Deep-sea mining: where are they seeking to mine first?

Much of the deep ocean floor is composed of vast, flat, sediment-covered areas called abyssal plains. Extensive deposits of manganese or polymetallic nodules have been found on the abyssal plains of the Eastern Pacific Ocean between Mexico and Hawaii.

The nodules are of commercial interest because they contain cobalt, copper, nickel and manganese, which have precipitated around fish bones, teeth and other small objects over millions of years. These metals are in demand to build batteries, electronic equipment and renewable energy technologies.

The largest deposits of nodules found to date lie at depths of four to six kilometers in an area called the Clarion Clipperton Fracture Zone (CCZ), in the eastern Pacific Ocean between Mexico and Hawaii. This is the area of the seabed where the International Seabed Authority (ISA), which regulates deep-sea mining in all marine areas outside national jurisdiction, seeks to hand out its first contracts for commercial mining.

The ISA has already granted 16 contracts to explore for metals across more than a million square kilometers of the CCZ. Some of the contractors want to start mining the nodules. (See map ‘Clarion Clipperton Fracture Zone’ on page 2.)

Clarion Clipperton Fracture Zone

Research expeditions have continuously identified new species in this area, leading marine scientists to speculate that the vast majority of life there has yet to be discovered. They believe that the CCZ may be one of the most biologically diverse areas of deep sea on the planet.

Major research projects, such as the JPI Oceans project ‘MiningImpact’ and the MIDAS Project, funded by the European Union,
discovered not only a high diversity of life in the CCZ, but also that groups of very different species live within just a few kilometers of each other. This suggests that many species are endemic to the CCZ or areas within it. Over half of the larger species discovered were found to depend on the nodules for their survival. Some, such as deep-sea corals and sponges, live on the nodules. Others, such as the female Casper octopus, depend on species that live on the nodules. Should the nodules be removed, it is unlikely that the animals that depend on them would survive, or that their habitats would recover.

Biodiversity and deep-sea mining
The sheer scale of the planned deep-sea mining operations in the CCZ has led many scientists to conclude that biodiversity loss would be unavoidable if mining were permitted to occur. While some species may begin to repopulate areas of the seabed that have been subject to very limited disturbance, scientists estimate that the nodules, and the animals that depend on them, may take “millions of years to recover”. Even a partial recovery of the animals in the surrounding sediment “may take hundreds to thousands of years.”

Causes for concern
A significant cause for concern is the size of the areas that would be impacted by nodule mining. A single mining operation is expected to effectively strip mine some eight to nine thousand square kilometers of seabed over the course of a 25-30 year mining contract. Another concern is sediment disruption. Sediment that has lain on the seabed for many thousands of years would be stirred up into the

Below: map shows areas within the The Clarion-Clipperton Zone under current exploration contracts, reserved for future exploration, and set aside for protection of the marine environment.
water column when the nodules are gathered or sucked up for transport to the mining vessel at the ocean surface. Modelling conducted under the MIDAS Project suggests that this plume could blanket the seabed for tens of thousands of square kilometers beyond the actual mining sites.

These plumes could expose animals living on or near the seabed to concentrations of sediment tens to hundreds of times higher than they are adapted for. This sediment suspension could be particularly harmful to species that live on the nodules such as deep-water corals and sponges that feed by filtering organic material from the ocean water.

There would also be additional sediment plumes generated from pumping out wastewater after nodules are brought aboard ships. Some companies are currently planning to pump the wastewater back into the ocean at depths of one or two kilometers beneath the surface, which equates to several thousand meters above the seafloor in the CCZ. This could lead to plumes of wastewater, sediment and residual ore flowing hundreds of kilometers away, impacting species at various depths. Increasing water cloudiness could affect species that use bioluminescence to hunt or find mates. Residual metals and other compounds in the wastewater could prove toxic to some forms of marine life and potentially get into the marine food chain.

Above: Casper octopods live at depths of more than 4,000 meters in the deep abyssal plain areas.

Right: Relicanthus sp. – a new species from a new order of Cnidaria collected at 4,100 meters in the CCZ that lives on sponge stalks attached to nodules.

Ocean and species of whales, dolphins, turtles and sharks also migrate through the area. Noise pollution is a further cause for concern. The noise from the continuous pumping of the ore to the surface over many months and years could impact species – such as whales and other deep-diving or deep-dwelling animals that use noise and echolocation to communicate and find prey. Little research has been undertaken to understand the likely impact of noise that would be generated by nodule mining operations.

Wider threats to ocean health
Deep ocean ecosystems are already facing multiple environmental stressors from pollutants and plastics, as well as climate change related impacts like acidification, warming, deoxygenation and reduced supply of nutrients from surface waters. At the same time, new species discovered by deep-sea expeditions, including those in the CCZ, could provide important ‘keystone’ functions or ecosystem services that we do not yet understand, and could even hold the key to medical or technological breakthroughs.
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Recommendations

The Deep Sea Conservation Coalition (DSCC) was founded in 2004 to address the need to prevent damage to deep-sea ecosystems and the depletion of deep-sea species on the high seas from bottom trawling and other forms of deep-sea fishing. The DSCC is made up of over 80 non-governmental organizations (NGOs), fishers organizations and law and policy institutes, all committed to protecting the deep sea.

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Above: Sea cucumber Amperima sp. on the seabed in the eastern CCZ.

Endnotes

6 Natural rate of sedimentation in eastern CCZ: 0.2 cm – 1.15 cm per thousand years (equals 0.002 mm–0.0115mm per year). Volz, J.B., Mogollon, J.M., Geibert, W., Arbizu, P.M., Koschinsky, A. and Kasten, S., 2018. Natural spatial variability of depositional conditions, biogeochemical processes and element fluxes in sediments of the eastern Clarion-Clipperton Zone, Pacific Ocean. Deep Sea Research Part I: Oceanographic Research Papers, 140, pp.159-172.
8 Ibid.