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DEEP-SEA MINING - BRIEFING PAPER

INTRODUCTION

Commercial scale deep-sea mining has yet to begin but, driven by markets and technology, corporations and governments have increased the pace of exploration for mineral deposits in deep ocean seabeds. Many of these deposits are found at depths between 1000 and 6000m below the surface and contain large concentrations of metals of commercial interest such as copper, nickel, manganese, gold, lithium, platinum and rare earth elements.

Many of the richest seafloor deposits are found in the half of the world's ocean floor that lies beyond the jurisdiction of any one country. Under the United Nations Convention on the Law of the Sea (UNCLOS), the sole authority governing the exploration and exploitation of the global seafloor is the International Seabed Authority (ISA). So far, the ISA has issued 27 licenses to member states and their contractors (private or state owned companies or agencies) for prospecting, or "exploring", mineral deposits. These licenses cover over a million square kilometres in the Pacific, Indian and Atlantic Oceans.

Companies are developing advanced technologies to mine and remove the minerals from deposits found on seamounts, in hydrothermal vents zones, and across the surface of deep abyssal plains. A number of ISA member states and their licensees are investing in research and development to move from exploration to commercial exploitation in the coming few years.

At the same time, recent scientific papers have shown that deep seabed mining is likely to cause many adverse impacts on deep-sea ecosystems, including a loss of habitat and biodiversity.

- There is widespread concern about these impacts because:

- Most deep-sea species reproduce slowly, live in slow-changing environments and are likely to be highly vulnerable to mining impacts;
- The deep sea helps regulate the planet's life systems, and little is known about the effects of seabed mining on that capacity;
- Many deep-sea habitats – hydrothermal vent zones in particular – are compact, localised and particularly vulnerable to external impacts;
- There is insufficient scientific knowledge to adequately assess the likely effects of deep-sea mining on habitats, biodiversity and ecosystems; and
- The remoteness of the areas in which deep-sea mining will take place will make monitoring and emergency response difficult.

Under international law (UNCLOS) deep sea minerals exploitation must be governed "to ensure effective protection for the marine environment from harmful effects", to prevent damage to marine fauna, and to ensure the "protection and preservation" of the marine environment. An ISA Mining Code is now in development, and these regulations must ensure that these key UNCLOS obligations are fully met.

THE DEEP SEA

The deep sea – the water and seabed below 200m – makes up 90% of the marine environment. It functions as the regulatory body of the entire biosphere, enabling the circulation of chemicals over the entire planet, regenerating nutrients and hosting infinitely rich fauna. It is fundamental to supporting life on Earth.

The key types of deep-sea areas where mineral deposits are known to occur are:

- the abyssal plains (the deep ocean floor);
- hydrothermal vents (both active vents and areas where venting has occurred in the past) found along ocean ridge systems (underwater mountain chains)
- seamounts (underwater mountains) and other topographical features.

These areas all have distinct faunas across different regions of the world's oceans. Most habitat-forming bottom-dwelling species are extremely vulnerable to human disturbance. The United Nations General Assembly has recognised this: it has repeatedly committed nations to take action to ensure that deep-sea fishing on the high seas is managed to prevent destructive fishing activities and damage to habitats and vulnerable species.

THE IMPETUS FOR DEEP SEABED MINING

Commercial interest in exploiting mineral wealth on the deep ocean floor first became a major topic of debate at the United Nations in the 1960s. However, technical challenges, the cost of extraction and environmental and legal concerns kept development slow.

Today, that is changing. The development of advanced robotics has seen increasing exploration and research in the deep ocean, and the potentially huge costs of exploitation are being offset by rising demand and prices for the metals available from the seabed. A new breed of specialised mining firm is poised to dive deep in its quest for valuable metals.

Some countries are welcoming investment in exploring for deep sea metals in areas within their jurisdiction. Others are laying claim to areas of the international seabed in the name of access to strategic supplies. However, the economic implications are still debated, and at least one government-level assessment of seabed mining has found economic claims questionable.[1] Comprehensive assessments of the environmental costs of seabed mining proposals are also lacking. This is partly due to uncertainties about the costs of complying with environmental regulations, insurance and liability for damage. The current lack of royalty and/or profit sharing arrangements for deep sea mining also brings uncertainty about economics.

THE PRACTICALITIES OF DEEP SEABED MINING

Mining is being planned in both the international areas of the deep seabed and areas within national jurisdiction. The planned sites are some of the most difficult places on earth to access. The unique and extreme environments require specialised approaches.

Commercial prospectors are interested in three types of mineral deposits, each from a different ocean location and requiring a different kind of mining.

POLYMETALLIC NODULES FROM THE OCEAN FLOOR

Polymetallic nodules (sometimes called manganese nodules) are potato-sized accumulations of minerals containing manganese and iron oxides, nickel, copper, cobalt and traces of rare earth elements. They lie on the seafloor over extensive areas of abyssal plains at depths of 4,000-6,500m and take millions of years to form.

[1] In New Zealand, the Chatham Rock (CRP) Environmental Protection Authority (EPA) decisions questioned economic claims made by proponents. http://www.epa.govt.nz/EEZ/previous-activities/notified-consents/chatham_rock_phosphate/Pages/default.aspx.

They provide the substrate for the growth of species such as sponges, which in turn provide habitats for many other species that inhabit the deep ocean plains.

Nodules are most likely to be extracted using hydraulic suction mining. Nodules are effectively scraped or vacuumed up over thousands of square kilometres using heavy machinery which compacts the surrounding sediment on the seafloor and pumps the nodule “slurry” to a vessel on the surface. Chemically laden wastewater is then pumped back to the seafloor.

There is evidence that most if not all suspension feeders and organisms living in or on the sediment of the seafloor, will be permanently destroyed at mining sites. Sediment, and possibly chemical plumes, will affect deep-sea life well beyond the areas directly impacted by the mining operations.

COBALT CRUSTS FROM SEAMOUNTS

Cobalt precipitates onto rock surfaces in the deep ocean, mainly onto seamounts. It takes one million years for these crusts to grow 1-5mm – less than the thickness of a smart phone.

The cobalt-rich crusts of economic interest are mainly found on seamounts in the western Pacific Ocean, at depths of 800-2,500m. Mining would involve removing the top 5-8cm of seamount flank, using techniques such water-jet stripping, chemical leaching, sonic separation and fragmentation by massive undersea cutting vehicles.

Seamounts are ocean biodiversity hotspots. They support complex and often endemic ecosystems. The crust is home to long-lived, slow-growing and habitat-forming species such as deep water corals. These species and their ecosystems will be eliminated by mining.

POLYMETALLIC SULPHIDES FROM HYDROTHERMAL VENTS

Deep-sea hydrothermal vents are areas where superheated water is forced out of the earth’s crust at the point where tectonic plates meet.

Valuable metals such as gold, silver and zinc lie in massive sulphide deposits, which accumulate as heat from the magma below starts a chain of reactions. The metals precipitate out of the hot water to form deposits around the vent sites.

Work preparing to exploit these deposits is already underway. A company called Nautilus Minerals has a permit to mine a site in the waters of Papua New Guinea and has developed a 310-ton robotic machine which will mine these deposits using rotating cutter heads.

Vent sites support some of the rarest and most unique ecological communities known to science. Here, species live by chemosynthesis rather than photosynthesis and are found nowhere else in the world. They were first discovered in the late 1970s and fundamentally changed our understanding of the evolution of life on earth.

Mining would destroy the vent chimneys and virtually all the attached organisms – some of which may be new to science and could provide new medicines and clues about the beginnings of life on earth.

QUESTIONS OVER THE NEED FOR DEEP SEABED MINING

The proponents of deep sea mining say it is necessary because of rising global demand for copper, cobalt, nickel, lithium, silver and rare earth and specialty metals. These metals are needed for renewable energy technologies such as rechargeable batteries, solar photovoltaic generators and wind power plants.

However, an authoritative 2016 report from the Institute for Sustainable Futures in Sydney concluded that even under the most ambitious renewable energy scenarios, this demand can be met without mining the deep sea.

The report, *Renewable Energy and Deep-Sea Mining: Supply, Demand and Scenarios,* found that projected demand for silver and lithium to 2050 will take up just 35% of known terrestrial resources – so can easily be met from existing supply.

The demand for other metals – copper, cobalt, nickel, specialty and rare earth metals – is less than 5% of existing resources. And although production of silver, lithium and some rare earth metals will need to expand as the world 'scales up' the use of renewable energy, increased recycling will help considerably.

The report concludes that "even with the projected very high demand growth rates under the most ambitious energy scenarios, the projected increase in cumulative demand – all within the range of known terrestrial resources – does not require deep-sea mining activity".[2]

At the June 2017 UN Ocean Conference, over 35 civil society organisations called for a halt to deep-sea mining, pointing out that alternatives can be found as economies change to more sustainable approaches, in line with the UN Sustainable Development Goals.

[2] Teske, S., Florin, N., Dominish, E. & Giurco, D. 2016, Renewable Energy and Deep Sea Mining: Supply, Demand and Scenarios. University of Technology Sydney https://opus.lib.uts.edu.au/handle/10453/67336

They argued that emphasis should be placed on reducing demand for raw materials by designing products better, sharing, re-using, repairing, recycling and developing new materials. They also looked towards smart energy and mobility systems, structural changes in consumption patterns and lifestyle change.[3] Every year in the EU 100 million mobile phones go unused, and less than 10% are recycled: this highlighted the potential of policies to increase global resource efficiency, they said.

EVIDENCE OF ENVIRONMENTAL IMPACT

Because deep seabed mining is currently speculative and experimental, the exact nature of impacts on deep-sea ecosystems remain unknown. But existing information has led many scientists to warn that mining could have a devastating effect on hundreds of thousands of square kilometres of the seabed.

The MIDAS (Managing Impacts of Deep Sea Resource Exploitation) project was a collaboration of physical and social scientists, legal experts, and representatives from industry, small business and non-governmental organisations (NGOs). Funded by the European Union between 2013 and 2016, the project aimed to help the industry, regulators and civil society understand the potential impacts of mining on deep-sea ecosystems.
It concluded that deep seabed mining would directly lead to:

- mortality of fauna living on mined substrate (surface which supports life);
- removal of substrate and habitat loss;
- habitat fragmentation;
- habitat modification.

It also concluded that there would be indirect impacts from:

- the formation of near-seabed sediment plumes;
- plumes caused by processing and shipping;
- the activity of crawlers and other seabed installations;
- the potential release of toxic substances; and
- noise and light “pollution”.

The overall conclusion of MIDAS was that, for most seabed areas experiencing direct mining impacts, recovery of deep-sea species and ecosystems was likely to occur only in the very long term – if at all.

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[3] Seas At Risk spearheads global NGO call to halt deep sea mining. 2nd June 2017. http://www.seas-at-risk.org/15-eu-marine-strategy/741-seas-at-risk-spearheads-global-ngo-call-to-halt-deep-sea-mining.html.

EXPLORATION AND EXPLOITATION IN NATIONAL WATERS

Individual countries can permit mineral exploration and exploitation in the seabed areas within their national jurisdiction, known as their continental shelves. Countries are entitled under the United Nations Convention on the Law of the Sea to a continental shelf extending 200 nautical miles (and sometimes up to 350 nautical miles) from its coastline.

The world's first deep seafloor mining is likely to start in 2019 within the 200 mile exclusive economic zone (EEZ) of Papua New Guinea, when the Canadian company Nautilus Minerals is due to start mining for gold, silver and copper from hydrothermal vent zones.

In January 2011, Nautilus was granted its first mining lease by Papua New Guinea for Solwara 1 – a hydrothermal vent site on the seafloor at a depth of 1600m. Nautilus claims that the ore there contains a copper grade of approximately 7%, compared with an average grade of 0.6% from land-based mines. It has been reported that Papua New Guinea has a 30% equity share in the Solwara 1 project.

In 2015 Nautilus unveiled three remote controlled machines, 15m long by 4.5-6m wide, designed to cut up the ocean floor and feed minerals back to ships.

The project has generated controversy in Papua New Guinea. In January 2017, fearing that Solwara 1 will lead to irreversible damage, the Solwara Warriors – a Papua New Guinea community group – were reported to be considering a legal challenge against the government, calling for greater transparency.

EXPLORATION AND EXPLOITATION IN THE INTERNATIONAL DEEP-SEA AREA

Licensed deep seabed mining exploration is now taking place way beyond the jurisdiction of individual countries – in the deep water of the Pacific, Atlantic and Indian Ocean.

THE ROLE OF THE INTERNATIONAL SEABED AUTHORITY

Access to these seabed resources beyond national jurisdiction (referred to in the UN Convention on the Law of the Sea as "the Area") is organised and regulated by the ISA. The Area covers 54% of the ocean.

Between 2001 and May 2017, the ISA awarded 27 contracts for mineral exploration in the Area. The contracts are to assess the commercial potential of mineral deposits within defined areas and provide baseline information on the ecosystems in the claim areas. They have been made with companies and governments, each with a sponsoring state. These exploration contracts could lead to exploitation contracts.

ISSUES SURROUNDING THE REGULATION OF DEEP SEABED MINING

The ISA is now in the process of developing a mining code to allow and regulate commercial deep-sea mining.

Some scientists and civil society groups are concerned about the process for putting together these regulations. Their concerns include:

- The process allows only limited participation by stakeholders.
- Many important meetings and procedures are entirely closed to observers, notably meetings of the Legal and Technical Commission.
- Detailed information provided to the ISA by contractors is considered proprietary, and is not shared.
- The process favours the interests of the mining industry and hampers the participation of scientists and environmental groups.
- The ISA does not yet have capacity to monitor the activities of its contractors.

The Deep Sea Conservation Coalition (DSCC) is calling for a rethink on whether the international community should permit deep-sea mining on the global ocean commons – and if so, how. The reconsideration should be based on: the potential for serious environmental damage; the possibility that the minerals can be found from other sources; the fact that demand for metals can instead be managed through better use, repair, recycling and product design.

If deep seabed mining is allowed to take place, then governments must ensure that the ISA regulations include robust requirements for:

- strictly limiting adverse environmental impacts, with clear conservation and management objectives;
- strategic or regional environment management plans;
- site-specific environmental management plans;
- environmental impact assessments (EIAs);
- mechanisms for independent scientific review, monitoring and compliance;
- liability provisions, insurance and bonds, a redress and liability fund, and a sustainability fund;
- transparency, including provisions to ensure public accountability and reporting, and public availability of environmental data.

The ISA must also improve its structure and working methods to ensure it has the capacity to develop and apply regulations to protect the marine environment. This will be debated at the August 2017 ISA meeting. The DSCC is calling on the ISA to:

- establish procedures to ensure that it works with greater transparency;
- establish an environment committee to ensure that environmental issues are properly addressed.

COUNTRIES AND COMPANIES

The ISA has entered into contracts with 27 contractors for the exploration of polymetallic nodules, polymetallic sulphides and cobalt-rich ferromanganese crusts on the deep seabed. These contracts are for up to 15 years and several have been renewed for an additional five years.

The contractors are a mix of corporate enterprises, state-owned companies and national research institutes or agencies. Several governments are keen to establish the rights to mine and to gain a foothold on the international seabed. Each contractor has a sponsoring country.

Seventeen of these 27 contracts are for exploration for polymetallic nodules in the deep abyssal plains in the Clarion-Clipperton Fracture Zone and Central Indian Ocean Basin. There are three contracts for exploration for cobalt-rich crusts in the Western Pacific Ocean and one in the South Atlantic. And there are six contracts for exploration for polymetallic sulphides on the South West Indian Ridge, Central Indian Ridge and the Mid-Atlantic Ridge.

A full list of the exploration contracts granted by the ISA, as at May 2017, is available on the Deep Sea Conservation Coalition website at http://www.savethehighseas.org/deep-sea-mining/the-main-players/