
<td></td>
<td>Caustic MgO</td>
<td>119 - 138</td>
</tr>
<tr>
<td></td>
<td>Dead-burned MgO</td>
<td>105 - 135</td>
</tr>
<tr>
<td></td>
<td>Fused MgO</td>
<td>( &gt;320 )</td>
</tr>
<tr>
<td></td>
<td>Mg Metal</td>
<td>( \approx 2430 )</td>
</tr>
</tbody>
</table>
Energy-intensive Value-added Products

Other Examples:

- Silicon
- Ferrosilicon
- Silicon carbide
- Sintered or electrofused refractories
- Traditional or advanced ceramics
- Reinforcing or insulating fibres
- Glass
- Industrial intermediates
Global Trends

- Environmental Regulations
- Health Regulations
- Recycling Efforts
- Technology
Environmental Regulations

**Negative Impact**

- Sulphur

**Positive Impact**

- Zeolites
- Perlite
- Dolomite
- Calcium carbonate
- Lime
- Magnesia / Magnesite
- Peat
- Diatomite
Environmental Regulations

Salt

Source: Institute for Mineralogy and Mineral Resources, 2001
Health Regulations

Asbestos

Fiberglass
Ceramic fibers
Carbon fibers
Aramid fibers

ATH
Wollastonite
Diatomite
Mg(OH)$_2$
Perlite
Vermiculite
Pumice
Pyrophyllite
Barite
Alumina/Emery

Silica

Garnet
Olivine
Magnesite
Slag

Source: Department of Occupational Health and Safety, Youngstown State University, 2001
Recycling

Source: National Asphalt Paving Association
Technology

**Past**
Glass → plastic containers
Acid → neutral paper

**Present**
Wireless communications
Flame retardants
“Superpave”

**Future ?**
Internet marketing
Fuel cell
CO₂ sequestration
What are the opportunities in British Columbia?
Project Selection

Successful IM Project

Deposit

Market

BC Industrial Base
Exports
Niche
Trends

Tenure
Technical Factors
Infrastructure
Transportation