Environmental Studies Program: Studies Development Plan | FY 2024–2025

Field	Study Information
Title	In Situ Sampling at a Historic Equipment Test Site on the Blake Plateau
Administered by	Marine Minerals Program
BOEM Contact(s)	Michael Rasser (michael.rasser@boem.gov), Mark Mueller (mark.mueller@boem.gov), Paul Knorr (paul.knorr@boem.gov)
Procurement Type(s)	TBD
Performance Period	FY 2024–2028
Final Report Due	TBD
Date Revised	May 18, 2023
Problem	Critical minerals are important to the economic and national security of the United States, yet little is known about the environmental impacts of mining seabed minerals in the deep sea because baseline studies and post-mining activity environmental assessments are limited or unavailable.
Intervention	This analysis will continue ongoing interagency efforts to study, plan, and manage for potential environmental impacts of critical mineral by studying an area that was historically impacted by large-scale testing of mining equipment.
Comparison	A natural experiment approach will be utilized, with in-situ sampling conducted in both impacted and control areas. This will allow a comparison of physical and biological characteristics that may be the result disturbance.
Outcome	An improved understanding of the potential long-term environmental impacts of deep-sea mining-related disturbance can inform future assessment analyses policy and management decision making.
Context	Sampling will occur at control and impact sites within a 20 x 15 km area of the U.S. Atlantic OCS that experienced seabed disturbance 50 years ago. This provides a unique opportunity to assess long-term recovery of a seabed mining operation that will be broadly applicable to all BOEM planning areas.

BOEM Information Need(s): BOEM needs to better understand the environmental impacts of seabed mineral mining on the OCS. Information from this study will be used to support future BOEM activities, particularly those related to the development of critical marine minerals. The study will also inform NEPA-mandated environmental assessments for BOEM's Marine Minerals Program by increasing our understanding of long-term benthic recovery processes and about critical mineral-rich seafloor habitats

Background: On June 4th, 2019 the Department of Commerce released EO 13817,"A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." The strategy directs the DOI to identify new domestic supplies of these minerals, ensure access to information necessary for the study and production of minerals, and expedite permitting for minerals projects, all "in a safe and environmentally responsible manner." The OCSLA assigns DOI/BOEM responsibility for developing OCS non-energy minerals, including critical minerals, while ensuring environmental protection. Significant deposits of

several critical minerals are found within the U.S. EEZ (Hein et al. 2016) but are not currently included in mineral resource assessments (Schultz et al. 2017; Fortier et al. 2018).

Marine areas with mineral-rich hard substrates support benthic communities that may differ in their response and recovery from disturbances such as extractive activities. These areas can support diverse communities including some rare species, yet basic ecological information such as faunal composition, population sizes, distribution, and connectivity is lacking. A sufficient understanding of the ecological impacts of mineral extraction is constrained by inadequate observational and baseline data. While a few studies have monitored changes during seafloor mining demonstration activities, they were limited by a lack of knowledge regarding the local and regional seafloor environment prior to commencement of extractive activities (Jones et al. 2018).

This study will continue interagency analysis of an historic deep-sea mining test site on the Blake Plateau (BP) in the U.S. Atlantic Ocean. Geological and mineral assessments on the BP began in the 1960s, leading to manganese nodule prospecting and extraction equipment-testing activities by Deepsea Ventures, Inc. (DV) in 1970. In addition, there were dedicated geologic and resource assessments in the early 1980s by the USGS and partners. There is semi-quantitative information of nodule/pavement abundance, geochemical data, and other associated records obtained from DV and other published sources. DV published documentation about the systems they developed and utilized. The USGS also has seismic reflection data, deep tow camera images, samples, (hundreds of pounds of nodules and sediments), and other associated records. This historical context provides a unique time series of seafloor disturbances, enabling assessment of disturbance recovery across a range of substrates and habitat types.

BOEM, USGS, and NOAA have been collaborating and planning for this joint study since 2018. On June 29, 2019 NOAA Ship *Okeanos Explorer* performed a systematic multibeam survey surrounding the "Deepsea Ventures Site." This initial mapping effort enabled a return visit by the *Okeanos Explorer* in 2019 to conduct an 8-hour exploratory Remotely Operated Vehicle (ROV) dive guided by USGS and BOEM input.[1] The dive documented evidence of past activities including a "patio block" marker installed by the USGS and apparent seafloor disturbances from equipment consistent with the types of seafloor mining equipment thought to have been used in the 1960's. This information was documented during a USGS-archival research visit to The Mariners' Museum in Newport News, VA, where copies were made of historical documents detailing the site's coordinates and historic activities. USGS has recovered important data from internal USGS records (e.g., tow camera imagery of the seafloor) about their 1980's fieldwork at the site and is reviewing this data.

The first phase of this study (MM-21-03: Investigation of an Historic Seabed Mining Site on the Blake Plateau) is expected to finish in 2023. In 2022, USGS, BOEM, and NOAA scientists contracted Ocean Infinity America to conduct a high-resolution mapping survey of the seafloor within the 50 km^2 study area using a Hugin 6000 AUV. The survey identified widespread sea floor disturbance throughout the study area and many of the patio markers deployed by the USGS. These results are being used to develop a precise, cost-effective sampling plan for collecting in-situ samples using an ROV. The purpose of the second phase of work proposed here is to conduct a second research cruise to implement the ROV-based sampling plan.

[1] https://oceanexplorer.noaa.gov/okeanos/explorations/ex1907/logs/nov7/nov7.html

Objectives: Provide needed information for future NEPA assessments by evaluating the potential environmental impacts from seafloor manganese nodule extraction, including to any endemic fauna, to better inform understanding of disturbance recovery, leveraging unusual access to a historically impacted site.

Methods: In-situ collection of geological and biological data at locations in both the disturbed areas and control areas. Samples will be analyzed to characterize and statistically compare control and impacted sites. It is expected that one 10-day cruise with a remote underwater vehicle (ROV) will be required to complete this work. More specific methods and analyses planned are as follows:

Geological Components

Seafloor collections: Samples of rocks, including crusts, nodules, pavements, and other lithologies hosting critical minerals, will be collected to characterize the composition and concentration of minerals within the targeted areas and determine where information on geochemical distribution of mineral phases is absent from past sampling. Recovered samples will be analyzed for mineral composition and major/minor/trace element concentrations. The isotope content of the nodules and crusts can also be analyzed to elucidate the paleoenvironmental conditions that influenced their formation.

Sediment samples will be collected for analysis of depositional history in and around experimental areas, identification sediment provenance and transport, and determination of mineral content. Where bottom currents are high, excessive erosion of the exposed rock leads to the surrounding sediments possibly being enriched.

Seafloor Morphology: High-resolution imagery and mapping over target environments will be used to quantify levels of disturbance from anthropogenic and natural sources and to provide information on the physical environment of undisturbed areas. Opportunities to utilize repeat surveys of target locations will allow changes to be tracked over short time scales.

Biological Components

Environmental Characterization: Water mass characterization (e.g., depth, temperature, dissolved oxygen, nutrients, particulate organic matter) will be conducted around targeted areas.

Community and Species Analysis: Dominant megafaunal invertebrates (e.g., crustaceans, echinoderms, sponges) and fish will be quantified and identified to the lowest possible taxon from video and digital still imagery, with targeted collections of individuals for voucher specimens. Habitat associations will be examined by comparing the faunal densities, community composition, and diversity among substrate types (nodules, pavement, crust, sediments). Species composition will be examined to identify any indicator species that may be representative of these habitats and useful for monitoring.

Population Ecology and Connectivity: Population genetics may be used to address connectivity among these systems and the adjacent seafloor. eDNA and animal telemetry networks provide a possible avenue to determine pelagic megafauna association with benthic habitat.

Specific Research Question(s):

1. What sensitive habitats and species are associated with critical mineral deposits and formations?
2. Are there biological or geological differences between previously disturbed areas and control sites?
3. What are the potential habitat and related environmental impacts of deep-sea seabed mining?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

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Hein JR, Koschinsky A, Mikesell M, Mizell K, Glenn CR, Wood R. 2016. Marine Phosphorites as Potential Resources for Heavy Rare Earth Elements and Yttrium. Minerals, 6, 88. https://doi.org/10.3390/min6030088

Jones DOB, Amon DJ, Chapman ASA. 2018. Mining Deep-Ocean Mineral Deposits: What are the Ecological Risks? Elements 14:225-330

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