

India Leading in deep sea minerals exploration of Polymetallic nodules & Polymetallic sulfide

Indian scientists are carrying out great activities in blue waters for exploration and developing technologies for extraction of Polymetallic nodules and Polymetallic sulfide from Central Indian Ocean Basin (CIOB). It would open new horizons to a resource of commercial and strategic value in the region to create a market-driven blue economy.

India is surrounded by seas from three sides. However, very few of us know about the activities of Indian scientists in marine studies. Indian oceanographers have extensively surveyed central Indian Ocean. India has also established itself as the only country to have two exploration contracts with the International Seabed Authority (ISA) in the Indian Ocean. Based on these contracts, India has exclusive rights for (a) 75000 sq. km of area in Central Indian Ocean Basin, south of Sri Lanka for polymetallic nodules and (b) 10000 sq. km of area for polymetallic sulfides near Rodrigues Triple Junction over part of South-West Indian Ridge and part of the Central Indian Ridge, in the Indian Ocean.

The exploration Areas indicated in the website of International Seabed Authority can be seen here:

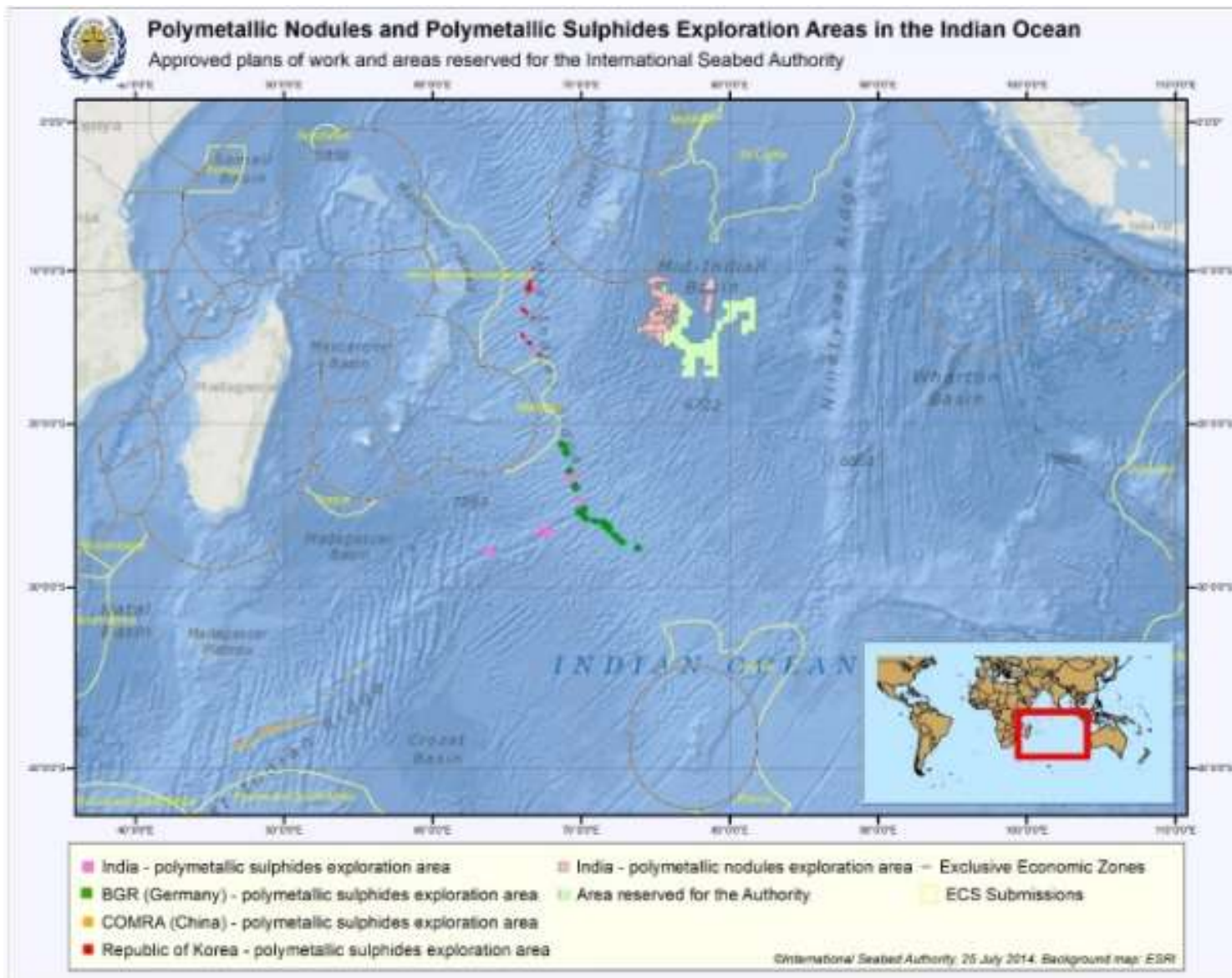


Figure: Polymetallic nodules and Polymetallic sulphides exploration area in the Indian ocean

What are Polymetallic Nodules and Polymetallic Sulfides?

Polymetallic nodules (PMN), also known as Manganese nodules, are potato-shaped, highly porous nodules found in abundance in the range of 4000 to 6000 meters of water depth. They develop as a central particle (such as a shell or piece of small rock) through the aggregation of layers of iron and manganese hydroxide and range in size from a few millimetres to ten centimetres. The composition of such nodules varies with their

environment of formation, but they include traces of nickel, copper and cobalt in commercially attractive concentrations. They also contain other valuable metals such as molybdenum, vanadium, lead, zirconium, cadmium and titanium.

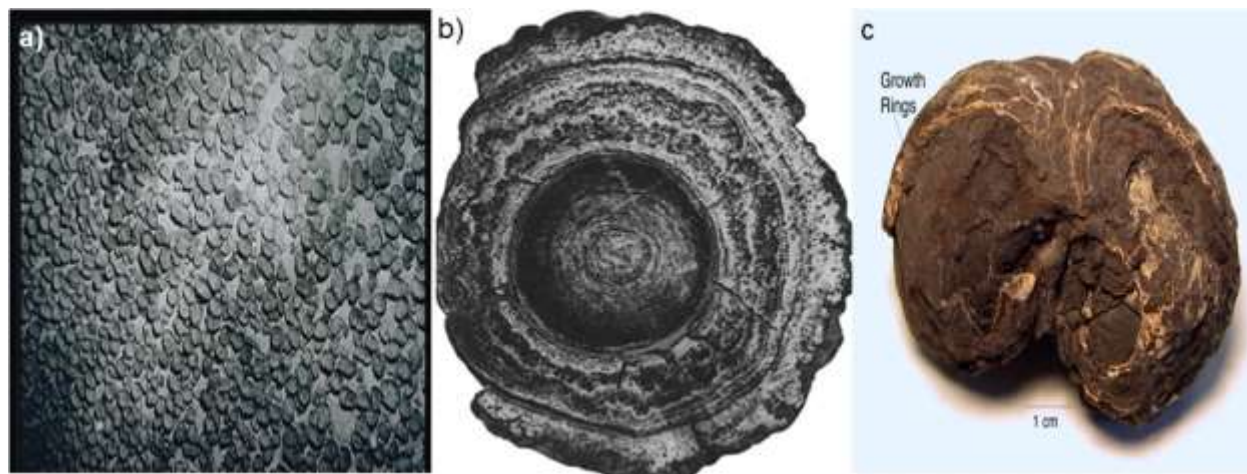


Figure: a) Polymetallic Nodules about the size of a potato, b) Cross-section showing growth rings and c) Close-up of the nodule

Deep sea bed hosted Polymetallic Sulfides (PMS) are consistent source of copper, zinc, iron and lead. Apart from these they are also seen as economically viable resources of precious metals (Au, Ag and Pt) and strategic metals, Germanium, Indium and Titanium (Ge, In and Ti). They constitute significant and important mineral resources of these metals.

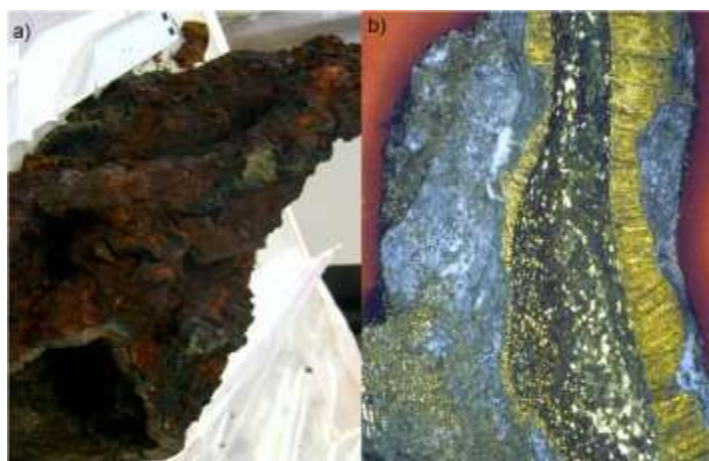


Figure: a) Cu-rich polymetallic Sulfides chimney, b) Cu-Zn-rich polymetallic Sulfides chimney

The unprecedented growth in mining as well as increase in industrial growth have resulted in a sharp reduction of continental mineral resources for the future. Exploration of resources in the oceanic region has therefore become extremely important.

Ministry of Earth Sciences is carrying out Survey & Exploration, Environmental Impact Assessment, Technology Development (Mining) and Technology Development (Extractive Metallurgy) for polymetallic nodules through various national institutes. National Institute of Oceanography (NIO) reported that estimated resource potential in the retained area (75,000 sq km area in CIOB) is 380 MMT (Million Metric Ton) of PMN. Abundance range in the retained area varies between 5 to 10 kg/m². Total metal content, specifically Copper, Nickel and Cobalt, is about 2.5%.



Figure: Estimated resource potential in the retained area

NIOT is proceeding to develop manned submersible for 6000 m. In-house designing is in progress using titanium alloys, acrylic visual ports, life support systems, power budgets, propulsion systems etc. This is going to be a major step towards developing 6000-m-depth-rated human scientific submarine 'Matsya 6000' for India's manned submersible programme.

India actively participates in the deliberations of The International Seabed Authority (ISA) meetings and been elected as a member of the Council since its inception. Indian representatives are members of the Legal and Technical Committee of ISA and the

Finance Committee. India has already imparted training to candidates from developing countries.

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