02 | FACT SHEET: Impacts Without Borders

Deep sea ecosystems are still under-researched and poorly understood. Science is just starting to discover the links between the deep sea and the marine environments with which we are more familiar. Our oceans are interconnected by currents and by the movement of marine species. Pollution and disturbances that occur in one location have the potential to significantly affect ecosystems, fishing stocks, and maritime communities in another.

As a result, it is not possible to predict the impacts of any individual deep sea mine, let alone the cumulative impacts of the many deep sea mining projects proposed for the Bismarck Sea and throughout the Pacific. The following describes the potential major impacts of deep sea mining.[1]

SEDIMENT PLUMES

Sediment plumes are clouds of sediment particles dispersed in water by currents. Sediment plumes would be generated at several stages during deep sea mining and may spread up to 200 km.

Sediment plumes pose an environmental risk due to their physical as well as chemical properties. Physically, sediment particles settling out of the plumes are likely to smother entire seabed ecological communities. Closer to the ocean surface where light penetrates, turbidity resulting from sediment plumes will reduce photosynthesis, thereby impacting on marine food webs. In deeper zones, where many species are dependent on bioluminescence, increased turbidity may also interfere with functions such as catching prey, defence against predators and communication with others of the same species.

The sediment plumes will mostly likely introduce nutrients from the deep water into surface waters, with the possibility of increased algal growth, including harmful algal blooms that can adversely affect shallow-water ecosystems. Increased algal growth may also reduce oxygen concentrations in deeper water and negatively affect pelagic (open ocean) ecosystems with "knock-on effects" for commercially valuable species.

Additionally, sediment particles could adhere to plankton reducing their ability to float. Entire food chains that depend on plankton as primary producers could be potentially affected. Sediment plumes will also expose marine food chains to heavy metals. A range of metals can be taken up directly from the ingestion of sediments by some species of fish. For other species metals may be taken up from the water column over gill membranes, while in other cases the most common route for metal uptake is via the food chain.

Where concentrations of heavy metals are high, acute toxicity can occur, leading to death. More subtle effects such as cell damage, mutations and reproductive failure are detected at lower levels of pollution. Species such as octopus, squids and cuttlefish readily accumulate heavy metals through their diet of fish, molluscs and crustaceans. Higher up the food chain, species such as tuna, dolphins and humans are vulnerable to heavy metal poisoning through their consumption of these and other contaminated seafoods.

OPERATIONAL & INFRASTRUCTURE-RELATED HAZARDS

Many risks are associated with the proposed operational activities of deep sea mines and the presence of mining equipment and vessels. These include:

- Constant light and noise deep underwater and on the ocean's surface;
- Stationary light from the support vessels could affect the behaviour of seabirds, whales, dolphins and sea turtles;

[1] Extracted from *Out of our Depth: Mining the Ocean Floor in Papua New Guinea, November 2011, Deep Sea Mining Campaign*

- Seismic events or storm surges causing spills, breakages and leakage;[2]
- Potential accidents, equipment malfunction and extreme weather conditions that could result in spillage of ore, fuel or other hazardous substances on the sea floor, in the water column or surface or on land.

SOCIO-ECONOMIC IMPACTS

Marine ecosystems provide fisheries, coastal protection, and cultural benefits to coastal communities worldwide. For example, a study of the social, economic, and cultural values of a small scale fishery in the Hawaiʻi Islands showed it provided food security and maintained social relationships and community wellbeing. Typically, in the Pacific Region, small scale fisheries provide nutrition for families, with surplus sold at local markets contributing to material family needs and the cash economy.[3]

Deep Sea mining threatens these relationships and benefits. Seafood forms a significant component of the diet of coastal and island peoples. Traditional foods are likely to encompass a range of shellfish, fish, seaweeds and sea mammals that could be impacted by high concentrates of heavy metals and other toxicants.

CUMULATIVE IMPACTS

Because of the interconnected nature of ocean environments, the cumulative impacts of deep sea mines is likely to be significant. The geographic footprint of each proposed seabed mining operation is likely to be large. The interactions between currents, weather and seismic events will mean that the spread of pollution and impacts cannot be contained nor readily predicted. The high level of uncertainty and risk associated with individual projects will accumulate and compound in unknown ways with several projects in the same area[4]

IN CONCLUSION: there is a high level of uncertainty about the impacts of deep sea mining and the risks it poses to marine environments and human communities. These uncertainties arise due to the experimental nature of the technologies and production processes, and the lack of scientific knowledge about deep sea ecosystems, currents at various levels in the ocean and the cumulative effects of deep sea mining. The only thing that is certain is that impacts will be associated with each step of the mining process.

SOLWARA 1: A Case Study in how not to manage environmental impacts

Canadian-owned Nautilus Minerals Inc. is the first company worldwide to receive an operating license for the mining of seafloor massive sulphides (also known as polymetallic sulphides) deposited by hydrothermal vents. Nautilus' proposed Solwara 1 sea floor mine site is located in the Bismarck Sea of Papua New Guinea at a depth of 1,600 metres *[See 07 FACT SHEET: Nautilus Minerals & The Solwara 1 Project]*. The site is situated around 25 km from the west coast of New Ireland Province, 40 km from Duke of York Islands and 50 km from Rabaul on the coast of East New Britain.

Environmental impacts will be associated with each step of the Nautilus Minerals Solwara 1 deep sea mining process *[See 08 FACT SHEET: Nautilus Minerals Production Process]*. Independent reviews of the Solwara 1 Environmental Impact Statement (EIS) detail deficiencies in the science and the modelling employed by Nautilus.[5] As a result

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[2] *Nautilus are you nuts! Second large earthquake near proposed Solwara 1 site*, media release, 12 October 2018,

[3] *Accountability Zero: A Critique of Nautilus Minerals Environmental and Social Benchmarking Analysis of the Solwara 1 project*, 2015

[4] *Deep-Sea Mining With No Net Loss of Biodiversity—An Impossible Aim*, March 2018*,*

[5] *Out of Our Depth: Mining the Ocean Floor in Papua New Guinea*, 2011; *Physical Oceanographic Assessment of the Nautilus Environmental Impact Statement for the Solwara 1 Project - An Independent Review*, 2012; and *Independent Review of the Environmental Impact Statement for*

many significant risks are poorly addressed including:

- Pollution from spills of oil or ore slurry from vessels at the surface, leakage from the riser or discharge pipes, and sediment plumes generated during the mining process and through the return of the discharge water;
- Seismic events or storm surges causing spills, breakages and leakage;
- Vertical (upwellings) and horizontal currents transporting sediment plumes and pollutants shorewards and into contact with marine food chains;
- The bioavailability and toxicity to marine species of heavy metals;
- The contamination of marine and human food chains resulting from pollution and associated health impacts for coastal communities;
- Impacts on artisanal and commercial fisheries and on sea-based tourism (e.g. game fishing, diving) and associated economic and social implications including for local food security, cultural practices, and livelihood opportunities;
- Light and noise under water and on the oceans surface generated by the seafloor mining tool and surface support vessels and the physiological effects on marine species and sea birds;
- The destruction of unique ecosystems at hydrothermal vents. This is of particular concern as limited information exists about the capacity of, or timescale, for hydrothermal vent systems to re-establish following widespread vent field destruction, and whether any new vent systems will be as biologically diverse.[6]

Papua New Guinea's environmental approvals process for Solwara 1 has clearly failed to protect the health of the marine environment, the livelihoods and well-being of coastal communities, and fisheries of national and regional economic importance.[7]

The Government of Papua New Guinea has approved an unprecedented mining operation with only the most superficial understanding of the consequences for the people of New Ireland and East New Britain and for fisheries of importance to Papua New Guinea and the Pacific region

The Environmental Management Plan for Solwara 1, the scientific studies supporting the EIS, and the permit approvals process have not been made public despite several requests.[8] **As a result, affected communities have launched legal proceedings in a bid to obtain key documents that would help them to clearly understand the potential environmental, health and economic impacts of the project and reveal whether the Solwara 1 deep sea mining project was in fact lawfully approved.**

the proposed Nautilus Minerals Solwara 1 Seabed Mining Project, Papua New Guinea, 2009,

[6] *Accountability Zero: A Critique of Nautilus Minerals Environmental and Social Benchmarking Analysis of the Solwara 1 project*, 2015

[7] *Out of Our Depth: Mining the Ocean Floor in Papua New Guinea*, 2011, Chapter 7,

[8] Letter to Prime Minister of Papua New Guinea; and letter to Department of Environment and Conservation in Papua New Guinea, 2012