

Deep Sea Mining

August 13, 2019

Source: *The Hindu*

Manifest pedagogy:

With depletion of resources over the continents, ocean has emerged an important potent region of resources for human utility. The exploration and exploitation of marine resources has led to many marine resources across the world. Marine resources and related issues are important from mains perspective

In news:

- India's ambitious 'Deep Ocean Mission' is all set to be launched this year.

Placing it in syllabus:

- Distribution of resources

Dimensions:

- Bottom relief of Indian Ocean
- Marine resources of Indian Ocean
- International Seabed Authority (ISA)
- Deep Ocean mining mission
- Criticisms

Content:

Deep Ocean mission is a proposed ₹8,000-crore project to explore the deep ocean minerals and is expected to start in October, 2019.

Bottom Relief of the Indian Ocean:

The Indian Ocean covers 20 % of the total area of all the

oceans of the world. It is a warm ocean blocked on three sides by the continents of Africa, Asia and Australia. The shape of the ocean is compact, with bold and regular coastlines.

In the south it extends up to the Antarctica continent where it merges into the Atlantic and the Pacific. The average depth of the ocean is 4000 m which is less varying and comparatively lesser than that of other oceans



Continental Shelf:

The continental shelf of this ocean is generally narrow with an average width of about 96 km. However, in the Arabian Sea, the Bay of Bengal and the Andaman Sea the width of the shelf varies from 192 km to 208 km. On the seaward margin of the shelf, the depth of water lies between 50 and 200 meters.

Due to intense glaciation the structure of the shelf adjoining the Antarctica has become very complex. In such areas the landward margins of the shelf are 150-200 m deep, whereas the seaward margins register depth varying from 400 to 500 meters. In the tropical areas different types of coral reefs such as, fringing reef, barrier reef and atoll are found on the shelf.

Continental slope:

The continental slopes on the outer margins of the shelf are marked by the extreme steepness, angle of slope varying from 10° to 30° . The continental shelves are characterized by many submarine valleys and canyons.

Ridges and Basins:

The Indian ocean has a continuous central ridge, called the Arabic-Indian Ridge, together with its southern extension, the Kerguelen-Gaussberg Ridge, which connects with the Antarctic continent. The central ridge separates the eastern basin from

the western basin. All the oceanic islands in this ocean are situated on the central ridge and on its cross ridges.

The Ocean is characterized by having many broad submarine ridges, separating several individual basins of the abyssal plain. One of its most distinguishing features is the presence of the series of curving ridges in the north-west segment of the ocean. The above-mentioned ridges divide the Indian Ocean into three distinct parts: 1. African part, 2. Australian part, and 3. the part adjoining the continent of Antarctica.

Oceanic Deeps:

Out of the total area of Indian Ocean, about 58.8 % forms deep sea plain between the depth of 4000-6000 m. Unlike the Pacific and Atlantic Oceans, the oceanic deeps with unfathomable depths are lacking. The **Sunda Deep near Java** is an exception. The depth of this oceanic deep is 7450 metres.

Islands:

Relative to the Pacific and Atlantic Ocean, the number of islands in the Indian Ocean is far less. Some of the islands are supposed to be parts of the mainland like Madagascar and Sri Lanka.

Marginal Seas:

Since the coastal areas of the Indian Ocean are generally plateaus, there are only two real marginal seas in this ocean: the Red Sea and the Persian Gulf. The Red Sea occupies a rift-valley between the continent of Africa and the Arabian Peninsula. The Red Sea is separated from the Indian Ocean by a submerged sill across the Strait of Bab-el-Mandeb. The Persian Gulf represents a shallow trough, which is practically enclosed and separated from the open ocean by the northward projecting Oman Peninsula. Due to this peninsula, the Strait of Hormuz has become very narrow, its width limited to only 80 km.

Marine resources of Indian Ocean:

The Indian Ocean Region is abundant with resources like **fisheries, aquaculture, ocean energy, sea-bed mining and minerals**, and provides tremendous economic opportunities to develop marine tourism and shipping activities.

Among these resources, fisheries and minerals are the most commercially viable industries. The United Nations Food and Agriculture Organization (FAO) report states that while other world oceans are nearing their fisheries limit, in certain areas, the Indian Ocean's resources have the potential to sustain increased production.

It is necessary for India to tap the enormous potential of the Ocean based Blue Economy, which will propel the nation into a higher growth trajectory. The development of Blue Economy can serve as a growth catalyst in realizing the vision to become a \$10 trillion economy by 2032. Additionally, the Indian Ocean Region is of strategic importance to India's economic growth as the most of the country's oil, and gas is imported through the sea.

Polymetallic nodules and polymetallic massive sulphides are the two mineral resources of commercial interest to developers in the Indian Ocean. Typically found at four to five km in water depth, polymetallic nodules are golf-to-tennis ball-sized nodules **containing nickel, cobalt, iron, and manganese** that form over millions of years on the sediment of the seafloor.

India is the first country to have received the status of a pioneer investor in 1987 and was allocated an exclusive area in Central Indian Ocean Basin by United Nations (UN) International Seabed Authority (ISA) for exploration and utilization of nodules. India is one among the top 8-countries/ contractors and is implementing a long-term programme on exploration and utilization of Polymetallic

Nodules through Ministry of Earth Sciences

The **Polymetallic Nodules programme** is oriented towards exploration and development of technologies for eventual extraction of nodules from the Central Indian Ocean Basin (CIOB) allocated to India. ((Apart from the CIOB, polymetallic nodules have been identified from the central Pacific Ocean known as the Clarion-Clipperton Zone))

India was given an area of about 1.5 lakh sq km in the CIOB for nodule exploration in 1987. In 2002, India signed a contract with the ISA and after complete resource analysis of the seabed 50% was surrendered and the country retained an area of 75,000 sq km

The Polymetallic Nodules Programme consisting of **four components**:

- 1) Survey and Exploration,
- 2) Environmental Impact Assessment (EIA) Study,
- 3) Technology Development (Mining) and
- 4) Technology Development (Extractive Metallurgy)

Participating Institutions are:

- National Centre for Antarctic & Ocean Research, Goa.
- National Institute of Oceanography, Goa

International Seabed Authority (ISA):

- The ISA is an **autonomous international organization** established under the 1982 United Nations Convention on the Law of the Sea (UNCLOS) and the 1994 Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea.
- The Authority is the organization which organize, regulate and control all mineral-related activities in

the international seabed area beyond the limits of national jurisdiction.

- It regulates deep seabed mining and ensure the marine environment is protected from any harmful effects which may arise from mining activities.
- The Authority, which has its headquarters in Kingston, Jamaica, came into existence on 16 November 1994, upon the entry into force of the 1982 Convention.
- The Authority became fully operational as an autonomous international organization in June 1996.
- There are 168 members of the International Seabed Authority as at 25 July 2017.
- India is a party since 1995.
- In the year 2000, it adopted regulations governing exploration for polymetallic nodules.

According to the ISA's website, it has entered into a 15-year contracts for exploration for polymetallic nodules, polymetallic sulphides and cobalt-rich ferromanganese crusts in the deep seabed with 29 contractors. Later it was extended for five more years till 2022. China, France, Germany, Japan, South Korea, Russia and also some small islands such as the Cook Islands, Kiribati have joined the race for deep sea mining

Deep Ocean mission:

- The central government has drawn up a five-year plan with a cost of ₹ 8000 crore for mining, researching and studying about the ocean floor that can help in forming solid decision on climate change and develop a desalination plant, powered by tidal energy and a submersible vehicle that can explore depths of at least 6,000 m (20,000 ft).
- One of the main aims of the mission is to explore and extract polymetallic nodules.
- These metals can be extracted and used in electronic devices, smartphones, batteries and even for solar

panels



- According to a release from the Ministry of Earth Sciences, the estimated polymetallic nodule resource potential in this area is 380 million tonnes (MT), containing 4.7 MT of nickel, 4.29 MT of copper, 0.55 MT of cobalt and 92.59 MT of manganese.
- Further studies have helped narrow the mining area to 18,000 sq km which will be the 'First Generation Mine-site'.
- India's mining site is at about a depth of 5,500 metres, where there is a high pressure and extremely low temperature.
- The mining technology with artificial nodules at 500 metres depth have already been developed and demonstrated.
- A Remotely Operated Vehicle and In-situ Soil Tester in the depth of 6,000 metres have been deployed.
- More tests are being conducted to understand how to bring the nodules up to the surface.
- A riser system comprising an umbilical cable or electromechanical cable and a hose is being developed.

Criticisms:

According to the International Union for Conservation of Nature (IUCN), these deep remote locations can be home to unique species that have adapted themselves to conditions such as poor oxygen and sunlight, high pressure and extremely low temperatures. Such mining expeditions can make them go extinct even before they are known to science.

The deep sea's biodiversity and ecology remain poorly understood, making it difficult to assess the environmental impact and frame adequate guidelines. Environmentalists are also worried about the sediment plumes that will be generated

as the suspended particles can rise to the surface harming the filter feeders in the upper ocean layers. Additional concerns have been raised about the noise and light pollution from the mining vehicles and oil spills from the operating vessels