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Protecting the Common Heritage of Mankind: Exploitation of the Deep Seabed

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Abstract: Plans for global exploration and exploitation of the deep seabed's vast mineral resources are well underway. The International Seabed Authority (ISA) has been given the challenging task of managing both the exploitation and the protection of the seabed ecosystems. In July 2015, the ISA will develop a regulatory framework to transition from exploration to exploitation. The ISA is expected to adopt a precautionary and strategic vision for seabed mining including networks of no-mining areas and regional environmental management plans. Networks of no-mining areas would protect regional biodiversity, ecosystem structure and function amidst the habitat destruction and sediment plumes caused by seabed mining. The no-mining areas adopted for the Clarion Clipperton Zone (CCZ) left out some critical sites due to conflicts with preexisting exploration contracts. Ideally no-mining areas should be designated during the early exploration phase and certainly before exploitation is authorized. Right now the ISA can balance the sustainable development of mining interests with protection of the seabed ecosystem. As the "common heritage of mankind", this frontier story could become either the tragedy of the commons or a victory for sustainable resource use – the choice will likely occur this summer.

One Sentence Summary: As the International Seabed Authority develops regulations to govern the exploitation of deep seabed mineral resources beyond national jurisdiction, it has a unique opportunity to adopt a strategic vision that incorporates a robust system of no-mining areas and other precautionary measures to ensure the long-term protection of the "common heritage of mankind" in the mining footprint of the deep seabed frontier.

Many of us have a connection with the coastline, but do not feel similarly attached to the bottom of the ocean. For example, over 30 years ago the New Yorker ran a cartoon about the deep seabed that contained an image of a group of high-society women enjoying their afternoon tea. The caption read: *I don't know why I don't care about the bottom of the ocean, but I don't*. A current version of that cartoon would include a key element: a smartphone. Once the realm of science fiction, mining the deep seabed is now a frontier in the technology sector because the seabed also houses the necessary metals and rare earth minerals that make our smartphones, electric cars, wind turbines and other devices possible. These frontier resources –and the ecosystems that surround them –have the potential to become either a victim of the tragedy of the commons or a victory for sustainable resource use in July 2015 when the International Seabed Authority (ISA) meets to consider a regulatory framework to govern the exploitation of deep seabed minerals under the principle "common heritage of mankind" (1, SOM text).

Deep sea benthic ecosystems are globally significant including a diverse mosaic of habitats including soft sediment abyssal plains, hydrothermal vents, seamounts, continental slopes and submarine canyons that can harbor unique and substantial biodiversity, endemic fauna, support rich fisheries resources, and provide numerous other ecosystem services (2). In addition to this biological richness, deep-sea ecosystems harbor rich mineral resources (3,4), and after years of quiet exploration by largely government-owned enterprises, commercial interests are increasing in mining polymetallic nodules, massive sulphides, and cobalt-rich crusts in extensive portions of the deep seabed within and beyond the limits of national jurisdiction. Nevertheless, many deep sea communities have extremely low ecosystem resistance to, and very slow recovery rates from, physical disturbance such as mining (5,6). The impacts associated with nodule mining may directly affect 100s to 1,000s of $km^2\ yr^{-1}$ per mining operation in areas of the abyssal Pacific (i.e., Clarion-Clipperton Fracture Zone (CCZ)), and at least 1-10 $km^2\ yr^{-1}$ along mid-ocean ridges. Further, the cumulative impacts from other human activities beyond mining in the deep sea are a concern, such as oil and gas development, industrial fishing pressure, release greenhouse gases and waste disposal (7,8,9).

Networks of marine protected areas, based on robust scientific principles, are one of the most powerful tools available to guard against loss of regional biodiversity in marine ecosystems due to exploitation of marine resources (10). Marine protected areas represent the precautionary approach because they preserve portions of the habitat in situations where exploitation may cause serious or irreversible damage (11). As a resource frontier, the deep seabed demands a precautionary approach through the use of marine protected area networks. The ISA pioneered a precautionary approach to spatial management in the Clarion-Clipperton Fracture Zone (CCZ), a region of the abyssal Pacific, when it adopted the deep seabed's first environmental management plan (12,13). The environmental management plan was science-driven, using robust, place-based design principles (SOM text) to create a mosaic of no-mining areas encompassing diverse habitat types (e.g., seamounts, abyssal plains, fracture zones) and adjacent to areas assigned for exploration (12,13). The ISA has the power and the opportunity, at the upcoming July 2015 meeting, to utilize lessons learned during the

pioneering CCZ process when it develops the regulatory framework for mineral exploitation in deep seabed areas beyond national jurisdiction.

Beyond the abyssal plains of the Clarion-Clipperton Fracture Zone, the lessons learned are transferable across a mosaic of deep seascape types (e.g., abyssal plains, hydrothermal vents, seamounts, abyssal plains, etc.) and varied geopolitical landscapes. First, networks of no-mining areas can be effective if their spatial location and extent are not compromised by jurisdictional boundaries or contractual mining exploration claims. In the Clarion-Clipperton Zone, existing mining exploration contracts required repeated modifications to the science-based recommendations for protected areas (14). Not bound by science, rights to an area stemming from a pre-existing contract for exploration can erode the effectiveness of protected area networks. By limiting the issuing of contracts for exploration in new areas until environmental management plans are in place, the ISA can mitigate interference with the scientific guiding principles essential to effective protective area network design.

Second, while the scientific guiding principles applied in the CCZ are unique to this abyssal plain region, the process of using the scientific guiding principles as a starting point to foster the iterative engagement between the ISA and scientific subject experts will enable success in other regions of the deep seabed (e.g., Mid-Atlantic Ridges, Indian Ocean, Western Pacific). We propose the ISA, in developing the regulatory framework for exploitation, apply a tightly integrated science-policy process for the environmental management plan workshops (SOM text). The science-policy process entails applying the scientific guiding principles from the CCZ in an iterative dialogue between the ISA, stakeholders and scientific experts to achieve tailored and effective management plans.

The ISA has a mandate to foster mining of deep sea resources under the common heritage of mankind, but it also has the responsibility to provide appropriate and timely protection to deep sea ecosystems within the footprint of the exploited habitat. A carefully designed policy framework can achieve balance by reducing uncertainty about future mining activities and protecting existing mining claims and economic investments, all while safeguarding deep sea biodiversity and ecosystem function at relevant geographic scales. While this endeavor will be challenging, the time is now for all of us to “care about the bottom of the ocean” and to assure appropriate environmental protection in the context of sustainable development of the deep sea.

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Figure 1. Spatial extent of the Clarion-Clipperton Fracture Zone and mining claims in the Abyssal Pacific spanning approximately 6,000,000 km^2, i.e., an area close in size the continental United States (approximately 7,664,000 km^2).

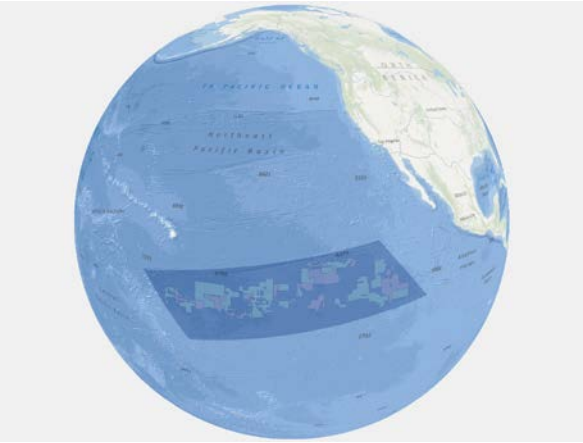
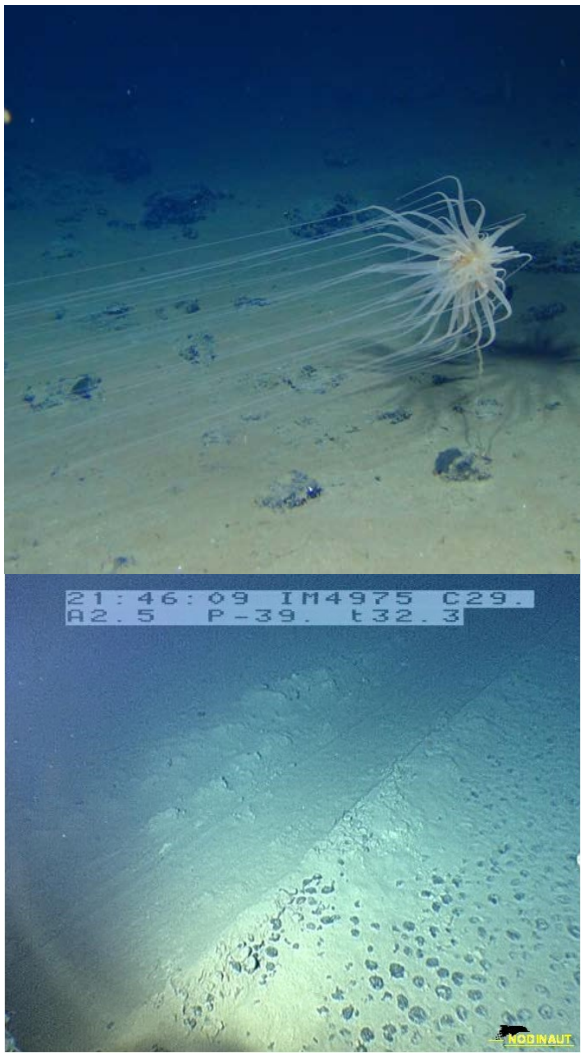


Figure 2a. Boloceroides sp. - anemone belonging to a newly discovered order at 4,100 meters in the Clarion-Clipperton Fracture Zone (CCZ) and manganese nodules (2b) Image of disturbed seabed 16 years after test mining for manganese nodules occurred in the CCZ.



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