How the environmental impacts of deep-sea mining are assessed

A briefing document, providing policymakers with key information on environmental impact assessments of deep-sea mining, has been published. The authors describe the Environmental Impact Assessment (EIA) process in detail to aid management and policy decisions regarding these sensitive habitats.

Hydrothermal vent chimneys are formed when heated pressurised seawater is ejected from fissures on the seafloor. As the hot vent fluids, which can reach temperatures of 450°C, meet the surrounding seawater and cool, they precipitate out dissolved metal sulphides, forming hydrothermal vent chimneys in tectonically active regions. Seafloor Massive Sulphides (SMS) are aggregations of collapsed hydrothermal vent chimneys. These SMS mounds may contain high-grade ores such as copper, zinc and gold. Recent technological and economic factors have converged to make the possibility of mining SMS deposits a reality, although no commercial extraction has taken place to date. Deep-sea SMS exploitation is a commercially attractive prospect, leading to a potential deep-sea gold-rush. Currently, management and conservation efforts are being developed in advance of industrial exploitation and can therefore provide an advance, rather than reactionary, assessment of the environmental impacts of deep-sea mining.

Proposed methods of exploitation include the use of large deep-sea remote operated vehicles to macerate the SMS deposits into slurries which are then pumped to a surface vessel for further processing. Hydrothermal vents typically have biologically significant ecosystems with high conservation value including endemic species and specialised communities. These communities are ‘chemosynthetic’; they derive their energy from chemicals such as hydrogen sulphide or methane dissolved in vent fluid. Similar to plants which form the base of photosynthetic communities, bacteria that are able to use methane and sulphides as a source of energy, form the basis for deep-sea vent communities. This means that the ecosystem is dependent on the vent, and cannot exist elsewhere.

The International Seabed Authority(1) regulates deep-sea mining activity in international waters, and has developed guidelines for an EIA process which will be used to assess applications for exploitation rights of SMS deposits and other deep-sea mineral resources, such as manganese nodules and cobalt crusts. These guidelines are informed by and inform working groups of scientists, industry and stakeholders, such as VentBase, who develop best practice approaches for EIA at deep-sea mine sites through consensus. The EIA process is part of a precautionary approach to management and may consist of three basic stages:

1. A scoping study to assess the area to be mined, an evaluation of possible environmental impacts from mining, and proposals to address these impacts.

2. An environmental survey composed of a number of separate assessments, including: an identification of habitats; an assessment of currents in the mining area and surveys of the seabed and the physical, chemical and biological properties of the water column. The baseline ecological survey includes attractive large animals, such as whales, that capture public attention as well as commercial fish stocks that might be affected by noise or the disturbance. Of concern are the endemic organisms to the vents that live on or in the seabed sediment adjacent to vents, which may be destroyed by the mining process.

3. An ecological risk assessment, based on the scoping study and environmental survey and is used to evaluate risk and develop effective mitigation strategies, such as set-asides areas. It was proposed at a recent VentBase workshop that the single most significant component of a mitigation programme is the establishment of appropriate ‘set-asides’. Set-asides should have similar physical, chemical and biological characteristics as the extraction site and should act as a source of recruits for recolonisation of the mining area.

Together with an environmental management plan, which describes monitoring plans for the mining areas before and after mining operations, and other aspects, such as the legal and policy framework, the EIA forms the basis for the Environmental Impact Statement, which provides an overview of the whole mining project.

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