Nodule Size: An Important Factor in Nodule Mining?

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ABSTRACT

A study of about 850 different sized nodules from 234 sites in the Central Indian Basin (CIB) showed a clear inverse relationship between size and grade of nodule. Among the different sized nodules, only the small (<2 cm) and medium (2-4 cm) sized fractions have higher grade (Cu+Ni+Co = 2.6 and 2.5 %, respectively) and highest weight percentages at every dredge haul. It is probably recommended that in CIB only small nodules will have to be processed after screening by size. In order to minimize ecological and environmental problems, it is emphasized that the nodules should be screened on sea bottom during mining, which may be possible by future technological modification of mining devises.

Key Words: nodule size, polymetallic nodules, Central Indian Basin, geochemistry, seafloor mining.

INTRODUCTION

Deep-sea polymetallic nodule deposits in the Indian Ocean have been of economic interest. Although occurrence of polymetallic nodules (PMN) were known in CIB, Siddique et al., (1978, 1984), Cartier and Wilson (1980), and Cronan and Moorby (1981) showed that only the Central Indian Basin (CIB) nodules have paramarginal grade that can be exploited on commercial scale. Many regional studies so far have shown that the principal factors affecting the nodule abundance are 1) variation in sedimentation rates, 2) processes of metal incorporation, and 3) sources of metals.

The National Institute of Oceanography (NIO), Dona Paula, Goa, carried out extensive geological and geophysical surveys in CIB using Institutional (RV Gaveshnii, ORV Sagam Kanya) and chartered vessels (MV Farnella, MV Skandi Surveyor, GA Reay, DSV Nand Rachit and AA Sindurroko) from 1982 to understand the formation processes, and distribution of nodule extension deposits. Various conventional sampling devices used for spot seabed sampling include Preussag free fall (FFB) and photo-boomerang (PFB) grabs; Vanveen and Peterson grabs; gravity, boomerang and spade covers, whereas bulk quantity of nodules and crusts were obtained by using indigenously designed bucket dredges with nylon net. The gravity, magnetics and multibeam sonar (Hydrosweep) baseline data were simultaneously collected.

While the economic and technical feasibility of nodule mining is a matter of debate, the mining of these nodules from about 5500 m water depth is considered even more difficult because, political, legal and environmental factors need consideration before actual start of mining. Many consortia in the countries from North America, Asia and Europe have carried out testing of the airlift, hydrolift and continuous line bucket (CLB) mining systems whereas Japan has decided to test their integrated mining system in 1996 (Markussen, 1994).


The NIO carried out basic geological and geophysical research on nodules in CIB whereas the metallurgical work is being carried out by other sister laboratories (NML, Jauhara and RRL, Bhuvneshwar) where the beneficiation processes of 2 or 3 metal recovery have been studied. Fernando and Sonawane (1991) and Jankiraman et al., (1994) discussed a possible conceptual design of nodule collector.

The economic recovery of nodules depends upon 1) recovery of high grade (combined Cu+Ni+Co) nodules with high abundance and 2) selec-