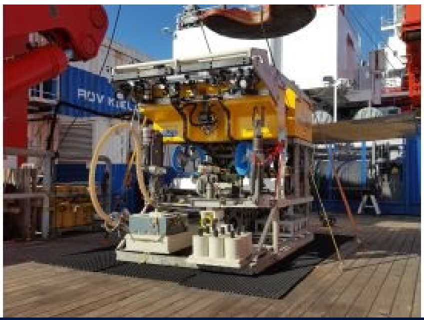
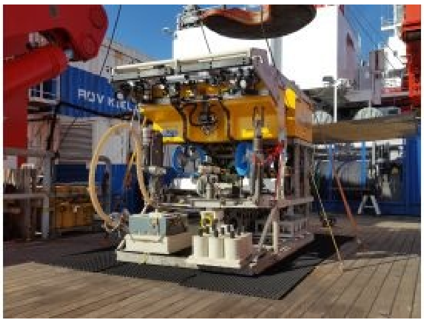
Assessing the Impacts of Nodule Mining on the Deep-sea Environment





Scientists of the JPI Oceans project 'MiningImpact' are embarking on a six-week expedition to the Clarion-Clipperton Fracture Zone in the Pacific. Their goal is to carry out independent scientific monitoring of the test of a pre-prototype nodule collector that will be conducted in parallel from a second vessel by the Belgian company Global Sea Mineral Resources.

MiningImpact fully adheres to good scientific practice and all data will be made publicly available. The findings of this integrated impact analysis will be translated into recommendations for improved environmental standards and guidelines of the Mining Code currently being drafted by the International Seabed Authority (ISA).

The study sites of MiningImpact in the Clarion-Clipperton Fracture Zone (CCZ) are located in water depths of more than 4,000 metres and more than 1,500 kilometres off the Mexican coast. The CCZ is an area of five million square kilometres, where manganese nodules are highly abundant on the seafloor. Concentrated in these nodules are metals of economic interest for high-tech products used for the energy transformation, mobility and telecommunication, such as copper, cobalt and nickel.

Legal Framework for Future Deep-sea Mining Activities

This seabed area between Mexico and Hawaii lies outside the Exclusive Economic Zone of any country and is part of the common heritage of mankind. This common area is managed by the ISA, based in Kingston, Jamaica, under the United Nations Convention on the Law of the Sea (UNCLOS), which has been joined by 167 countries and the European Union. The ISA is currently working on the exploitation regulations of the Mining Code, which will form the legal framework for future deep-sea mining activities, and is being developed through an iterative process with several stakeholder consultations. These international regulations should include stringent environmental standards, such as for establishing the environmental baseline, the monitoring of mining operations, and threshold values for impacts and indicators of ecosystem health. To shape these regulations, scientific knowledge on the ecological impacts of deep-sea mining is urgently required. The JPI Oceans collaborative project MiningImpact is dedicated to contributing to the assessment of these impacts and to proposing solutions to prevent serious harm to the abyssal ecosystem.

The remotely operated vehicle ROV Kiel 6000 of GEOMAR, workhorse of the MiningImpact2 expedition. It was used among others for deploying and recovering NIOZ sensor platforms and artificial nodule frames. (Photo: Henko de Stigter)

The German Federal Institute for Geosciences and Natural Resources (BGR) has chartered the multi-purpose vessel *Island Pride* and invited MiningImpact partners to conduct their independent monitoring of a pre-prototype nodule collector test from this vessel. The Belgian company GSR has agreed to its activities being independently investigated and has worked closely with the scientists to give them access to all trial activities. These trials will take place in the Belgian and German contract areas of the CCZ. "This offers a unique opportunity for us to collect, for the first time, quantitative scientific evidence on the environmental consequences of nodule extraction in a more realistic scenario than was previously possible," explains project coordinator Dr Matthias Haeckel from GEOMAR Helmholtz Centre for Ocean Research Kiel. Investigations will not only address the direct impacts of the collector vehicle as it harvests manganese nodules, but also those induced by the suspended sediment plume that is created by this process and affects a much larger area. The data will provide information on ecosystem effects of potential future mining that cannot be drawn from the small-scale benthic impact experiments conducted in the past.

Main Goals of the Expedition

At the same time, a fully integrated monitoring approach will be tested that will inform future needs for the surveillance of human activities in the deep sea to ensure compliance with environmental standards and targets. “Employing state-of-the-art scientific equipment will allow us to determine the spread of the suspended sediment plume created by the vehicle harvesting the nodules as well as the blanketing of the adjacent seabed by resettling fallout from this plume. We will finally be able to put numbers to this type of impact,” says Dr Henko de Stigter from the Royal Netherlands Institute for Sea Research (NIOZ), who is leading the plume sensor group on board.

As well as the manganese nodules, the collector machine is expected to remove the top 10-15 centimetres of the seafloor and the fauna living on and within it. “In addition to surveying the loss of biodiversity across different faunal classes, our work includes studies on biogeochemical fluxes, microbial turnover rates and ecosystem functioning, in situ ecotoxicology, release of trace metals from the suspended sediment plume, emissions of noise and light by the collector vehicle and much more,” says Dr Haeckel to summarize the main goals of the expedition. Among the specialized instruments that will be deployed are two remotely-operated vehicles (ROV), an autonomous underwater vehicle (AUV), in situ oxygen profilers and experiment chambers, in situ pumps and 50 inter-calibrated hydro-acoustic and optical sensors for measuring the suspended sediment concentrations and particle sizes.

Manganese nodule with a deep-sea sponge. Expedition SO242. (Photo: ROV KIEL 6000, GEOMAR)

Longer-term Effects of Deep-sea Mining

From 2015, the JPI Oceans MiningImpact project has investigated the ecological consequences of deep-sea mining and how the impacts may be mitigated. It has included an assessment of decade-old tracks of previous studies as well as small experiments to understand the interaction between nodule removal and the responses of deep-sea life. The first phase, which is already completed, provided substantial first insights into the expected longer-term effects of deep-sea mining. Now, in the second phase, the scientists plan to conduct a comprehensive monitoring of the immediate environmental impacts of the first test of an industrial pre-prototype collector in real time. The first attempt to test the collector by GSR in spring 2019 did not take place due to a technical failure of the power and communication cable to this instrument.

“The research of the MiningImpact consortium is extremely important and essential to ensure that the marine environment in the deep sea will be protected according to highest possible standards,” says Professor Katja Matthes, director of GEOMAR. “The results of this project will provide the scientific evidence that is urgently needed by the ISA as input for improved environmental standards and guidelines of the Mining Code,” Matthes continues.

After 12 days of self-isolation in a hotel in San Diego and repeated Covid-19 PCR tests, the scientists are ready to embark on the expedition that will be carried out under strict hygiene conditions.

Background: MiningImpact - Environmental impacts and risks of deep-sea mining

The second project phase of MiningImpact (2018-22) builds on the first phase and addresses three major research foci concerning deep-sea mining: (1) the larger-scale environmental impact caused by the suspended sediment plume, (2) the regional connectivity of species and the biodiversity of biological assemblages and their resilience to impacts, and (3) the integrated effects on ecosystem functions, such as the benthic food web and biogeochemical processes.

The MiningImpact project is conducted independently of DEME-GSR’s activities and does not receive any financial contributions from DEME-GSR. Conversely, DEME-GSR does not receive any funding from the MiningImpact project. DEME-GSR is also conducting its own monitoring programme aboard its vessel.
