



WORKSHOP ON PROCESSING TECHNOLOGIES, METAL RECOVERIES & ECONOMIC FEASIBILITY OF DEEP SEA MINING

Dates: 3-6 September 2018

Location: Ministry of the Environment, ul. Wawelska 52/54, 00-922 Warszawa, Warsaw, Poland.

Terms of Reference

Background

- The International Seabed Authority [ISA, or the Authority] regulates the mineral resources in the seabed areas beyond the national jurisdiction by licensing these areas to the contractors for activities in the areas for potential seabed mining.
- The Authority conducts technical workshops with objectives to obtain the views of recognized experts in specific subjects related to deep seabed mining, with participation by internationally recognized scientists, technologists, researchers and members of the Legal and Technical Commission (LTC), as well as representatives of contractors, the offshore mining industry experts and member States.
- The last workshop on polymetallic nodules (PMN) mining technology took place in February 2008 in Chennai, India, in cooperation with the Ministry of Earth Sciences. Six of the total eight exploration contractors then (all for PMN - China, Germany, India, the Republic of Korea, Poland and the Russian Federation) presented papers in the workshop. Three contractors, viz. India, IOM and Yuzhmorgeologiya also presented progress on the processing technologies into copper, nickel, cobalt and manganese.
- During the workshop in 2008, a preliminary cost model for a deep seabed polymetallic nodule mining and processing venture was developed. The status of nodule processing technology, and resource requirements for three- and four-metal plants with a view to ascertaining possible cost-cutting methods to reduce the overall cost of processing were discussed.
- The PMN resources have been compared to terrestrial nickel laterite ores which can be processed via pyrometallurgical or hydrometallurgical means. Although the process development strategies for these nodules could be drawn from processing of similar terrestrial ores, the exploration, mining and transportation costs are substantially greater than laterite ores. Taking into account that mineralogy & chemistry of PMN and cobalt rich crusts (CRC) are similar, it is anticipated that the procedure of their processing would be similar as well. For polymetallic sulphides (PMS), though the technology is well known for their ancient land based analogues, volcanic massive sulphides (VMS);

certain features of the modern massive sulphides should be considered for the scheme of extraction of metals.

- Processing of seabed resources and smelting plants are going to be land based industries beyond ISA's jurisdiction. The contractors provide data of processing technology and their cost in the annual report. The taxation may be influenced by in terms of quantum of metal recoveries, and its values in world metal market. Processing can cost up to 70% of the total seabed mining project, thus would influence the overall economics and decisions of mining project.
- This Workshop is jointly sponsored by the Interoceanmetal Joint Organization (IOM: Bulgaria, Cuba, Czech Republic, Russian Federation, Slovakia Republic and Poland), and Ministry of the Environment, Republic of Poland, and will review in general the current status of processing and economics of mining of three deep sea mineral resources.

Objectives

- The objective of this workshop, in broad terms, is to discuss issues such as status of R&D in metallurgical processes including ore pre-treatment, metal recovery, comprehensive utilization and waste disposal; energy consumption in these technologies, design of metallurgical equipment and upscaling. Economic feasibility, including the cost models from deep sea to shipment on land; fluctuating metal markets and long term forecasts, economic consequences of different processing options, possible impacts of seabed mining on metal markets, techno-economic and venture comparison study to terrestrial resource mining.
- The outcomes of the workshop will enable the Secretariat to get additional financial inputs for exploitation regulations, as well as status of contractor's understanding on these issues.
- The workshop is open to all stakeholders for participation and they must register online on or before 3rd August to ensure they are included in the logistics.
- Workshop deliberations and outcomes will be published in a Technical Study, edited by the Steering Committee, with the support of the Secretariat. Additionally, there is a plan to deliver the following items:
 - Briefing Paper
 - Technical Study
 - A paper in a relevant international journal
 - Public information: Press release (ISA, IOM and the Env.Ministry, Poland).

TECHNICAL STUDY CONTENTS WILL INCLUDE:

- An Executive Summary
- Terms of Reference
- Workshop Presentation Summaries (requested in advance)
- Consensus answers/discussions to Plenary

Workshop organization

- The Terms of reference as well as the provisional Agenda has been the result of a joint effort of an Steering Committee formed by the following individuals:

Steering Committee

- Dr. Tomasz Abramowski, IOM [host country]
 - Dr. Kaixi Jiang, China
 - Dr. Richard Roth, MIT, USA
 - Dr. Georgy Cherkashov, Russian Federation
 - Dr. Piotr Nowak, Poland
 - Mr. Harald Brekke, Norway
 - Dr. Mario Juan A. Aurelio [Phillippines]
 - Mr. Sergio Hernandez, Chile
 - ISA members [Dr. Sandor Mulsow and Dr. Pratima Jauhari]
- Participants are invited to present should submit a 500 to 750-word abstract (including references) in advance or before the end of the workshop.
 - The workshop will be divided in 2 sections:
 - Section one: presentations on key elements of the processing technologies and economics of deep seabed mining perspective. These lectures will be presented by international experts, and representative of the contractors.
 - Section two: the participants will be requested to appoint themselves in one of the following working groups:
 - (a) Working Group 1: would address the overview of R & D in processing technologies and metal recovery, comprehensive utilization and waste disposal.
 - (b) Working Group 2: would address the economic feasibility issues such as economic consequences of different processing options, the cost model, global metal market, supply and demand, techno-economic feasibility & venture comparison.
 - (c) Working Group 3: would determine environmental concern including the waste disposal issue, processing plant location choice and determination
 - Participants serving as moderators and rapporteurs would be expected to deliver draft summaries of their breakout group findings using bullet lists with explanatory detail as appropriate by the close of the workshop.

- The Steering Committee has identified the following core areas that need to be addressed by the working groups. These key elements should guide the working group discussion and the moderators to lead each working group:
 - Processing technologies (metal recovery)
 - Economic feasibility of mining seabed minerals
 - Impact of seabed mining on terrestrial mineral supplies
 - Environment – clean marine technology, waste disposal and recycling
 - International cooperation, regulations, and role of the ISA as regulator