Proceedings of The Eighth (2009) ISOPE Ocean Mining Symposium
Chennai, India, September 20-24, 2009

ISBN 978-1-880653-75-3; ISSN 1946-0066

Future of Deep Seabed Mining and Demand-Supply Trends in Indian Scenario

Maruthadu Sudhakar[1], *Syamal Kanti Das*[2]
[1] National Centre for Antarctic and Ocean Research, Headland Sada, Goa, India
[2] Ministry of Earth Sciences, CGO Complex, New Delhi, India

ABSTRACT

Polymetallic (Manganese) nodules attracted the attention of world community in the mid sixties as a potential economic resource of strategic minerals like Copper, Nickel and Cobalt. Since then both industrialized and developing countries have become increasingly aware of the economic importance of the recoverable resources. India as a pioneer investor in the Indian Ocean has retained an area of 75,000 sq. km. for various research and development works. The estimated total resources in the Indian Ocean is estimated to be about 15 x 10^{10} tonnes and the existing prime area suitable for first generation mining of nodules is around 50 x 10^4 Sq. Km. The Nodules from the Central Indian Basin (CIB), only, meet the first generation mine site criteria and scientific studies have confirmed that the ore grade nodule resources are mainly concentrated between 10° S and 16° S. Also at 2% cut-off grade, nearly one third of the explored area in CIB provides high grade regions. India has developed a crawler based shallow bed mining system, as a part of joint activities with University of Seigen, Germany, and the system has been tested up to 400 m depth. The system constitutes a crawler based collector module, Riser module (flexible hose) and Control module. The data generated form trials at shallower depths is being used for preliminary design for nodule mining system suitable for operations in CIB. An Emerging Concept of a deep seabed mining system is discussed in this paper. The land resources of the world in respect of four metals, namely Manganese, Cobalt, Nickel and Copper are presented and compared with potential metal resources of deep sea manganese nodules. Also an attempt has been made for inference on future metal requirements and prices based on present and historical consumption and production patterns.

KEY WORDS: Deep seabed mining; Polymetallic nodules; Demand and supply.

INTRODUCTION

The exploration work done so far reveals that although the task is far from being completed, the possibility of commercial mining using first generation equipment and methods is foreseen in near future. Nodule mining technology involves picking-up of the nodules from the ocean bed and bringing them to the vessel. Following four alternative design concepts for mining systems have been developed and are being improved further and tested over the years:

- Passive nodule collector with hydraulic lift or air lift system,
- Self propelled active collector with hydraulic lift or air lift system,
- Continuous Line Bucket (CLB) Mining systems, and
- Modular or shuttle mining system.

There are 7 pioneer investors under the Deep sea bed mining regime, only a few Pioneer investors are active for research and development of deep sea bed mining technology. The development of hydraulic pump lift and hydraulic air lift systems is based on the technology and experience gained in operating oil risers in deep waters and the know-how built in connection with slurry transportation of minerals at sea and on land (Amann, 1994). The high reliability and survivability associated with various types of collectors designed, developed and tested by various agencies for the last three decades mainly concentrated on collectors which can be divided into passive and active collectors. The passive concept and ability to function without power, qualifies them for use as commercial scale collectors. Passive collector is not acceptable for consideration of commercial mining system due to very low nodule collection and sediment rejection efficiency. The passive rake has the highest potential, however it needs further research and development investigation (Brockett and Kollwentz, 1977).

As far as the Hydraulic mining systems are concerned, the mechanical. concept of US consortia has very high collection efficiency but it needs separate hydraulic sediment separating sub-systems. The concept has a large number of moving parts and is most complicated. The mechanical ramp design is more complicated than the drum design, but its ability to eliminate sediments is higher. The survivability and reliability of the system for long operation is doubtful (Brockett, 1999).

The family of hydraulic collectors has the potential for commercial mining operations. There is no substantial difference between design of hydraulic or mechanical ramp collectors from the point of view of collector size, weight, power and handling requirements (Brockett et al., 1979). The two considerations that would significantly influence the decision to use either design are system reliability and maintainability. According to recently published literature, the hydraulic pump/air lift system appears to be the most promising. As per Kauffman, continuous hydraulic dredging approach (using air lift