Response to Questions from Rep. Huffman for Dr. Thaler, Blackbeard Biologic

1. What magnitude of environmental impact can exploratory deep sea mining activities have on the ocean ecosystem?

Exploratory deep-sea mining, meaning identifying and assessing potential ore deposits, conducting environmental impact studies, and testing prototype mining equipment will have wildly differing impacts depending on the kinds of exploration undertaken. Large scale video transects of a region to assess nodule density would have minimal impacts to the marine environment. Environmental impact studies designed to quantify the extent of environmental harms and establish appropriate biodiversity baselines and environmental thresholds are generally small in scale with impacts tied directly to the immediate benthic environment. For polymetallic nodule fields, those impacts are minimal but for seafloor massive sulphide deposits, which are much smaller in in area with biodiversity concentrated around the ore body, the impacts can be substantial. Large-scale studies meant to explore the long-term impacts of deep-sea mining may be conducted over large areas of the seafloor, with impacts comparable to those of commercial mining. Geologic surveys which employ seafloor penetrating SONAR to visualize an ore body introduce acute high-frequency sound which can cause harm to nearby marine mammals and other soniferous species. Finally, testing of protype and commercial mining equipment prior to the onset of commercial mining would be expected to have environmental impacts on parity with commercial production, but over a relatively smaller area of the seafloor.

Ultimately, though, deep-sea mining exploration, rather than exploitation, occurs over a narrow temporal window, and the most significant difference is in the lack of chronic disturbance which occurs over the 30-year life of a deep-sea mining project.

2. The Metals Company cites Stewart, E.C.D., Wiklund, H., Neal, L. et al. Impacts of an industrial deep-sea mining trial on macrofaunal biodiversity. Nat Ecol Evol (2025) and O'Malley, B.J., Schwing, P.T., Chernoch, S.K. et al. Thorium-234 as a tracer for deep-sea mining sediment plume deposition. Nat Commun 16, 10633 (2025) to claim that "benthic biodiversity and sediment plume impacts are confined to the directly mined area". Are these the only potential environmental concerns related to the proposed deep sea mining? Would you characterize these studies as a "robust, scientifically grounded basis to commence and responsibly scale commercial operations"?

These are good, well-constructed studies, but they are limited to investigating specific impacts and do not, on their own, provide a holistic, comprehensive assessment of the potential impacts of commercial deep-sea mining.

“Impacts of an industrial deep-sea mining trial on macrofaunal biodiversity” provides an initial assessment of biodiversity loss 2 months after small-scale test mining was conducted. While this study shows a significant loss of biodiversity, with a decline in macrofaunal density of 37% and a reduction of species richness of 32%, with no evidence of change in areas affected by the benthic plume, they account for only a subset of the organisms present in nodule fields over a relatively short time frame. Long-term studies of mining impact show that after almost 3 decades, recovery of the immediate mining area is minimal (Jones et al., 2025, 2017; Simon-Lledó et al., 2019). Long-term studies are essential for assessing the full scope of deep-sea mining impacts to the seafloor, especially considering the chronic disturbance that will be caused by the continuous operation of mining tools over the life of the mining lease, as opposed to the acute impacts of single, discrete impact studies which occur over relatively short time-frames over a smaller overall operational footprint.

“Thorium-234 as a tracer for deep-sea mining sediment plume deposition” provides a compelling case for Thorium-234 isotopes as a useful trace indicator to monitor the spread of benthic plumes. The study makes no conclusion regarding the environmental impacts of such plumes, but does demonstrate that detectable sedimentation from the mining plume can spread up to 2 km from the mining track in this test case, which contradicts the claim that “sediment plume impacts are confined to the directly mined areas”.

Both studies are based on a tracked-crawler vehicle for nodule collection. These results would not be directly transferable to other nodule collection technologies, such as those proposed by Impossible Metals.

Direct seafloor impacts from the mining tool, which include disturbance of the substrate directly in the mining path as well as the production and spread of benthic plumes are not the only impacts related to proposed deep-sea mining. Nodules, themselves act as habitat, and the removal of nodules necessarily results in habitat loss (Amon et al., 2016; De Smet et al., 2021). The role of nodule density and habitat connectivity to the overall biodiversity and abundance of species endemic to nodule fields is poorly characterized. Removal of nodules may also reshape the microbial communities which underpin healthy nodule fields (Wear et al., 2021).

The benthic plume created by the collection vehicle removing nodules from the seafloor is not the only plume of concern, and may not be the most impactful plume. The midwater plume, produced when nodules are dewatered aboard a surface vessel can disrupt marine food webs (Dowd et al., 2025). In response to the Dowd et al. study, The Metals Company revised their discharge plan to release the dewatering plume at greater depths. No environmental studies investigating the effects of this deeper dewatering plume have been published. In an unrelated study, deep-sea corals exposed to suspended particles from polymetallic sulphides, as could be expected from a deeper discharge plume, resulted in tissue loss, necrosis, and the bioaccumulation of copper in coral specimens (Carreiro-Silva et al., 2022).

There is also the potential for unplanned surface plumes, which can have significant effects on surface species directly around the mining vessel (Helm, 2021). While no deep-sea mining company is currently proposing a surface discharge, in their first test of an integrated prototype mining system, The Metals Company experienced a significant accidental discharge of nodule-enriched fluids at the surface, which was large enough to be tracked from space.

Noise from deep-sea mining operations can span vast areas, with acute impacts focused in the area immediately around the mining site, the riser and lift system, and the surface vessel (Williams et al., 2022). The cumulative impacts of chronic noise exposure from mining systems will likely be far greater than the short-term impacts of acute sound exposure on marine mammals (Williams et al., 2025).

3. Is there anything else you would like to respond to or expand on from the hearing?

One unique environmental consideration related to deep-sea mining is the potential resource conflict between the mineral value of the ore and the scientific value of deep-sea discovery. For the last 50 years, every major discovery in the deep sea has happened aboard an American ship or with the major contribution of US researchers. These are real, economically tangible discoveries. Discovering hydrothermal vents, the phenomenon of chemosynthesis, and the isolation of heat-resistant proteins, fundamentally changed how we think about biology and revolutionized the medical industry. From hydrothermal vents to methane seeps to cold water corals to whalefalls, we discover new, novel, and often completely unexpected ecosystems which overturn our understanding of ecologic processes in the deep sea at a rate of roughly once per decade. Last year, a Chinese research team discovered the deepest know complex ecosystem at 10,000 meters (Peng et al., 2025). Within 2 to 3 years of the commencement of well-monitored commercial deep-sea mining, we will likely double the total observation time spent on the deep seafloor. This nearly guarantees that over the lifetime of a polymetallic nodule mine, we will discover new and novel ecosystems within the mining area for which the economic value of marine genetic resources may exceed the commercial value of the ore.

The discovery of new and novel ecosystems would essential reset an environmental impact statement and require significant scientific study of the area, effectively triggering an environmental all-stop of operations until the impacts of mining on a new and novel ecosystem could be assessed. Currently, there are no policies or regulations that could compel an all-stop in the case of significant new ecologic discoveries in the deep sea.

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