LEGAL ASPECTS OF DEEP-SEA MINING

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**Introduction**

Deep seabed mining is a significant new and emerging activity for usage of the global oceans. The principal drivers of this new interest are largely the result of a combination of technological advances in marine deep seabed mining and processing; a dramatic increase in demand for metals primarily fuelled by emerging economies, leading to a rise in metal prices; a decline in the grade of land-based Nickel, Copper and Cobalt Sulphide deposits; and increased demand and reduced supply of rare earth minerals.

Interest in deep-seabed mining began in mid-1960s with the publication of a book by J.L. Mero entitled *The Mineral Resources of the Sea*, which provided the estimates of manganese nodules present on the floor of the Pacific Ocean which led many to envision manganese nodules as the vast reserve of strategic minerals. Over the next 20 years, countries such as the US, France and Germany conducted research projects on nodule mining, but these were eventually abandoned after realising their commercial non-viability. However, over the past decade, demand for strategic resources in various countries—especially China, Japan, Korea, India and Brazil—has led to a resurgence of interest in sea-bed minerals. The private sector and the financial institutions that support such interest believe that deep seabed mining can be commercially viable.

The surge in search for alternative sources of supply of strategic minerals and rare earths has also been ongoing since China—the predominant supplier of rare earth minerals—announced its decision to reduce its export quota in September 2009. China, which produces about 97 percent of rare

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1 In 2013, the UK Prime Minister pledged to put Britain at the forefront of a new international seabed mining industry, which he claimed could be worth £40 billion to the UK economy over the next 30 years. Terry Macalister, David Cameron says seabed mining could be worth £40bn to Britain, THE GUARDIAN (March 14, 2013).

2 International Seabed Authority, Technical Study No.11 *Towards the development of a regulatory frame work for polymetallic nodule Exploitation in the Area* (2013).


4 Statement of ISA Secretary-General during the launch of UK Seabed Resources Limited, the latest exploration contractor with the ISA, 14 March 2013.
earth minerals in the world, allegedly restricted exports in order to conserve supplies for its own high-tech and green industries. As a result, there has been a shift of mineral exploration and development activities to ‘non-traditional’ sources, viz. polymetallic nodules, seafloor massive sulphides and cobalt rich ferromanganese crusts, occurring within and beyond the national jurisdictions. Such deposits also have the potential to contain rare earth elements, something that is likely to enhance their attractiveness as targets for seabed resource development.

It is pertinent to note that mineral resources beyond national jurisdiction are the “Common Heritage of Humankind” (CHM) under the 1982 United Nations Convention on the Law of the Sea (UNCLOS). The mineral resources of the ‘Common Heritage’ are administered by the International Seabed Authority (ISA) under Part XI of the UNCLOS. Accordingly, offshore deep seabed mining beyond national jurisdiction can only be undertaken through application for a license from the ISA. This article outlines the legal aspects of deep seabed mining.

**Mineral Resources of Deep Seabed**

Commercial interest is currently focused on three types of deep seabed mineral resources: polymetallic nodules, polymetallic Sulphides or seafloor massive Sulphides and Cobalt-rich Ferromanganese crusts deposit. Table 1 shows the location, oceanic area and metal constituents of these marine resources.

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5 US, Japan and the European Union filed a complaint at the WTO against China’s restrictions on rare earths exports in 2012.
Polymetallic Manganese Nodules

Polymetallic nodules, also known as manganese nodules, are rock concretions formed of concentric layers of iron and manganese hydroxides around a core, which occur on the seafloor at the depths of 4000 - 6000 m. While nodules vary in size, size of most nodules ranges from 2 to 10 cm in diameter, about the size of potatoes. They take one million year to grow to one millimeter. Its formation requires a nucleus, low sedimentation rate, oxidizing conditions and low velocity bottom currents. Polymetallic nodules

Table 1 – Important Deep Seabed Mineral Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Location/ Depth</th>
<th>Oceanic Area</th>
<th>Key products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymetallic nodules</td>
<td>deep-seafloor, deep-water abyssal plains (4,000-6,000m)</td>
<td>Clarion-Clipperton zone, Peru Basin, Southern Ocean, North Indian Ocean</td>
<td>Manganese, Nickel, Copper, Cobalt, Iron, rare earths</td>
</tr>
<tr>
<td>Polymetallic Sulphides</td>
<td>Hydrothermal vents, submarine volcanic ridges (500-4,000m)</td>
<td>Southwest Indian Ridge, East, southeast and northeast Pacific Rise; Red Sea</td>
<td>Copper, Zinc, Lead, Gold and Silver</td>
</tr>
<tr>
<td>Cobalt-rich Manganese Crusts</td>
<td>seamounts (800-2,500m)</td>
<td>South Pacific island states</td>
<td>Cobalt, Manganese, Nickel, rare earths, Tungsten, Tellurium</td>
</tr>
</tbody>
</table>

nODULES, containing a high concentration of Manganese, lie on the seabottom sediments. They have been found in many ocean areas of the Pacific, the Atlantic and the Indian Ocean. These nodules contain several metals and non-metals including Manganese, Iron, Nickel, Copper, Cobalt, Titanium, Aluminium as the majors components and some minor constituents like Sodium, Magnesium, Silica, Zinc, Oxygen and Hydrogen. While they occur in all oceans, deposits in the Clarion-Clipperton Fracture Zone (CCZ) is the eastern Pacific are considered to be among the richest, containing high grade and high abundance nodules.7 It is estimated that the CCZ contains a potential resource of 62 billion tons of nodules, comprising 17,500 million tons of Manganese, 761 million tons of Nickel, 669 million tonnes of copper and 134 million tonnes of Cobalt.8

Polymetallic Sulphides

Polymetallic sulphides are also known as Seafloor Massive Sulphides (SMS). They are rich in Copper, Iron, Zinc, Silver and Gold. Polymetallic sulphide deposits are concentrated over thousands of years by seafloor hot springs at sites along with active global submerged volcanic mountain range that extends through all the ocean basins of the world. These deposits also occur at sites associated with volcanic island chains such as those along the western boundary of the Pacific Ocean, tectonic plate boundaries along the mid-ocean ridges, back-arc ridges and active volcanic arcs, typically at water depths of around 2,000 meters for mid-ocean ridges. These deposits are formed over thousands of years through hydrothermal activity, which is when metals precipitate from water discharged from the Earth’s crust through hot springs at temperatures of up to 400°C. These hydrothermal vents are often referred to as ‘black smokers’ because of the black plumes formed by the activity. The International Seabed Authority database contains locations of about 350 known sites of hydrothermal activity; but it is estimated that vents are likely to occur at approximately 100km intervals along the 60,000 km mid-oceanic ridge system that encircles the globe, including in some EEZs.

7 ISA, Technical Study No. 6, A Geological Model of Polymetallic Nodule Deposits in the Clarion-Clipperton Fracture Zone (2010).
Cobalt-Rich Manganese Crusts

These are generally found on hard-rock sub-strata throughout the ocean basins. They form at the seafloor on the flanks and summits of seamounts, ridges, plateau, and abyssal hills where the rocks have been swept clean of sediments intermittently for millions of years. Ferromanganese crusts contain sub-equal amounts of Iron and Manganese and are specially enriched in Cobalt, Manganese, Lead, Tellurium, Bismuth, and Platinum relative to their lithospheric and seawater concentrations. These crusts are precipitated over millions of years on the submerged flanks of inactive underwater volcanoes from metals dissolved in seawater and also derived from input of metals by both rivers and seafloor hot springs. These are found at water depths of about 400 – 4,000 meters, with the thickest and most cobalt-rich crusts occurring at about 800 – 2,500 meters. The most prospective area for cobalt crusts is the Magellan seamounts in the Pacific Ocean, east of Japan and the Mariana islands.

Legal Regime of Deep Seabed Mining

The 1982 UN Convention on the Law of the Sea (UNCLOS)\textsuperscript{9} sets out the legal framework for uses of ocean space as well as ocean activities. Establishment of maritime zones and the rights and duties of states within these zones are at the core of the UNCLOS. Maritime zones, as outlined by UNCLOS, are: the territorial sea, the contiguous zone, the exclusive economic zone, the continental shelf, the high seas and the ‘Area’ (seabed outside national jurisdictions). Article 1(1) of the UNCLOS defines ‘Area’ as “the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction”.\textsuperscript{10} Activities in the ‘Area’ are governed by the


\textsuperscript{10}The area of the world’s oceans totals approximately 361.1 million sq km, which represents 71 per cent of the Earth’s surface. If all coastal States were to claim a 200-nm exclusive economic zone limit, the extent of ocean areas under national jurisdiction would be approximately 109.4 million sq km, making the size of the area beyond the limits of national jurisdiction (the ‘Area’) approximately 251.7 million sq. km or 49 per cent of the Earth’s surface. Three ocean areas in the ‘Area’ are considered as primary areas. The Clarion-Clipperton area is between the west coast of the continental United States and Hawaii, whose size is approximately 2.5 million sq. km. The second area lies in the south-western
provisions of Part XI of UNCLOS. Section 2 of Part XI provides the fundamental principles governing the ‘Area’. One of the fundamental principles governing this regime is that the ‘Area’ and its resources are the ‘Common Heritage of Mankind’. Section 133 of UNCLOS defines ‘resources’ as “all solid, liquid or gaseous mineral resources in situ in the ‘Area’ at or beneath the seabed, including polymetallic nodules”.

Legal regime for the administration and development of the mineral resources of the ‘Area’ is provided in the Part XI of the UNCLOS and in Annex III to the Convention which contains the “Basic Conditions of Prospecting, Exploration and Exploitation” with respect to the resources of the Area. Annex IV contains the statute of the Enterprise, the operating arm of the International Seabed Authority, and the 1994 Agreement, which modified Part XI and the Annexes in significant ways. Regarding dispute settlement, Annex VI of the UNCLOS provides for establishing ‘Seabed Disputes Chamber’ of the International Tribunal for the Law of the Sea (ITLOS). The ‘Seabed Disputes Chamber’ has jurisdiction to settle disputes with respect to activities in the ‘Area’.

Pacific basin. This area is about 1 million sq km. The third area in the central Indian Ocean basin is about 500,000 sq km. The pioneer site awarded to India is in this area. These three areas account for about 2 percent of the ‘Area’.

11 Article 136, UNCLOS.
12 Resources, when recovered from the Area, are referred to as “minerals”. See: Article 133(b), UNCLOS.
13 Part XI contains the legal framework governing “activities in the Area”. It consists of five sections, which detail an extremely complicated but unique regime of the Area and its institutional framework Convention, Articles 133 to 191, UNCLOS.
16 Article 186, UNCLOS.
17 Article 187, UNCLOS.
The regime for seabed mining under Part XI has undergone significant changes by virtue of the 1994 Agreement. The 1994 Agreement has made important adjustments to the substantive provisions in the Convention which were initially contentious and delayed the entry of the UNCLOS into force. It provides that the obligations applicable to ‘private contractors’ shall also apply to the ‘Enterprise’. This removes any competitive advantage of the ‘Enterprise’ over ‘private contractors’.\(^{18}\) The provision relating to the mandatory transfer of technology by the contractor to the ‘Enterprise’ or to developing country’s operators has been substituted by a “general duty of cooperation by sponsoring States to facilitate the acquisition of deep seabed mining technology if the Enterprise or the developing country is unable to obtain such technology in open market or through joint-venture arrangements”.\(^{19}\) The financial terms of the contract are modified to a single market-oriented system with a preference for ‘simple royalty’ system. The decision-making process in the ISA has been modified by the Agreement which requires that all organs of the ISA, including the Assembly, should make efforts to arrive at decisions by way of consensus, as a first step.\(^{20}\)

By its’ terms, the 1994 Agreement forms an integral part of the UNCLOS. It states that Part XI of the UNCLOS shall be interpreted and applied together as a single instrument. In the event of any inconsistency between this Agreement and Part XI, the provisions of the Agreement shall prevail. Where a provision of Part XI, Annex III, or Annex IV is affected by a provision of the Agreement, the effect of the relevant provisions of the Agreement is addressed in the UNCLOS in each individual article. Exploration and exploitation of mineral resources in the ‘Area’ has to be carried out in accordance with regime Part XI, adapted by 1994 Implementation Agreement. The mining regime for the ‘Area’ is given practical effect by providing for an institutional framework in the form of ISA through which the Stateparties\(^{21}\) are required to organize and control

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\(^{18}\)Section 2, paragraph 4, Annex of the Agreement.

\(^{19}\)Section 5, Paragraphs 1 and 2, Annex of the Agreement.

\(^{20}\)Section 3 (2), Annex to the Agreement.

\(^{21}\)As on March 7, 2014, there are 166 States parties to UNCLOS. The United States is one of the last remaining countries that have not ratified UNCLOS, along with Iran, Libya, North Korea, Ethiopia and Burundi.
activities in the ‘Area’, particularly with a view to administer the resources of the ‘Area’ by adoption of regulations. 22

Activities in the ‘Area’ are to be carried out by the Enterprise, 23 independently or in association with the Authority by States Parties or state enterprises or natural or juridical persons which possess the nationality of States Parties or are effectively controlled by them or their nationals, when sponsored by such States. 24 Article 137 (3) of the UNCLOS provides that “no State or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals recovered from the ‘Area’ except in accordance with this Part. Otherwise, no such claim, acquisition or exercise of such rights shall be recognized.”

General Principles Governing Deep Seabed Regime

Some of the important principles governing the deep seabed regime are as follows: 25

– ‘Area’ and its’ (mineral) resources are the common heritage of mankind; i.e. rights over resources are vested in mankind.

– ISA shall act on behalf of ‘mankind’; all Parties to the UNCLOS are responsible for organizing and controlling mining activities in the ‘Area’.

– Mining activities shall be carried out for the benefit of mankind; this implies equitable sharing of economic benefits.

– No State shall claim or exercise sovereignty or sovereign rights over any part of the ‘Area’ or its mineral resources.

22 Articles 156-157, UNCLOS.
23 Under the UNCLOS, the ‘Enterprise’ was given extensive powers to embark on seabed mining, transportation, processing and marketing of minerals recovered in the ‘Area’, either on its own or jointly with willing and qualified entities, including those from developing states. See Article 170 (1), UNCLOS.
24 Article 139, UNCLOS.
25 Section 2, Part XI, UNCLOS.
Common Heritage of Mankind\textsuperscript{26}

Common Heritage of Mankind (CHM) is a relatively novel concept in international law and politics in ensuring a new place for the regime of the ‘Area’. UNCLOS provides that the ‘Area’ and its resources are neither subject to claims of sovereignty by any state nor subject to appropriation by any state or natural or juridical persons; and are to be used for peaceful purposes only.\textsuperscript{27} All rights in the resources are vested in mankind as a whole, with the ISA acting as a type of trustee on behalf of ‘mankind’.\textsuperscript{28} Activities in the ‘Area’ are to be carried out for the benefit of mankind as a whole.\textsuperscript{29} These concepts have been further defined under Article 136 of UNCLOS as related to “the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.” By extension, it can be argued that there are four core components of CHM that govern exploitation, resource recovery and utilization, of the deep seabed resources:-

- There can be no private or public appropriation; no one legally owns common heritage spaces.

- Representatives from all nations must manage resources contained in such a territorial or conceptual area on behalf of all, since a common area is considered to belong to everyone. This is the reason for establishing ISA to coordinate shared management.

- All nations must actively share the benefits acquired from exploitation of resources from the common heritage region, with each other. This requires restraint on profit-making activities of private corporate entities in accordance with the concept of a global public good.

- The commons should be preserved for the benefit of future generations.

\textsuperscript{26}The basic principles GA Res. 2749 (XXV) adopted by the UN General Assembly on December 17, 1970 became the basis for development of the regime for the ‘Area’ and its resources at the Third United Nations Conference on the Law of the Sea.

\textsuperscript{27}Articles 136, 137 and 141, UNCLOS.

\textsuperscript{28}Article 137(2), UNCLOS.

\textsuperscript{29}Article 140(1), UNCLOS.
Although the CHM sets forth the overarching framework for deep seabed mineral exploitation, the actual implementation is broadly governed by the 1994 Agreement on the Implementation of Part XI (sections 6 and 8 of the Annex). Section 6 of the Annex which deals with production policy, emphasizes that the development of resources of the ‘Area’ shall take place in accordance with “sound commercial principles”; that “there shall be no subsidization of activities in the Area”; and that “there shall be no discrimination between minerals derived from the ‘Area’ and from other sources.”

Section 8, paragraph 1, on financial terms of contracts provides that:-

- The system of payments to the Authority shall be fair to both, the contractor and the Authority; and shall provide adequate means of determining compliance by the contractor within such system.

- The rates of payment under the system shall be within the range prevailing in respect of land-based mining of the same or similar minerals, in order to avoid giving deep seabed miners an artificial competitive advantage or imposing on them a competitive disadvantage.

- The system should not be complicated and should not impose major administrative costs on the Authority or on a contractor. Consideration should be given to the adoption of a royalty system or a combination of a royalty and profit-sharing system.

- The system of payments may be revised periodically in the light of changing circumstances.
Institutional and Regulatory Framework

International Seabed Authority (ISA) is one of the most important institutions established by the 1982 United Nations Convention on the Law of the Sea. It came into being on November 16, 1994 upon the entry of the UNCLOS into force. The membership of the ISA consists of all parties to the 1982 Convention who are ipso facto members of the Authority. The need for an international machinery to administer the ‘Area’ arose from the fact that investors in seabed mining activities could not exercise exclusive rights over parts of the seabed where they could explore and exploit the mineral resources. Those areas would otherwise be subject to the ‘freedom of the high seas’ and would be accessible to nationals of other States in the exercise of their own ‘high seas freedom’. The ISA, therefore, provides an essential safeguard for investors who intend to undertake long term development of the resources of deep seabed areas by giving them exclusive rights to the resources of those areas for the duration of their contracts or by issuing licenses to them for the purpose.

Powers and Functions of ISA

The mandate of ISA is to administer the mineral resources of the deep seabed beyond national jurisdiction which is referred to as the ‘Area’ and to organize, carry out and control activities in the ‘Area’ on behalf of mankind with a view to administering the resources therein. Use of the ‘Area’ for other activities, such as pipeline and cable laying and scientific research, unconnected with exploitation of seabed mineral resources do not fall within the competence of the ISA and therefore can be freely carried out as part of the ‘freedom of the high seas’. It has such incidental powers consistent with the Convention, as are implicit in, and necessary for, the exercise of those powers and functions with respect to activities in the ‘Area’.

Beyond its functions in the ‘Area’, the UNCLOS also gives the ISA certain powers and functions in relation to the continental shelf beyond 200 NM. Under Article 82 (4) of the UNCLOS, the ISA is to receive the payments or contributions from coastal states having extended continental shelf. Upon receipt of the payments or contributions, the ISA is required to distribute them among State Parties on the basis of equitable sharing criteria. This in essence gives the ISA a distributive role in respect of benefits derived from a maritime zone outside that of its field of primary competence, the ‘Area’.
ISA is responsible for developing and overseeing regulations governing the issuance of prospecting, exploration and eventually, extraction licenses for minerals in the ‘Area’. The Authority has prepared the deep seabed mining code as follows:

- Regulations on Prospecting and Exploration for polymetallic nodules in the Area\(^\text{31}\)

- Regulations on Prospecting and Exploration for polymetallic sulphides in the Area\(^\text{32}\)

- Regulations on Prospecting and Exploration for cobalt-rich crusts\(^\text{33}\)

The current challenge though, is to develop regulations on the exploitation of these minerals. The powers and functions of the ISA are exercised through a number of organs, namely the Assembly,\(^\text{34}\) the Council and the Secretariat.\(^\text{35}\) There are also subsidiary organs of the Council such as the Legal and Technical Commission.\(^\text{36}\) Further, functions of operational arm, the ‘Enterprise’ are presently being carried out by the Secretariat.\(^\text{37}\) The mineral resources of the ‘Area’ can only be explored and exploited in accordance with the rules, regulations and procedures promulgated by the ISA. Otherwise, no claim, acquisition or exercise of rights shall be recognized.\(^\text{38}\)

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\(^{32}\) Regulations on prospecting and exploration for polymetallic Sulphides in the Area, adopted May 7, 2010. (ISBA/16/A/12/Rev.1 dated 15 November 2010). Also reproduced in Selected Decisions 16, pp. 35-75.


\(^{34}\) The Assembly is the plenary organ of the ISA consisting of all the states parties to the UNCLOS and Agreement.

\(^{35}\) Article 158 (1), UNCLOS.

\(^{36}\) Section 1, Para 4, Annex of the Agreement.

\(^{37}\) Section 2, Para 1, Annex of the Agreement.

\(^{38}\) Articles 136 and 137, UNCLOS.
ISA Assembly has a number of specific powers and functions, including the consideration and the adoption of the regulations, rules and procedures relating to prospecting, exploration and exploitation of the resources of the ‘Area’ upon the recommendation of the Council.\(^{39}\) Council is the executive organ of the ISA with exclusive power to approve applications for mining contracts or licenses submitted to it in the form of plans for exploration or exploitation.\(^{40}\) The Legal and Technical Commission is the technical arm of the Council which makes recommendations to the Council on scientific and technical matters and generally assists the Council in the administration of activities in the ‘Area’, including formulation of mining regulations.\(^{41}\)

**Environmental issues and Mining Regulations**

The ISA has adopted regulations for each of the three types of mineral resources found in the ‘Area’ – manganese nodules, cobalt-rich crusts and massive Sulphides– with detailed provisions on the mining of these resources. At present, these regulations only cover the first two phases of deep seabed mining, i.e. prospecting and exploration. A license for deep seabed mining from ISA merely requires submission of data on general seismic surveying of the seabed by ship, with minimal ground sampling. Regulations for commercial exploitation of deep seabed resources are yet to be adopted by the ISA. The absence of a regulatory regime for exploitation of deep seabed resources is due in part to a number of unresolved environmental issues. It is evident that mining will impact the marine environment significantly, especially in the immediate vicinity of mining operations. Impacts may include the crushing of living organisms, the removal of substrate habitat and the creation of sediment plumes. There is also the possibility of other environmental damage through malfunctions in the riser and transportation system, hydraulic leaks, and noise and light pollution.\(^{42}\)

Presently, ISA is working on formulation of regulatory framework for exploitation of deep seabed minerals. It has recently come out with a draft

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\(^{39}\) Article 160, UNCLOS and Section 9, Para 3, Annex of the Agreement.

\(^{40}\) Section 3, Para 11(a), Annex of the Agreement.

\(^{41}\) Article 165, Para 2(f), UNCLOS.

regulatory framework for exploitation of manganese nodules. On the other hand, intensive exploration is under way in various areas, and scientists on research vessels are constantly collecting new information about seabed habitats. The findings will feed into the future exploitation regime, which should be in place long before mining of manganese nodules starts. Further, regulatory framework for exploitation of Cobalt-rich crusts and massive Sulphides is needs to be worked out. In this scenario, efficacy of Environmental Impact Assessment (EIA) remains uncertain because of the lack of regulations for exploitation of deep seabed minerals. The ISA needs to put in place the institutional, procedural, and substantive components of precautionary environmental management before the exploitation phase begins.

**Conclusion**

Increasing interest in deep seabed mining has raised many questions about its potential environmental impacts and the need for regulatory mechanism to protect marine environment. Under the UNCLOS, the International Seabed Authority (ISA) has the responsibility to ensure protection of marine environment as part of its mandate to manage mining in seabed beyond national jurisdiction (the ‘Area’). However, the ISA is yet to adopt the regulatory framework for exploitation of deep seabed minerals in the ‘Area’, thus, exploitation of deep seabed minerals is still a long-term proposition.