Concluding the Review

Precious Metals

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Markets, Prices and Interest
Comparison: Vosey’s Bay

- Estimated proven and probable reserves of 32 million tonnes grading 2.75% nickel, 1.59% copper and 0.14% cobalt.
- (880,000 contained nickel, 508,800 tonnes copper, 44,800 tonnes cobalt)
- Additional 40 million tonnes of indicated mineral resource grading 1.89% nickel, 1.90% copper and 0.12% cobalt and 6 million tonnes of inferred mineral resource grading 1.9% nickel, 1.0% copper and 0.2% cobalt available as part of the Voisey's Bay project.
**USGS ‘Noteworthy’ Exploration 2004: Interest in Precious Metals**

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<th>Au</th>
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<th>Co</th>
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<th>Ni</th>
<th>Pb</th>
<th>PGM</th>
<th>Sb</th>
<th>Zn</th>
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<td>5</td>
<td>19</td>
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Precious Metals in Seabed Minerals

- Gold and Silver are potential by-products in Polymetallic Sulfides
- Precious metals often contribute significantly to the profitability of sulfide ores
- Gold and silver are major incentive to exploration on land and sea
Gold and Silver Price History

Gold and Silver Prices (2005 Dollars)
Gold

- Jewelry
- Dental
- Electronics
- Investment
- 2005 Production: 2450 metric tonnes
- Reserves: 42,000 metric tonnes
Gold’s Applications

![Graph showing gold consumption (tonnes) from 1996 to 2001. The graph includes categories such as Dental, Industrial, Retail/Investment, and Jewelry. The years 1997 and 1999 show a slight decrease in consumption compared to the other years.]
Gold Production - 2005

- South Africa
- Australia
- United States
- China
- Peru
- Russia
- Indonesia
- Canada
- Other countries
Gold Production History

![Gold Production History Graph]

Production (Tonnes) vs Year

Legend:
- Europe
- Africa
- Asia
- America
- Oceania
Gold Reserves

- South Africa
- Australia
- Peru
- Russia
- United States
- Indonesia
- Canada
- China
- Other countries

0 5,000 10,000 15,000 20,000
Silver

- Jewelry
- Photography
- Chemical/Industry
- Coins
- World Production 2005: 20,300 tonnes
- Reserves: 270,000 tonnes
Silver Demand

- Jewelry and Silverware: 33%
- Coins and Medals: 3%
- Industrial Applications: 40%
- Photography: 24%
Silver Production - 2005
Overview and Conclusions
What Happened to the Nodule Mining Industry of the 1970s?
The Answer is in the Prices

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<tr>
<td>Cu ($/lb)</td>
<td>1.71</td>
<td>2.07</td>
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<td>Ni ($/lb)</td>
<td>5.82</td>
<td>5.93</td>
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<td>Co ($/lb)</td>
<td>14.42</td>
<td>44.62</td>
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<td>Mn ($/MTU)</td>
<td>3.75</td>
<td>3.41</td>
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To What Do Prices Respond?

- Supply-Demand Balance
- Risk
- Alternative Investments (e.g. expansion of existing deposits, improved processing efficiency)
- Changes in Consuming Technologies (e.g. Mn in Steel)
What Might the Future Bring?

• Strong demand growth and continuing price increases in response to development of advanced developing countries
• Eventual reduction of Russian Exports as economy improves
• Development of advanced auto batteries as major new market for Ni, Co and Mn
• Increased demand for specialized Mn products
• Potential reduction in demand for lead in auto batteries
• Continued cyclical market behavior in response to economies
• PAL technology contribution to seabed minerals as well as laterites
Risk: The most important factor

- **Industry Wide**
  - Uncertainty of demand projections
  - Market changes due to end user technology or preferences
- **Land-based Minerals**
  - Political uncertainty of some mineral regions (e.g. Pakistan-Iran region; Congo)
- **Seabed Minerals**
  - Technical uncertainty of seabed mining technology
  - Untested ISA regime
Current Trends

• Increased nickel and cobalt production in Australia and New Caledonia and application of Pressure Acid Leach technology to reduce operating costs;
• Development of the large Voisey’s Bay nickel-cobalt-copper deposits in Canada and large nickel laterite deposits elsewhere;
• Continued development of existing copper and zinc mines to meet demand growth;
• Continued demand growth for minerals to support the development of China’s industrial and commercial economy.
Transitional Uncertainties

• Short term economic cycles
• Recovery of Russian Economy
• Development of land-based deposits
  – Large scale capital requirements
  – Environmental and conservation limitations
Transformational Factors

- Rising intensity of use of metals in China and other developing countries will lead to a sustained increase in demand for all major metals in deep seabed minerals.
Transformational Factors

- The transportation sector, and automobiles in particular, will be a key factor in rising demand
  - Development of economy will require mobility, leading to more personal vehicles
  - Fuel efficiency needs will promote high energy battery use in vehicles, increasing demand for cobalt, nickel and/or high quality manganese
Findings and Conclusions

• The rising GDP of China and other developing countries will lead to higher than average growth of demand for major metals to be derived from deep seabed minerals

• The Automobile sector demand will both expand conventional uses (copper and lead) and will open new demand for nickel, cobalt and manganese in high energy batteries
Findings and Conclusions - 2

• Precious metals are an important driving force in mineral exploration. Prospects for recovery of gold and silver from polymetallic sulfides will be a factor in building interest in early seabed mining operations
Findings and Conclusions -3

• Legal and regulatory conditions are a major factor in evaluation of attractiveness of mineral deposits for development
  – Demonstration of an effective and efficient legal and regulatory regime for the deep seabed will compliment factors that make seabed mineral resources technically and economically attractive
Looking Ahead

• Seabed minerals have the opportunity to become a major source of supply to the world economy
• The first operations are likely to address proven markets with demonstrated growth potential and limited land based expansion
• By-product precious metals will have an important effect in attracting investment
• The demonstration of both technology and legal/regulatory climate by the initial operations will ease the way for subsequent development of seabed minerals