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Ifremer's implication in deep-sea minerals and associated ecosystems exploration as a research institute and as a contractor with the International Seabed Authority

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Ifremer is the French research institute entirely dedicated to the ocean. As part of its mission of public policy support, Ifremer, sponsored by France, holds two contracts for the exploration of deep-sea minerals in the Area with the International Seabed Authority (ISA), one for polymetallic nodules in the Pacific Ocean, the other for polymetallic sulphides along the Mid-Atlantic Ridge.

As per the ISA regulations for the exploration of deep-sea minerals, an exploration contract involves: assessing the mineral resources; defining the environmental baseline; assessing and monitoring the impact of exploration activities that could impact the environment; developing mining and processing technologies; and providing training opportunities to the personnel of the ISA and developing States.

Deep-sea environments, where mineral resources are found, are home to a wealth of life that is still largely unknown, as is their role in the major global cycles. Starting their exploitation at this stage could have irreversible impacts on these ecosystems and on the overall functioning of the oceans. Although this places Ifremer, as a research institute and contractor in a peculiar position, it justifies a focus on further studying the functioning of the ecosystems associated to marine minerals resources and their role in the global functioning of the ocean, prerequisites to inform future decisions and the set-up of adequate regulations.

In this context and in line with Ifremer's scientific strategy, the objectives of Ifremer's programmes of activities, funded by the French government under the France 2030 "deep-sea" programme, are:

Nodules:

- Improve the confidence in the resource assessment by performing additional sampling and acquiring acoustic and optical high resolution data;
- Progress our knowledge of biological communities: quantify and model the impact of test-mining activities; characterize habitats and benthic fauna; improve the tools of integrative taxonomy; define an environmental impact assessment and monitoring strategy.

Sulphides:

- Conduct a first unclassified resource assessment of the TAG hydrothermal vent field, identify new sites and conduct local exploration;
- Increase knowledge on biological diversity, ecosystem dynamics and functioning and habitat characterization of active and inactive vent sites, life cycles, colonization processes and

connectivity of species; improve knowledge on microbial communities and fauna of inactive vent sites; study of adaptation and acclimation capacities of communities to assess their resilience.

Beyond this research conducted as a contractor, Ifremer is also contributing to: the development of methodologies to facilitate the assessment of the deep-sea biodiversity, the taxonomic identification of deep-sea species and the monitoring of hydrothermal fields; capacity development via initiatives such as Meioscool; the independent assessment of the environmental impact of the test of the "Patania II" prototype, conducted by Global Sea Mineral Resources, as a partner to the Joint Programming Initiatives Oceans projects "Mining Impact" I and II led by Geomar; and to the work of the ISA by participating to ISA led workshops and by providing scientific expertise to the French Ministries for their contribution to the development of the ISA regulations and recommendations.

The presentation will highlight some key scientific results and contributions as an ISA contractor as described above.