International Standards for Resource and Economic Evaluation

Applications for Deep Seabed Mining

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Standards and Stakeholders

Over years, standards have been developed and adopted to insure stakeholders that evaluations regarding prospects for economic development of mineral deposits are:

- An **accurate presentation** within the limits of the data available
- **Assumptions and uncertainties** clearly identified
- Assessments are carried out in line with **widely accepted international standards and best practices**

Resource and Reserve Assessments

- Sought by **governments and organizations** to assess supply vulnerability, encourage development, promote research and develop conservation policies
- Sought by **mineral developers** to plan development of individual deposits and to guide investment decisions
- Sought by **investors and by securities regulators** to prevent misleading or false information from disrupting stock exchanges and securities markets

Milestones

- **1533**: Agricola Identifies Importance of Mineral Evaluation and Reporting
- **1909**: Herbert Hoover Defines Mineral Reserves as Proved, Probable or Possible
- **1976-80**: National Supply Concerns Lead to New Taxonomies of Mineral Resources Based on Geologic Certainty and Economic Feasibility
- **1989**: Scandals in the 1960s and 1980s Lead to First National Code on Reporting of Ore Reserves

Forces for Change

Business:

- Scale of investment capital required to develop new mines
- Role of Securities Exchanges in Financing Mineral Development
- Role of “Junior Exploration Companies”

Government:

- Mineral Resources in Warfare and in the Modern Economy
- Minerals as a Factor in International Development

Commercial Focus on Resource Classification

Stakeholders

- **Professional Societies** in Geology, Mining, Law, Industry and Accounting
- Mining Industries, Investors, Securities Exchanges

Common Stakeholder Classification Model

- CRIRSCO Template

Reinforced in National Legislation or Regulation

- e.g. Australia's Joint Ore Reserves Committee, Canada's NI-43-101

Industry Best Practices

- Competent/Qualified Person
- Standard Definitions
- Resource Database
- Geological Interpretation & Modeling
- Mineral Resource Estimation
- Modifying Factors
- Mineral Reserve Estimation
- Reporting Standards
- Reconciliation

Industry Resource Definitions

Mineral Resource

- Inferred Mineral Resource
- Indicated Mineral Resource
- Measured Mineral Resource

Mineral Reserve

- Probable Mineral Reserve
- Proved Mineral Reserve

Modifying Factors

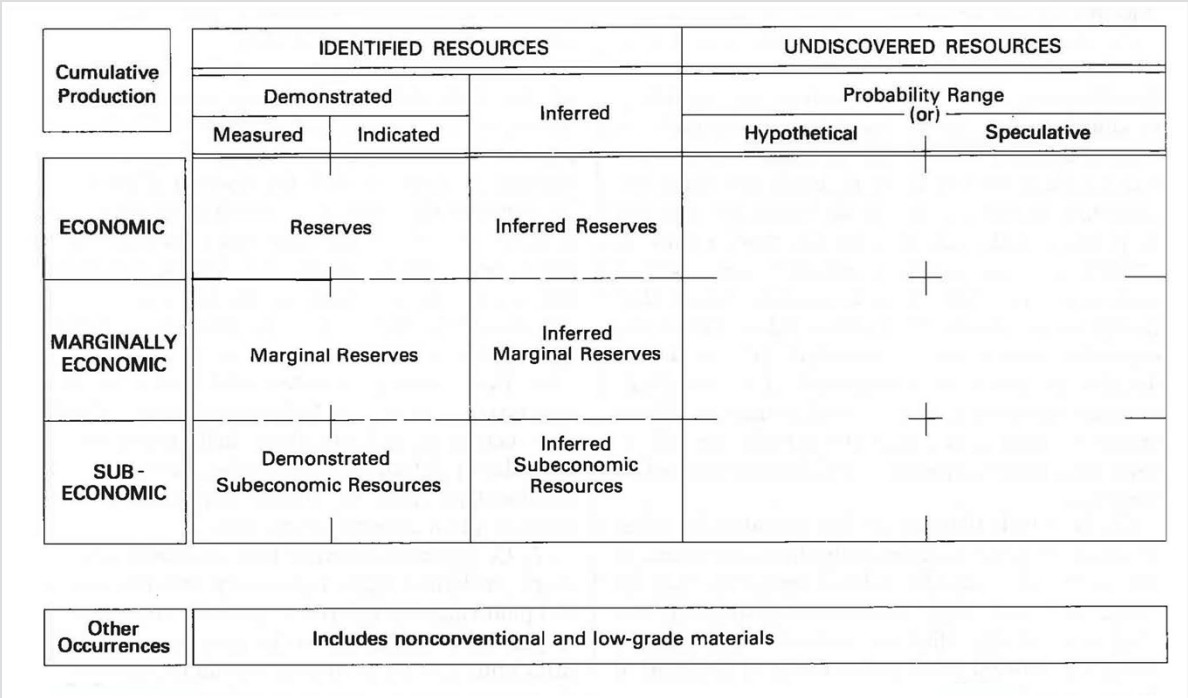
- Harvesting/Recovery Technology Capabilities
- Environmental and Social Regulations
- Government Regulations for Mining Operations
- Investment and Operating Costs
- Commodity Markets and Mineral/Metal Sales
- Financial Regulations for Exploitation
- Legal Rights (exclusivity, tenure, title)

Government and Agency Interests

- National Inventory of Mineral Resources
- Land Use Planning
- Economic Development
- Infrastructure
- Environmental Regulation
- Social Impact
- National Security

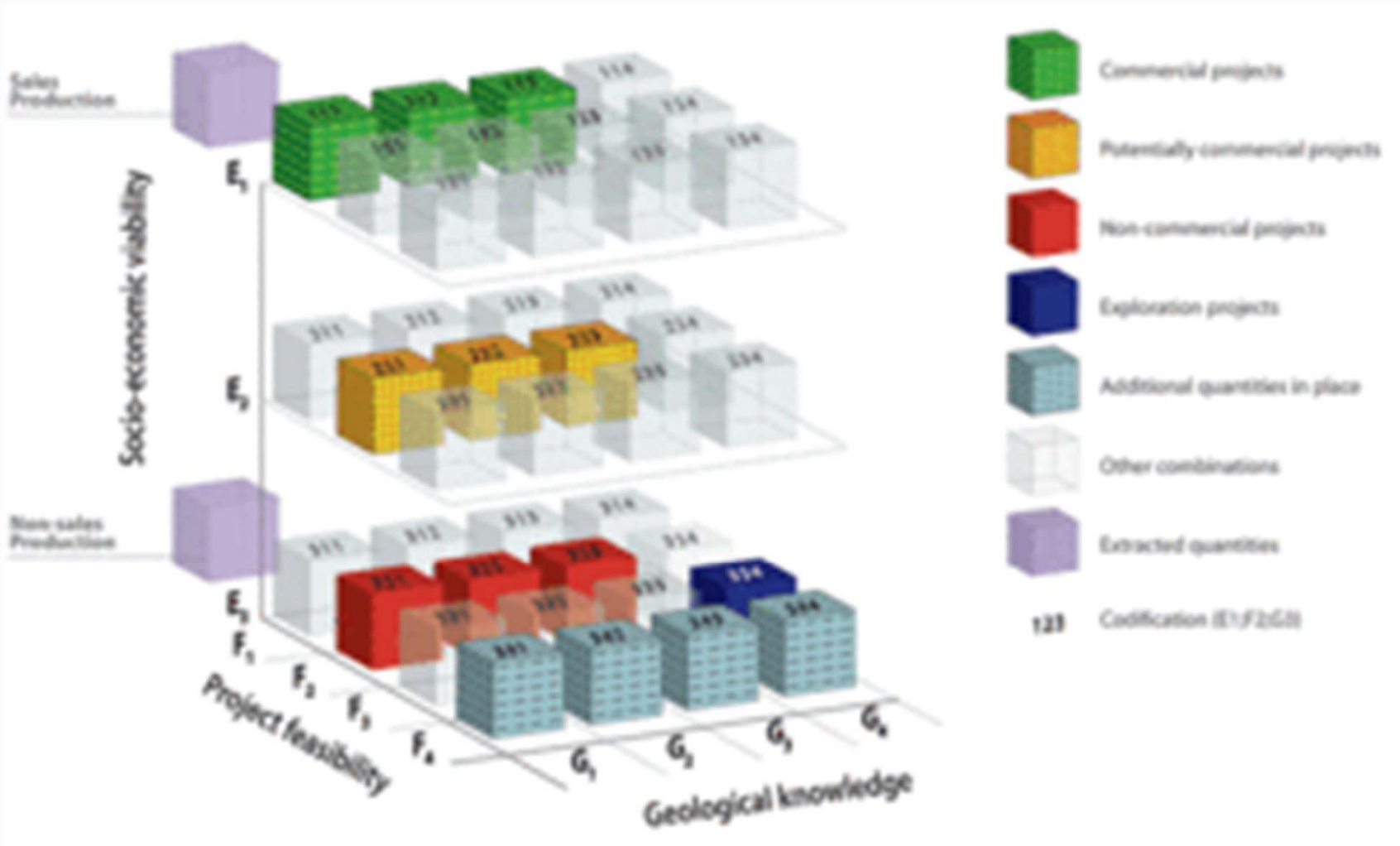
The “McKelvey Box”

- Published in 1980 by the US Geological Survey to support government policy-making on resource management and security of supply
- Used economic and geologic measures to categorize mineral deposits
- Informed UNCLOS III in addressing reserves and resources

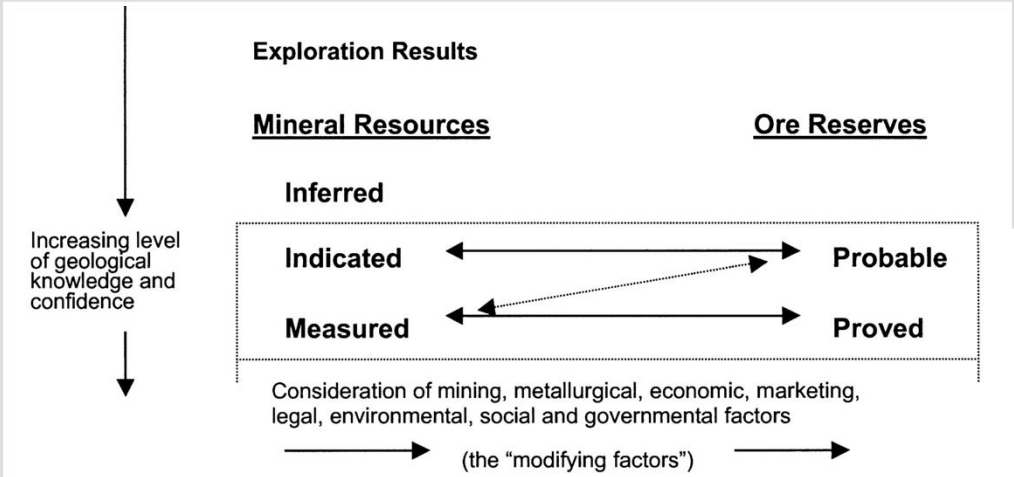


Two Dimensional Depiction of Mineral Inventory
X-axis: Assurance of Mineral Presence
Y-axis: Economic Outlook

UN Framework Classification



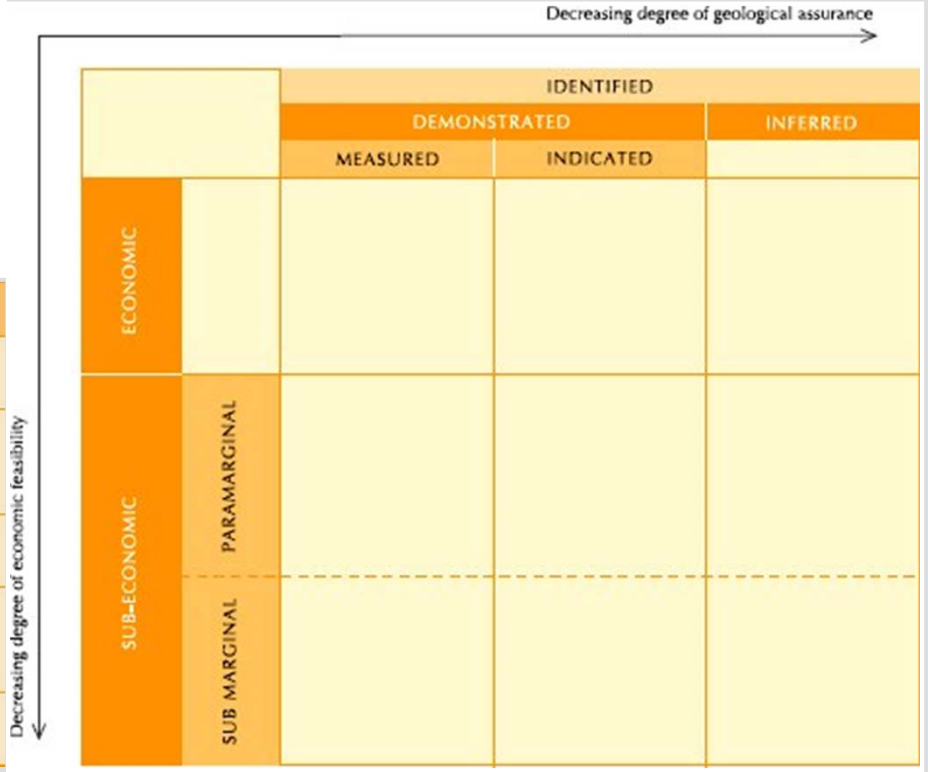
Two Paths of Resource Assessment



National scheme	JORC scheme	Mining losses	Milling losses
Measured Resources	Proved Ore Reserves	deducted	not deducted - but are considered in assessing economic viability
	Measured Mineral Resources	not deducted	not deducted
Indicated Resources	Probable Ore Reserves	deducted	not deducted - but are considered in assessing economic viability
	Indicated Mineral Resources	not deducted	not deducted
Inferred Resources	Inferred Resources	not deducted	not deducted

← Commercial Assessment

Government Planning ↓



Resource Reporting Systems and the ISA

- Industry and government interests in Mineral Resource categorization are different but can be compatible.
- CRIRSCO Taxonomy and the UNFC are in place
- The ISA has interests in both industry and resource management perspectives and may find both systems useful

Four Take-Aways

- Reserves and Resources are not just a mineral determination - they are financial measurement reflecting a comprehensive commercial assessment
- Critical Components include
  - Industry Standards and Best Practices
  - Resource Database
  - Competent Person

Standards and Practices for Deep Seabed Minerals

- Guidance for sampling and interpolation
- Projection of mineral and metal prices
- Environmental Standards and Practices
- Cost Engineering and Estimation of Mining System Costs

The Resource Database

- Geospatial Database
- Measured Data
  - Mineral, Topography, Soil Properties, etc.
  - Biological and Environmental Resources
- Inferred Data
  - Interpolation System
  - Level of Uncertainty

The Competent Person

A “Competent Person” is a minerals industry professional:

- a member at *an appropriate classification* of an organization *specified by the national authority* with *enforceable disciplinary processes* *including the powers to suspend or expel a member*.
- a minimum of *five years* relevant experience in the style of *mineralisation or type of deposit* under consideration and *in the activity* which that person is undertaking.

Resource Reporting

- ISA Regulations *Require* Submission of Resource and Reserve Estimates at End of Contract
- Public Reports of Resources and Reserves are Governed through National Law and Regulation
- CRIRSCO Provides a *Template for Reporting* of Reserves and Resources to Promote Compatibility
- Quality of Reports depends upon *Industry Best Practices* and *Oversight by Competent Professionals* in fields such as Geology, Mineral Processing and Cost Engineering

Next Steps

- *Update ISA Regulations* defining Reserves and Resources
- *Identify Industry Best Practices* for Evaluation of Deep Seabed Mineral Resources
- *Promote Professional Competence* in Exploration and Evaluation of Seabed Mineral Deposits through Development of Criteria and Professional Education
- Adopt a *Common Taxonomy for Seabed Resource Databases*, including mineral, biological and environmental factors
- Integrate Industry Reports into an *ISA Model of Seabed Mineral Provinces of the Area*

Thank You