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Review Article

Harnessing offshore mineral resources of EEZ of India: Advances in exploration, assessment and sustainable mining technologies

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Abstract: Exclusive Economic Zone of India (EEZ) holds immense potential for the mineral requirements of the country especially construction sand, heavy minerals, phosphorite, lime mud and polymetallic crust and nodules. Offshore exploration within EEZ of India has systematically advanced under the Geological Survey of India (GSI), identifying 5,89,160 sq km as Offshore Prospective Areas (OPA). Focused studies on construction-grade sand, heavy mineral placers, lime mud, phosphorites, and polymetallic crusts and nodules employ a multi-disciplinary framework, integrating high-resolution bathymetric mapping, seismic surveys, sediment sampling, and geochemical analyses. Key findings include a delineation of 511 sq km off the coast Kerala, holding 992 million tonnes of silica-rich construction sand, and a 18,767 sq km area with lime mud reserves of 1,53,996 million tonnes (>40% CaO). Heavy mineral resources, distributed across 1,317 sq km, include economically vital minerals like ilmenite, rutile, zircon, monazite and vanadiferous titanomagnetite. Polymetallic nodules from the Andaman and Lakshadweep Seas, rich in Co (0.21%), Ni (0.76%), and Rare Earth Elements (REE) (average 1,499 ppm), are significant for strategic metal reserves. These results demonstrate the viability of marine mineral extraction technologies, such as trailing suction hopper dredgers and advanced robotic systems, in sustainable resource development. The compilation underscores India's potential to harness offshore mineral wealth, reducing import dependence and supporting industrial and technological growth.

Key Words: Offshore minerals, construction-grade sand, heavy mineral placers, lime mud, phosphorites, polymetallic crusts and nodules

Introduction

The significant growth in the construction sector has resulted in an increasing demand for fine aggregate, particularly river sand, which has become a limited resource in India due to extensive over-exploitation since the 1990s (Padmalal and Maya, 2014). This excessive extraction has precipitated detrimental environmental impacts, highlighting the urgent need for alternatives such as offshore sand to alleviate these concerns. Dunes and beaches of India are rich in strategic heavy minerals, including thorium (Th), uranium (U), and

Eez Resources Technology Assessment

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