Ocean mining: India's next frontier

by Surya Kanegaonkar , India Inc. 18/08/2020

As India makes its push towards self-reliance, the demand for key metals, minerals and rare earths is set to grow exponentially. If deep sea mining becomes a success, it can ensure end-to-end supply chain resilience.

A structural shift is in play with supply chains shifting out of China, and Modi government is recognizing a once in a century opportunity to boost domestic manufacturing on the back of it. To become a manufacturing hub, decoupling from raw material sources which are otherwise held captive by foreign state-run oligopolies is crucial, and taking cognizance of this, New Delhi is pushing to explore deep sea mining. India already holds exploration licenses from the International Seabed Authority (ISA), a UN body which regulates mining in international waters. In 2018, the government decided to allocate $1.1 billion spread over five years, to the "Deep Ocean Mission" for furthering this effort, investing in exploration and technology development for extraction.

Contracts to Explore Polymetallic Sulfide Areas

Sponsoring state	Contractor	Expiration date
China	China Ocean Mineral Resources Research and Development Association	2026
Russia	Government of the Russian Federation	2027
France	IFREMER (French Research Institute for Exploitation of the Sea)	2029
South Korea	Government of the Republic of Korea	2029
Germany	Federal Institute for Geosciences and Natural Resources	2030
India	Government of India	2031
Poland	Government of the Republic of Poland	2033

Source: International Seabed Authority, "Deep Seabed Minerals Contractors," accessed May 1, 2018, http://www.isa.org.jm/deep-seabed-minerals-contractors

The undersea treasure

Polymetallic sulphide nodules mined from the seabed are rich in zinc, copper, tin and lead, with minor components of precious metals like gold and silver as well as minerals like selenium, indium and gallium. Importantly, rare earth elements (REEs) are found in abundance. Ferromanganese crusts, on the other hand, are largely composed of cobalt, with traces of molybdenum, vanadium and platinum. From mobile phones to batteries and from industrial equipment to healthcare devices, the applications of these “critical metals” are numerous, especially in an increasingly digitized world that is simultaneously going green.

Contracts to Explore Cobalt-Rich Ferromanganese Crusts

Sponsoring state	Contractor	Expiration date
China	China Ocean Mineral Resources Research and Development Association	2029
Japan	Japan Oil, Gas, and Metals National Corp.	2029
Brazil	CPRM (Geological Survey of Brazil)	2030
Russia	Ministry of Natural Resources and Environment	2030
South Korea	Government of the Republic of Korea	2033

Source: International Seabed Authority, "Deep Seabed Minerals Contractors," accessed May 1, 2018, http://www.isa.org.jm/deep-seabed-minerals-contractors

Proponents of deep-sea mining have pointed to the fact that yields are nearly a hundred times higher compared to continental, surface crust mining. In some cases, as it is with platinum and palladium, the concentrations can reach 400 and 1900 times what is seen in traditional surface mines. Academic studies have noted that the financial feasibility of seabed and deep-ocean mining could well depend on the content of precious metals which are often the biproduct of the extraction of critical metals and REEs. Moreover, in a time when loose monetary policy in the developed world has pushed bond yields to new lows, the demand for precious metals has resulted in a sharp rise in prices. As discussed in a previous article on the impact the structural shift in global economics would have on the gold (and similarly, silver) market, underwater exploration for rare metals becomes an increasingly attractive opportunity in light of a positive forward guidance.

Contracts to Explore Cobalt-Rich Ferromanganese Crusts

Type of Resource		Polymetallic Nodule	Ferromanganese Crust	Deep-Sea Sediment	Seafloor Massive Sulfides
Location and development status	Area	Northeast Pacific Ocean	West central Pacific Ocean	Northeast Pacific Ocean	Southwest Pacific and Indian Ocean
	Water depth	4000-6000 m	1000-2000 m	400-6000 m	400-3000 m
	Relationship to high sea or EEZ	High sea	High sea	High sea	Tongan and Fijian exclusive economic zone (EEZ), high sea (Indian Ocean)
	Tenement	Yes (from ISA[2])	Applying to ISA in 2016	-	Yes (from Tonga, Fiji, and ISA)
Geological features	Geological setting	Oceanic intraplate (deep-sea plain)	Oceanic intraplate (volcanic chain, seamount)	Oceanic intraplate (deep-sea plain)	Subduction and mid-ocean ridge (volcanic chain, seamount)
	Ore body	Nodule	Crustification	Unconsolidated sediments	Chimneys and mounds
	Major minerals	Fe-Mn oxides	Fe-Mn oxides	Ca phosphate	Polymetallic sulfides
	Target metals	Ni, Co, Cu, Mn	Co, Ni, Pt	Rare earth elements	Cu, Zn, Au, Ag
	Genesis	Hydrogenetic diagenetic	Hydrogenetic	Hydrogenetic diagenetic	Hydrogenetic fluid
	Scale of deposit	>100 km	~10 km	>100 km	~1 km
	Amount of resource	188 million tons[3]	Not estimated yet	16,500 million tons[3]	Not estimated yet

KIOST Korea Institute of Ocean Science and Technology ISA International Seabed Authority ore tonnage, see the text for reference

Courtesy: Korea Institute of Ocean Science and Technology

What are India's plans?

India, designated as a "Pioneer Investor," has access to 75,000 square kilometres for exploration and extraction, of which 18,000 has been identified for initial work in the Central Indian Ocean Basin near the Andaman and Nicobar Islands. Situated near a volcanic zone, the sediment near the hydrothermal vents are rich in minerals, hosting 380 million tonnes (MT) of polymetallic nodules. These nodules contain an estimated 93 MT of manganese, 4.7 MT of nickel, 4.3 MT of copper, 600 thousand tonnes of cobalt besides smaller but extremely valuable volumes of gold, silver and rare earths. For the venture to be commercially viable, a minimum of 3 million tonnes of nodules needs to be extracted after which significant economies of scale can be experienced.

Taking into account the unique challenges posed by the high water pressure and soft seabed in the area, The National Institute of Ocean Technology has a dedicated team in the Deep Sea Technology Group developing indigenous Remotely Operated Vehicles (ROVs), Remotely Operated In-Situ Soil Testers (ROSIS) and a portable version of it (POSIS), subsea transformers and universal subsea latching systems. NIOT is collaborating with Moscow's Experimental Design Bureau of Oceanological Engineering (EDBOE) on ROV development, under the strategic partnership that India and Russia share. Underwater vehicles are being augmented with seabed imaging, homing, docking, and sensor fusion technologies in a bid to develop full exploration and extraction capabilities.

A crawler on the sea floor would act much like a vacuum cleaner, collecting and crushing the nodules and then sending the ore up to the "mother ship" through a flexible riser. The work done has paid off to the extent that it has surveyed the potential mining region and tested its crawler at a depth of 6000 metres. A full integrated mining system should be up and running by 2021-22.

Environmental and political concerns

The natural replacement of nodules takes decades, and the disturbance caused to the ocean floor could, in many ways, be irreversible. Tests done on trial seabed mining from 1989 showed that the recovery of the ecosystem is slow. Marine biodiversity and microbial activity would be under threat, and campaigners have made their concerns clear. However, with China increasingly active in the ocean mining space, political considerations around the world suggest that state-funded ventures will continue to counter potential CCP domination of the high seas. India too has taken this into account when advancing its development plans for the Andaman and Nicobar Islands, which would host the nearest port for ocean mining vessels. Yet, private funding for such ventures remains limited since the worry over changes in ISA regulations hang as a dark cloud over future mining prospects. Funding from state seems to be the way forward, for now.

The road ahead

Deep sea mining will be a pillar of India's "Aatmanirbhar" plan. Self-reliance across the supply chain involves securing what the electronics industry calls "critical metals," many of which are found six kilometres undersea. The economics look promising, and the government will have to compare the deleterious effects on seafloor's ecological sensitivity against the environmental impact of continental mining. Power projection in the IOR is equally important in the face of expansionism at India's doorstep, and considering the billion-dollar investment into the Deep Ocean Mission, the path the government intends to take seems all but clear.

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