

# 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 Vosey's Bay project.

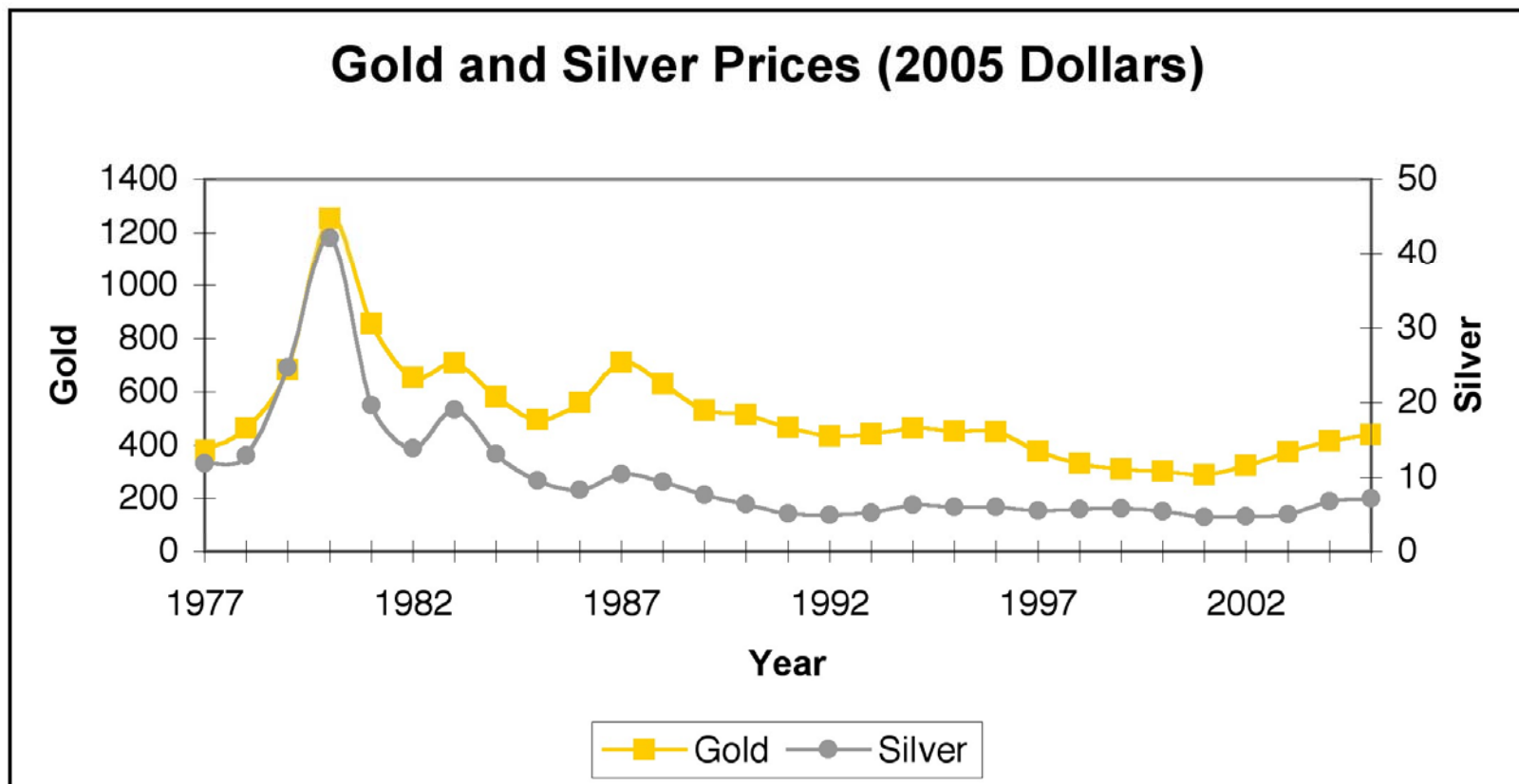
# USGS 'Noteworthy' Exploration 2004: Interest in Precious Metals

	Ag	Au	Ag	Co	Cu	Ni	Pb	PGM	Sb	Zn	Diam.
Africa	20	17	1	2	3	3		2		1	
Aus	4	4			1						
Canada	26	19	3	1	6		1	3	1		3
L. America	21	17	8		3		1			1	
Pacific	4	3		1	2		1				
USA	9	9			2						
Other	14	13	2	1	2	1					
<b>Total</b>	<b>98</b>	<b>82</b>	<b>14</b>	<b>5</b>	<b>19</b>	<b>4</b>	<b>3</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>3</b>

# 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

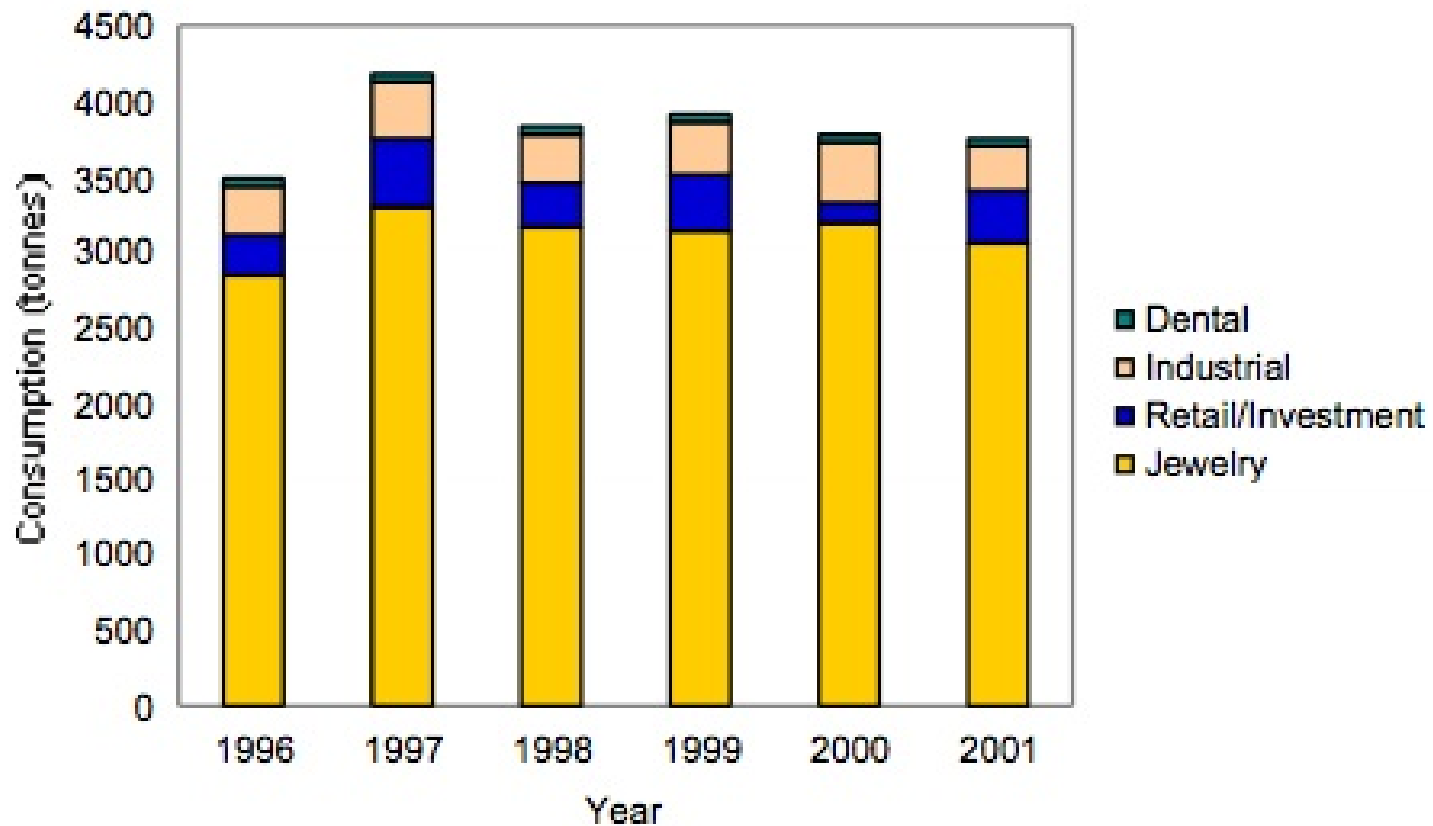
# Gold and Silver Price History



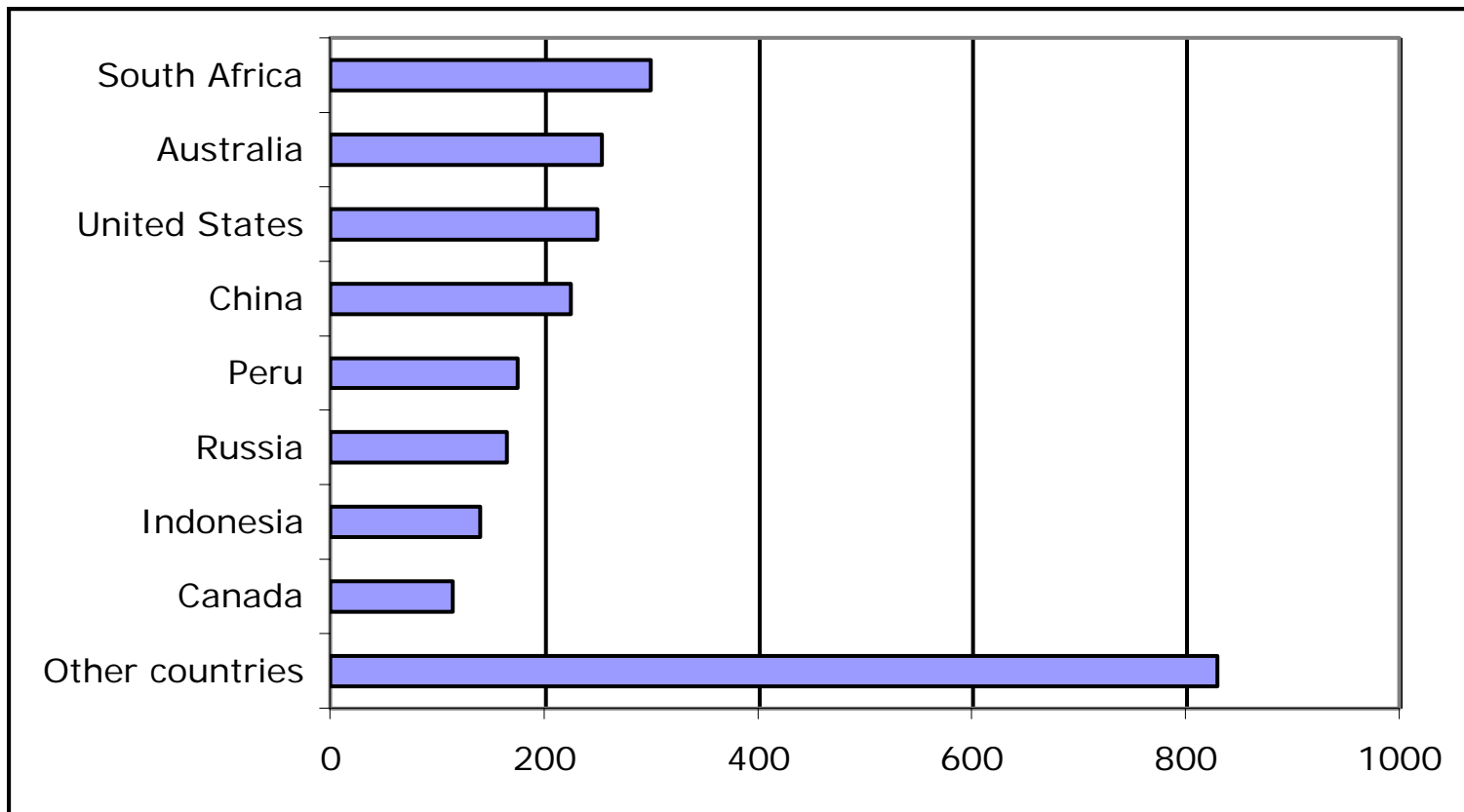
# Gold

- Jewelry
- Dental
- Electronics
- Investment
- 2005 Production: 2450 metric tonnes
- Reserves: 42,000 metric tonnes

# Gold's Applications

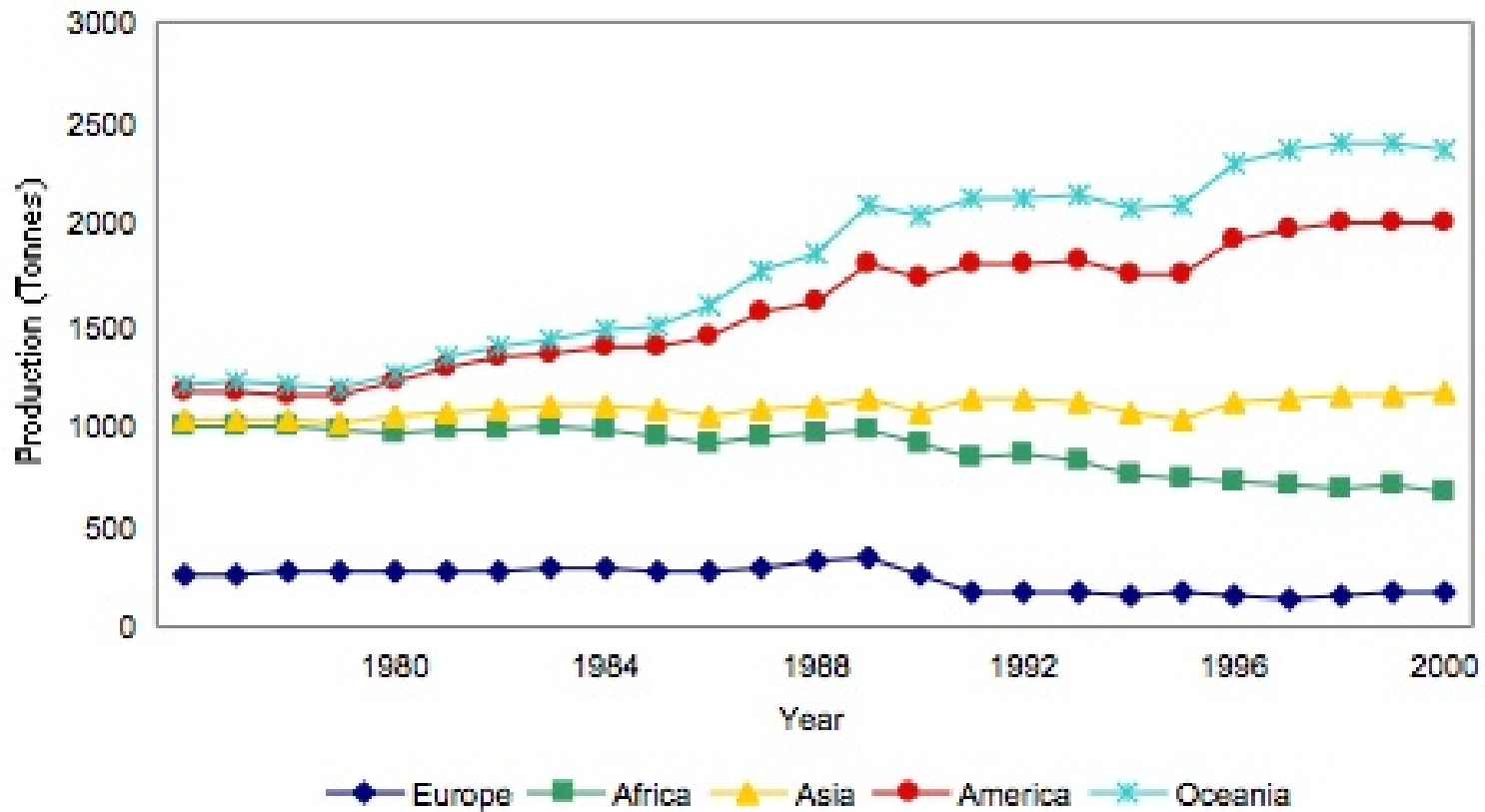


# Gold Production - 2005

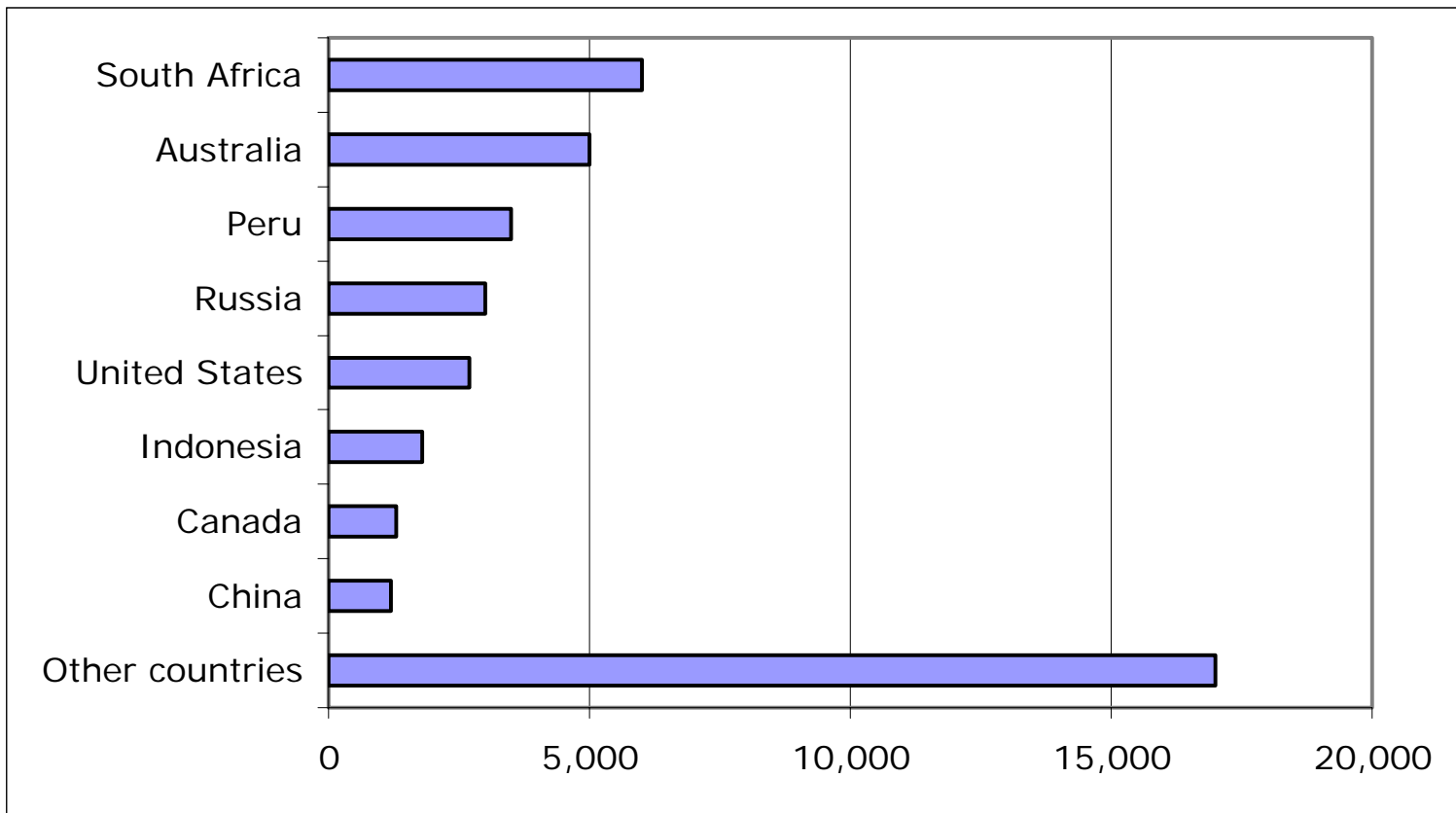




# Gold Production History



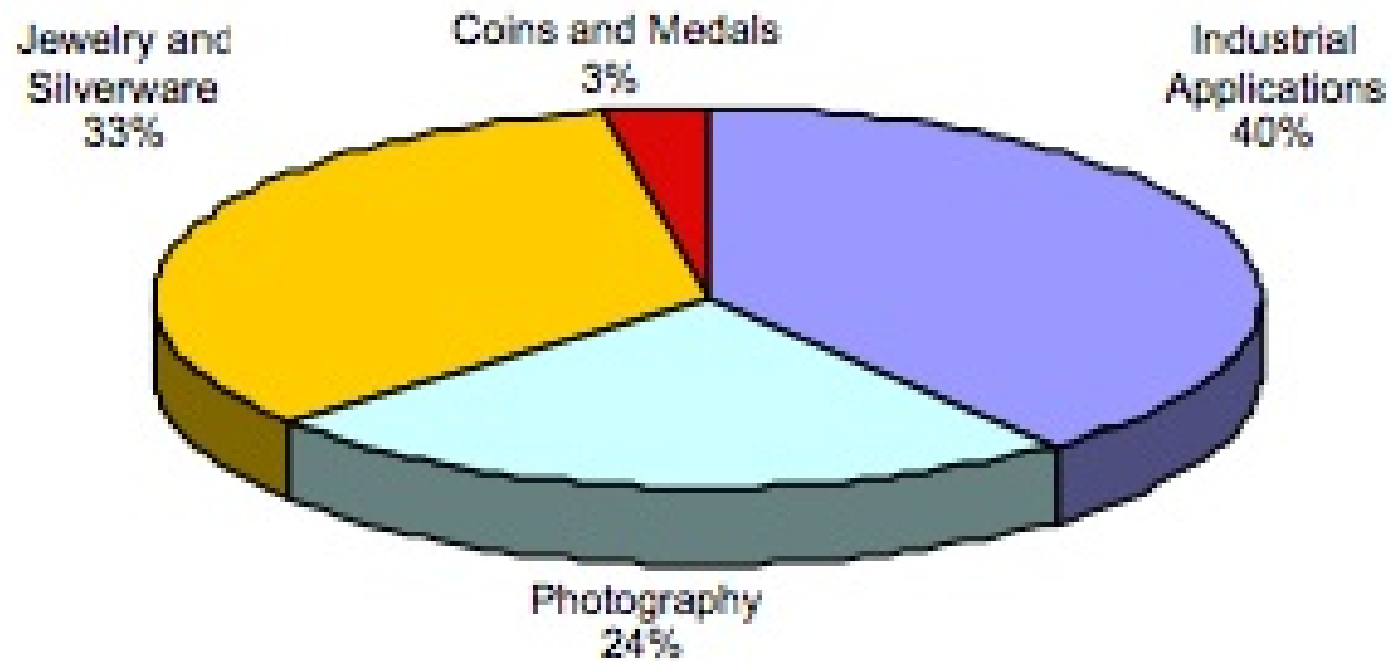
# Gold Reserves



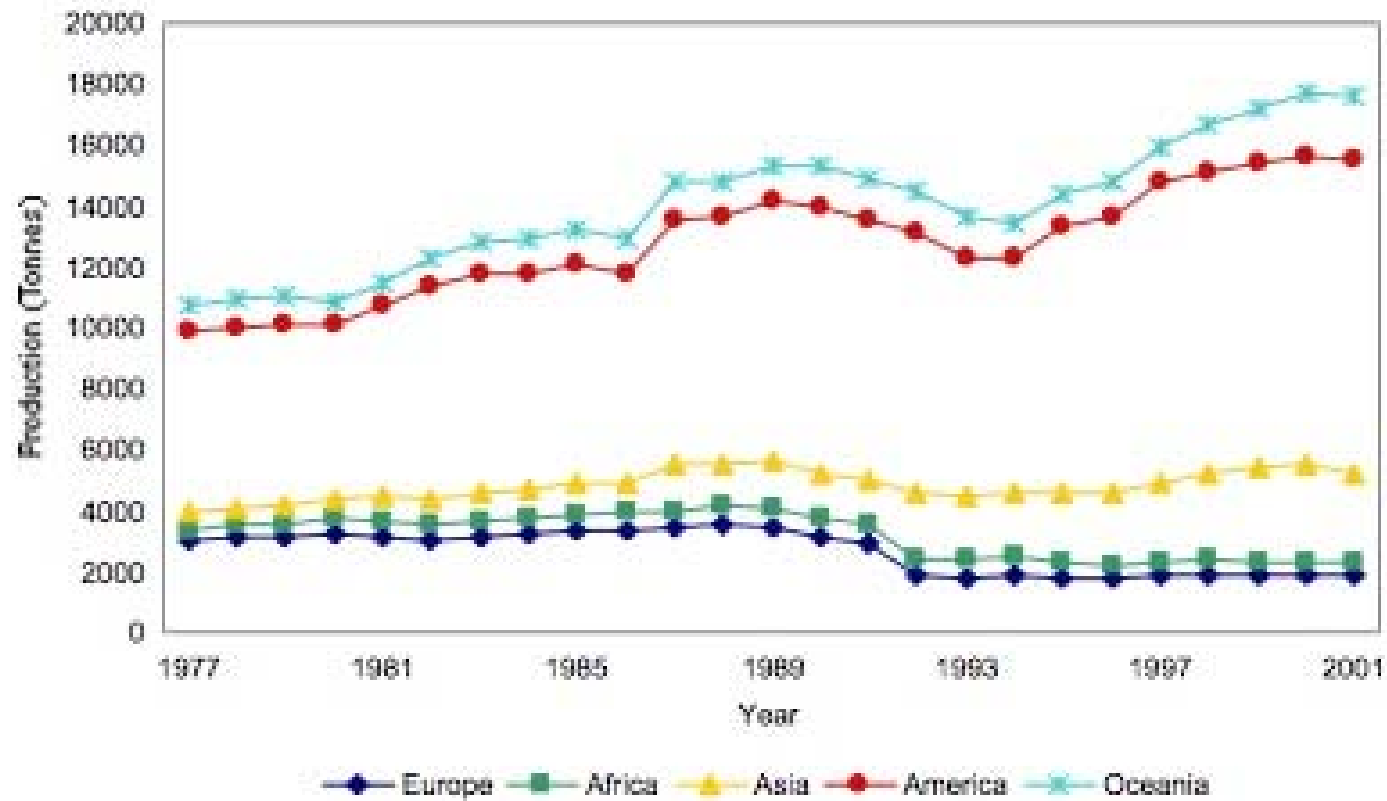
# Silver

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

# Silver Demand



# Silver Production - 2005



# Overview and Conclusions

# What Happened to the Nodule Mining Industry of the 1970s?

## The Answer is in the Prices

(prices in 2005 \$)	1977	1980	2005
Cu (\$/lb)	1.71	2.07	1.69
Ni (\$/lb)	5.82	5.93	6.59
Co (\$/lb)	14.42	44.62	15.80
Mn (\$/MTU)	3.75	3.41	4.71

# 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

