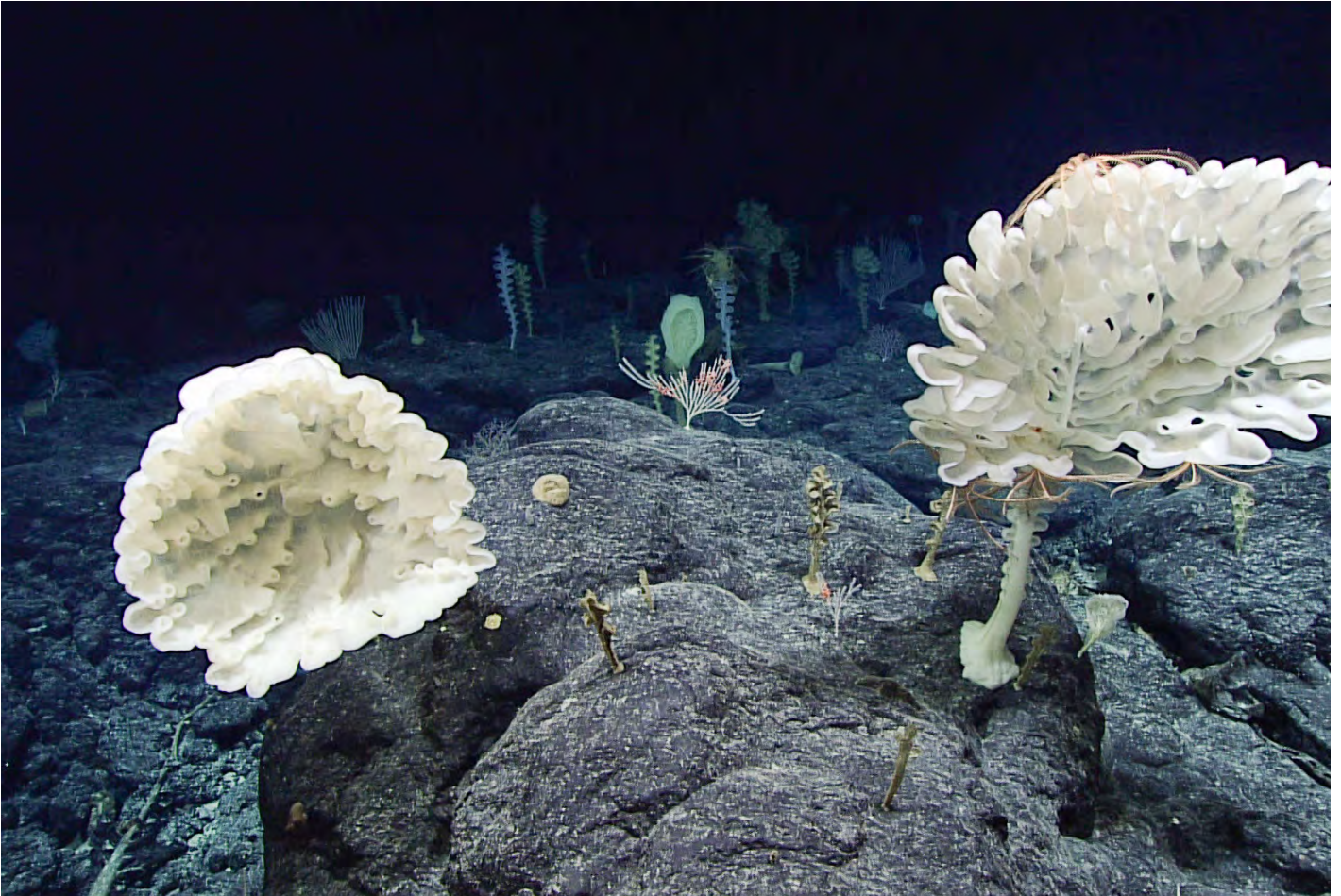


# THE DEEPEST DIVE

Deep sea mining for rare earth metals has clear environmental benefits, but the mining itself could pose a significant threat to the ocean's ecosystems. We take a look at an issue that divides environmentalists

**AUTHOR:** Helena Pozniak





## Forest of the Weird

**T**hese deep waters are an unlikely setting for a modern day gold rush. Pitch black and silent, the abyssal plains beneath the high seas are some of the most pristine parts of the planet. Some four to five kilometres below the Pacific, they lie peppered with knobby black fist-size lumps, which have developed undisturbed for millions of years.

Within these nodules are rare earth metals that could feed our growing technology needs and low carbon future. Unsurprisingly, pressure to extract them sooner rather than later is mounting.

Thousands of miles away, mining companies are developing giant mechanical harvesters and putting them through their paces in deep water tanks and then the ocean. These could eventually trundle along the sea bed, hoovering up the metallic nodules and squirting them thousands of metres up to the surface.

A host of nations are chomping at the bit to get going, not least the Pacific island state of Nauru which at the end of June asked authorities to fast-track long-running talks on mining permissions within two years, prompting dire

warnings from environmentalist groups, who believe too little is known about the the impact of the practice.

Deep sea mining is often discussed - if at all - as a clear tussle between the environment versus profits, with vigorous campaigns from pressure groups. But Nauru, which is collaborating with contractor The Metals Company (formerly DeepGreen), says it wants mining to proceed as soon as possible, as it has most to lose from climate change. Private companies must be sponsored by a state to mine the deep seas.

But this is a complex problem with many vested interests. And when Dr Alan Jamieson, senior lecturer in marine ecology at Newcastle University, describes deep sea mining to his students, they're wholeheartedly against it. But, he asks, what about their smartphones and touchscreens? Electric cars? What would they be willing to give up? What about batteries to store renewable energy - electrification is a key strategy for countries moving towards net zero, and these battery metals are in hot demand by green technologies. "By the end of the class they almost completely won over to the idea that a certain amount of deep sea exploitation is necessary," he says.

Once metals are in use, mining firms argue, they can be then recycled within

a circular economy. But that's a simplification, say scientists: extracting and recycling metals from discarded electric car batteries and other technology is complex and costly.

And at the bottom of the oceans are millions of kilometres of untapped wealth. Late last year China, which has ambitions to mine the deep seas, sent a crewed submersible more than 10 kilometres down to the bottom of the Mariana Trench in the Western Pacific - the deepest waters on the planet. In June this year, the Indian government



**Yellow Sponge**



## Corals on Seamount

approved a mission to develop deep sea technologies. But no one can mine the high seas without the UN's permission.

Twenty two international contractors, from countries such as the UK, India, Japan, Korea, Singapore, China, Russia, and Poland have been awarded exploration licences by a United Nations body, and 19 of these are for the manganese nodules found in the area of the Pacific known as the Clarion-Clipperton Zone (CCZ), a stretch roughly the size of Europe, which seems the mostly likely area

for exploitation. This hosts roughly 21 billion tonnes of nodules containing largely manganese and also cobalt, nickel and copper. Nations can sponsor companies and scientists to take out licences.

As scientists continue to examine how mining might affect delicately balanced marine life deep beneath the surface, various mining interests await international approval.

Geologically, these nodules are nothing like the rocks they resemble. They've formed over many millions of



grants countries rights to resources stretching 200 nautical miles beyond their coasts. But this leaves 46 per cent of the world's oceans unclaimed by nations - the high seas.

To date, no one has authority to physically start mining this no-man's land - and that's down to the UN's International Seabed Authority (ISA), formed in 1994 some three decades after the UN designated the high seas as a common heritage of humankind. Its remit is to manage access to deep sea wealth, prevent conflict and ensure profits are spread fairly. Exploration licences only permit investigation and research. In order to mine metals, companies and countries need a licence to exploit. None of these have yet been granted and there are regulatory hurdles to jump before the ISA grants permission. But commercial interest in the deep sea is escalating along with the technology to pursue it.

"We're at a stage where conceivably deep sea mining could start and be viable within the reasonably foreseeable future," said Michael Lodge, secretary-general of ISA, speaking on The Deep-Sea Podcast. But ISA has postponed meetings set for July.

Although vast - the CCZ stretches for six million square kilometres, it measures just one per cent of the whole ocean. With today's mining

years, as metals precipitate from water and layer upon objects such as shark teeth, bones and other objects on the sea bed. Elsewhere in more contested areas, polymetallic deposits rich in copper form around hydrothermal vents, and cobalt-rich ferromanganese crusts settle on 'mountains' beneath the sea, and these areas are more contested by environmentalists.

From the outside, this might look like an unruly scramble for resources, but the rule of law prevails. An international agreement signed in 1982



## **Mining the CCZ could be one of the largest anthropogenic alterations to the surface of our planet that we engage in”**

**Professor Jeffrey Drazen**



technology, it would take approximately 6,500 years for an underwater harvester to mine the entire mineralised area of the CCZ, said Lodge.

Billions of dollars of investment have gone in to developing huge robotic vehicles, some weighing in at more than 300 tonnes, to crawl across the sea bed. But early testing has been hit by glitches. In April a Belgian prototype became stuck on the seafloor after detaching from the cable connecting it to a ship above. In June, the European Parliament joined calls for a pause to deep sea mining until effects upon ecosystems were better understood, and some leading companies are calling for a moratorium.

These are the clearest, most untouched waters in the world. “Mining the CCZ could be one of the largest anthropogenic alterations to the surface of our planet that we engage in,” said Professor Jeffrey Drazen at the department of oceanography at the University of Hawaii at Manoa, speaking on The Deep-Sea Podcast.

Some mining companies have kept their operations confidential, making it difficult to assess their impact accurately. But fine sediment will be stirred up and squirted up to the surface along with the nodules. This must be discharged into the sea again - potentially choking delicately







## Coral and Squat Lobster

balanced marine life. “We don’t know how large those clouds of mud will be or how long they will persist - but it’s anticipated that mining will take place continuously,” said Drazen. “That could have a large impact beyond the direct footprint of mining ... We don’t have hard numbers but we know the ecosystem will be affected beyond where the mining vehicles operate.” Scientists estimate enormous plumes of silt could rain down at least 10 kilometres beyond the site.

Research also shows tracks made

by vehicles on the sea bed remain for years, and ocean life in the upper layers will be crushed by weight of the vehicles. Once thought to host little life, these plains are a biodiversity hotspot, research is revealing, and much life is supported in part by the nodules themselves.

“These are complex communities that have taken millions of years to form,” says Dr Helen Scales, marine biologist and author of *The Brilliant Abyss*.

“Larger creatures depend upon them. And we know these microbial commu-

nities are important for storing carbon. They won't recover quickly."

Our understanding of the CCZ is limited by its remoteness, says Scales. "But we are finding that this is one of the richest areas in terms of diversity anywhere in the deep ocean. And the nodules are an integral element. They're the basis of the ecosystem. If you remove them, you will fundamentally change it. It's been likened to removing trees from a forest."

Consider too, said Drazen, that these nodules will take millions of years to recover. "Life won't evolve fast enough to deal with this loss of habitat."

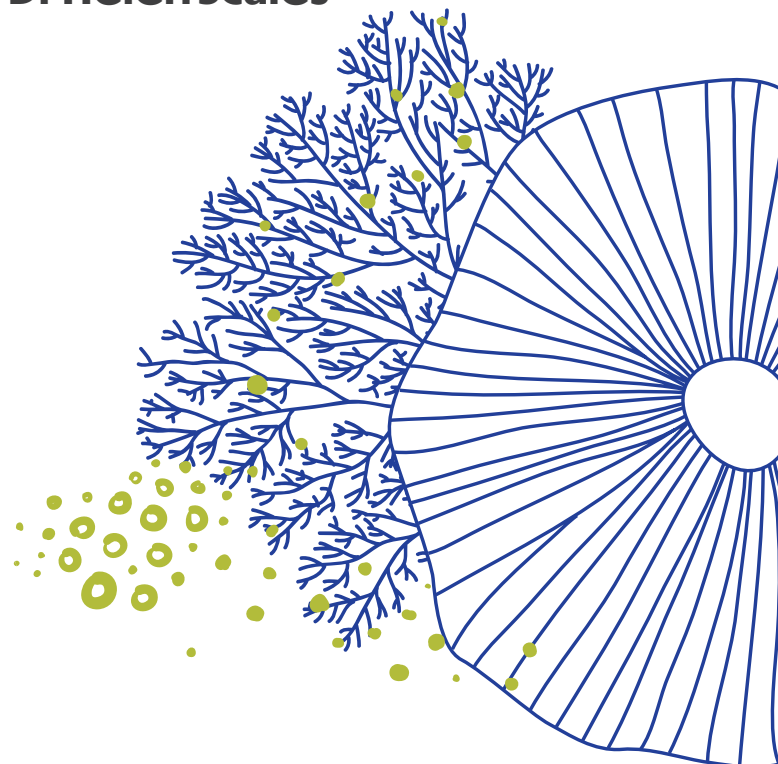
But the case for mining is strong. By 2050, the World Bank estimates we'll need 500 per cent more lithium, for a predicted population of 9.7 billion, up from 7.9 billion today. Batteries will be essential to store energy generated by wind, solar and tidal, and the growth of electric vehicles will push demand for minerals. Much mineral wealth, cobalt in particular, is currently mined in countries with unethical working practices. The case for deep sea mining is often made as a straight choice between good and bad.

"I wouldn't say there are no alternatives," said Lodge, on the Deep Sea Podcast. "We are not ... going to run out of minerals on land, but you'll have to spend more to access them. The environ-



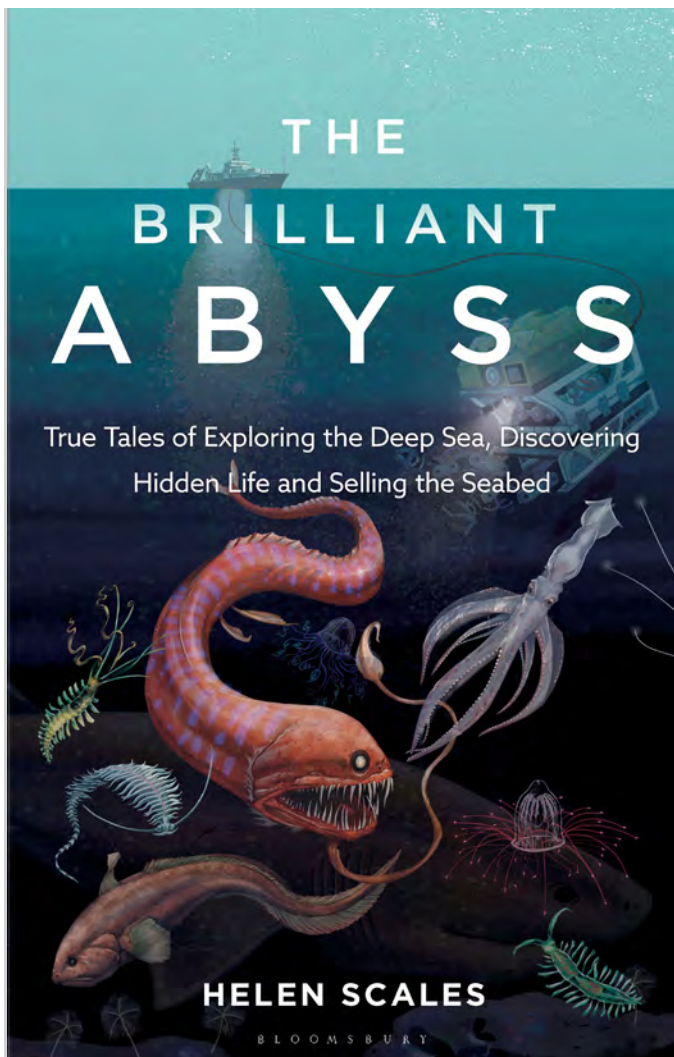
**Nodules are an integral element. They're the basis of the ecosystem. If you remove them, you will fundamentally change it. It's been likened to removing trees from a forest"**

—  
Dr Helen Scales



mental burdens on land are great... let's not pretend that mining on land is environmentally friendly." If deep sea mining is a technological and engineering challenge, companies can nonetheless avoid political and ethical problems of corruption.

In this case, at least science is playing catchup - in contrast to the devastation wrought by excessive fishing and trawling. Researchers have time to assess the impact before deep sea mining begins. "We've caught this one in the early stages, and that is reassuring," said Drazen. Several large zones of the



CCZ are now officially protected from exploitation - in total more than 1.4 million square kilometres. But areas marked out for exploitation are those in the North Pacific between Hawaii and Mexico, where nodules are most densely scattered, and where there's most life, says Scales: "It's the sparser areas that are protected."

Ultimately contractors will have to release some of their profits generated by deep sea mining, and ISA is considering how to disburse this, possibly funding marine research or efforts to combat climate change.



## Iridogorgia Coral

In 2020 ISA was hoping to finalise regulations but has been delayed by the pandemic. There is optimism, however, that member states will reach some consensus this year.

Despite vigorous campaigns and an emotional plea by environmentalist and broadcaster David Attenborough, many believe harvesting the sea floor is a question of when, not if. “There are certainly companies that would have you believe the only alternative is to mine the deep sea floor [rather than mining the land],” said Drazen, “but that’s not really true.”

We need more imagination, says Scales, in our vision of low carbon technologies of the future, and more research into alternative materials for a low carbon future. “I think it’s naïve to say that all the technologies we have currently are those we will use in large numbers in the future,” she says. “Are we just going to replace our fossil fuel dependency with a metal dependency? There’s no easy answer. But there’s an awful lot more to discover in the deep ocean, which is just as important as rain forests in the biodiversity and health of our planet.” ■