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Precautionary Steps Towards Deep-Sea Mining

By Shantanu Sharma

SYNOPSIS

The supply of minerals such as nickel and cobalt, is essential for reaching net-zero goals, but these minerals are rare on land and found mostly in just a few countries, leading to geopolitical competition. Deep-sea mining for these minerals is seen as a way to address this supply issue, but there are downsides to it.

COMMENTARY

The answer to solving the risks posed by climate change may lie more than 1000 m beneath the surface of the ocean. Mineral deposits in ocean basins contain polymetallic nodules, rocks composed of multiple metals and minerals with sizes ranging from a golf ball to a large potato. These are rich in critical minerals required for the rapid deployment of green and clean energy technologies, the development of high-tech applications, and supporting urbanisation and growing populations.

Exponential growth in the production of clean energy technologies, increased exploration, and mapping of the ocean floor, and improvement in delivery technology from ocean depths have made deep-sea mining (DSM) technologically possible and economically feasible in recent years. One of four key regions for DSM, the Clarion-Clipperton Zone (CCZ), which lies beneath the central Pacific Ocean, is estimated to hold nodules containing more transition-critical minerals – manganese, nickel, copper, and cobalt – than all known land deposits combined.

As the nodules are loosely scattered on the seafloor, it is relatively easy to collect them using submerged dredging machines, after which they are piped up to a vessel for processing. After mineral retrieval, waste, and sediments are pumped back into the ocean.

Why Are Countries Pursuing Deep-Sea Mining?

Transition-critical minerals are rare on land and are highly concentrated in just a few countries. The availability of these minerals is necessary for the production of solar panels, on-shore wind turbine engines and magnets, rechargeable batteries used in electric vehicles, and nuclear energy. As a result of long-term investment, effective industrial policy, and market interventions, China currently dominates the global supply of strategically important rare and critical minerals like cobalt, a mineral whose 80 per cent of global supply is produced by Chinese-owned or financed mines.

Achieving net-zero goals would require the supply of metals like copper (which is required to build complex grids to handle electricity produced by decentralised renewable sources, electric vehicles, and microchips) to be doubled by 2035. The demand for transition-critical minerals is projected to increase significantly in the future and the global availability of these minerals is dependent on trade relationships.

Hence, increasing securitisation, big power competition, supply chain disruptions, political instability, export controls, cost fluctuations, and natural disasters can threaten access to these minerals. Countries like the US, China, India, Japan, Russia, South Korea, and Norway are increasingly looking toward DSM as a solution to diversify supply sources and reduce dependency on foreign sources for imports.

Negative Impacts of Deep-Sea Mining

Access to this vast trove of mineral riches will however come at an enormous cost to the marine ecosystem. Due to extremely high pressure and cold temperatures near the ocean floor, we have little knowledge about the deep-sea ecosystem, but what little we do know is concerning. Drastic physical and chemical disturbances due to DSM will result in irreversible habitat destruction and biodiversity loss for the largest ecosystem on the planet, with diversity rivaling that of rainforests.

The impact of DSM is not just restricted to the ocean floor. Excessive noise and vibration, release of toxic metals into the food chain, and oxygen depletion will have far-reaching impacts on the ocean at varying depths. Furthermore, sediment plumes created by dredging can disperse by more than 100 km through ocean currents, causing fishery depletion. For DSM to be economical, very large areas of ocean floor are needed for mining. Sediment plumes from mining the CCZ alone will affect an area of more than 1,500,000 km2, which is equivalent to Spain, Portugal, France, Belgium, and Germany combined.

Alarmingly, DSM can worsen climate change impacts by releasing trapped carbon dioxide and destabilise heat absorption by the ocean. As a result, different organisations and stakeholders such as the European Parliament, International Union for Conservation of Nature, civil societies such as Pacific Network on Globalisation, mining companies like Rio Tinto, automakers, more than 800 marine scientists, and over 25 countries have called for a moratorium or a ban on seabed mining.

Realities of Deep-Sea Mining

Proponents of DSM argue that it is a better alternative to land-based mining as a single marine mine site can provide multiple metals of economic interest. This would reduce the need for land-based mining which is associated with air pollution, drinking water contamination, relocation of towns and villages, depletion of groundwater, deforestation, and unsafe working conditions. But the truth is that systemic and institutionalised patterns of poor labour practice and weak environmental regulations still persist in land-based mining in developing countries due to lobbying and corporate profitability.

Although DSM is painted as a solution to supply chain dependency and climate crisis, in reality, it is a solution to neither of those problems. While DSM provides an alternate source for mineral collection, an onshore commercial processing, smelting, and refining facility is required to convert the mineral to consumption-grade metal. Onshore facilities that can process the nodules at a commercial scale are concentrated in a few countries in Southeast Asia, where current land-based mines are present. Furthermore, existing processing facilities in land-based mines produce high-grade metals cheaply only by relying on cheap labour, emission-intensive coal plants, and neglect of toxic waste management.

The Way Forward

To prevent further damage to the environment and habitations, systemic bad policies and practices need to be addressed. The lack of sufficient knowledge to properly assess environmental impact, understand the knock-on effects, effectively protect marine environments, lack of strong regulatory frameworks, undefined enforcement protocols, nascent mining, and monitoring technologies, should prompt caution. These characteristics leave little room for error.

In the short term to medium term, metals would be primarily sourced through cheaper land mines. There is an urgent need to address the present profit-driven malpractices, lobbying, and environmental and human exploitation in mature land-based mines. The solution might lie in an alternate cheaper, reliable, safer, and cleaner energy source – nuclear, which can be quickly and cheaply retrofitted on existing coal plants.

It would lower demand for DSM and could lower reliance on coal plants for refining, require less land, and lower the cost of commercial metal extraction and processing. As a first step, Singapore can support evidence-based multistakeholder decision-making for approving DSM environmental impact assessment and start divesting from unsustainable land-based mines.

The Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ) Treaty, which Singapore is a signatory of, will help ensure the conservation and sustainable use of marine biological diversity. In the longer term, sufficient resources and personnel are required to enforce the principles set forth by the International Seabed Authority.

Reliance on mining could be significantly reduced in the future by embracing circular economy practices through reusing, redesigning, repurposing, and recycling critical minerals. Scientists estimate that recycling has the potential to meet 40 per cent to 77 per cent of Europe's clean energy metal needs by 2050, but globally the recycling industry is lacking capacity and investment.

Although DSM is a promising step forward to ensure the development of clean energy technologies, there is a need to adopt a precautionary approach and to weigh the downside effects before pursuing it.

Shantanu Sharma is a Senior Analyst with the Centre of Excellence for National Security (CENS) at S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University (NTU), Singapore. His work focuses on emerging technologies, AI and privacy-enhancing technologies, and combating disinformation.

S. Rajaratnam School of International Studies, NTU Singapore
Block S4, Level B3, 50 Nanyang Avenue, Singapore 639798