Preliminary Geotechnical Properties of Deepsea Sediments from the Central Indian Basin

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ABSTRACT

Geotechnical properties of the Plio-Pleistocene sediments from nodule bearing area in the Central Indian Basin have been studied to know shear strength and water content variation with depth. It reveals that surface sediments have low (1kPa) shear strength which increases with depth. Average undrained shear strength of siliceous sediments is 3.6kPa and average water content is 430%. Sediments have high porosity (88-93%) and imply compressible nature. Bioturbated layers show increase in water content and reduction in shear strength. Calcareous core collected from nodule barren area indicates low water content (201%) and wide scatter in shear strength (3-14kPa).

KEY WORDS: Central Indian Basin, siliceous and calcareous sediments, polymetallic nodules, shear strength, physical properties, Pioneer Area.

INTRODUCTION

Polymetallic nodules are widely spread on deep seafloor of the world oceans at 4 to 6km water depths. These nodules are considered as a future strategic metal resource due to their enrichment in copper, nickel, cobalt and manganese (Yamazaki, et al. 1990). The Central Indian Basin (CIB) in the Indian Ocean has been known for its economic potential of polymetallic nodules after the National Institute Oceanography, Goa completed preliminary but extensive exploratory survey of this basin in 1987. The major achievement of this survey was allotment of the Pioneer Area by UNCLOS (United Nations Convention on Law of the Sea) to the Government of India in 1987 and exclusive rights for further development of these mineral resources. Various geological aspects of nodules and sediments of this basin are studied by scientists at Geological Oceanography Division of NIO, Goa. However not much attention was given towards the geotechnical studies of nodules and associated sediments which are mandatory for mining as well as for environmental impact studies. To have suitable mining design, work on geotechnical studies of the sediments associated with the nodules has been started (Khadge, 1992). Though several countries have been developing deep-sea mining technology, a problem of suitable and commercial miner still remains unsolved.

Size wise geochemistry of nodules (Valsangkar and Khadge, 1989) showed that smaller nodules have high copper, nickel, cobalt concentrations, and they also have more occurrence in the Central Indian Basin. Study on shear strength and adhesiveness between nodule and sediments from the Central Pacific Ocean (Tsurusaki 1984; Handa and Yamazaki, 1986) showed that geotechnical properties change according to sediment type and lithology. Bioturbation can change the physical properties of sediments considerably (Richardson, 1983). These observations in addition to nodule distribution are very useful to make strategies for effective and economic mining. This paper describes physical properties and shear strength distribution in six gravity cores collected from the Pioneer Area in the Central Indian Basin. The work is part of the ongoing geotechnical program for this basin.