Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Investigation of an Historic Seabed Mining Site on the Blake Plateau (MM-21-03)
Administered by	Office of Environmental Programs
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Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	United States Geological Survey (USGS)
Total BOEM Cost	$400,000
Performance Period	FY 2021–2025
Final Report Due	September 2025
Date Revised	April 1, 2024
Problem	Very little is known about the environmental impacts of mining seabed minerals in the deep sea. Critical minerals are important to the economic and national security of the United States, yet there is inadequate information about their associations with sensitive habitats and species (e.g., corals, sponges, and infauna), and the environmental impacts of mining.
Intervention	This analysis will advance BOEM, USGS, and NOAA efforts to study, plan, and manage for potential environmental impacts of critical mineral mining activities on the OCS, as directed by Administration directives.
Comparison	Compare areas that contain critical minerals to other seafloor environments (e.g., what habitat/ecosystem role do critical mineral deposits serve?). Additional comparisons include evaluating natural change processes (e.g., sediment dynamics) and examining areas of historic substrate disturbance/removal. This study will also set the stage for conducting in-situ field experiments to compare control versus treatment areas.
Outcome	An analysis of the long-term environmental impacts of deep-sea mining will be completed and provide a new framework for related future efforts.
Context	The initial spatial focus and fieldwork will occur in the U.S. Atlantic OCS in a defined 20 x 15 km area that experienced seabed mining disturbance 50 years ago, providing a unique opportunity to assess long-term recovery of a seabed mining operation. However, the environmental analysis approaches developed in this study 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. This is responsive to Executive Order 13817, Executive Order 13840, and the recent Presidential "Memorandum on Ocean Mapping of the United States EEZ." The study will also inform NEPA-mandated environmental assessments for

BOEM's National OCS Oil and Gas Leasing program and Marine Minerals Program by increasing our understanding of critical mineral-rich seafloor habitats and their associated fauna.

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 mineral-rich hard substrates (i.e., crusts, nodules) 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 is currently lacking, including faunal composition, population sizes, distribution, and connectivity. 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, International Seabed Authority https://www.isa.org.jm/scientific-activities).

This study is a focused analysis of an historic deep-sea mining test site at approximately 800 m depth on the Blake Plateau (BP) in the U.S. Atlantic Ocean. Geological and mineral assessments on the BP began in the 1960's, leading to commercial manganese nodule extraction test activities by Deepsea Ventures, Inc. and dedicated geologic and resource assessments in the early 1980's by the USGS and partners. From Deepsea Ventures, there is semi-quantitative information of nodule/pavement abundance, geochemical data, and some other associated records obtained from published sources. Deepsea Ventures published documentation about the systems they developed and utilized. The USGS also has seismic reflection data, deep tow camera images (thousands of images), samples (hundreds of pounds or more), and other associated records. This historical context provides a unique time series of seafloor disturbances, enabling an unusual ability to assess disturbance recovery across a range of substrates and habitat types.

BOEM, USGS and NOAA have been collaborating to learn more about this site and planning for this joint study. On June 29, 2019 NOAA Ship *Okeanos Explorer* performed a systematic multibeam survey surrounding the "Deepsea Ventures Site." This initial mapping enabled a return visit by the *Okeanos Explorer* on November 11, 2019 to conduct an 8 hour exploratory Remotely Operated Vehicle dive guided by USGS and BOEM input (NOAA Ocean Exploration and Research 2019). 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 Mariner's Museum in Newport News, VA, where copies were made of historical documents detailing the site's coordinates and historic activities. USGS has also been recovering important data from internal USGS records about their 1980's fieldwork at the site.

In 2022, USGS, BOEM, and NOAA scientists contracted Ocean Infinity America to conduct a high-resolution mapping survey of the seafloor within the 50 km2 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 that will be a second phase of the project (see: https://www.boem.gov/environment/environmental-studies/mm-24-02).

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

Methods: This study will encompass the first two parts of a potential four-part approach:

1. Site mapping and characterization - High-resolution mapping of benthic habitats over targeted locations (likely with an autonomous underwater vehicle) coupled with water-column characterization will provide information about the physical environment of control areas and disturbed areas. The type of data that may be collected include imagery, multi-beam and side scan sonar. This work will require a ~14 day research cruise.
2. Develop a Field Survey Plan and Experimental Design – Using high resolution imagery and maps, a detailed field plan for in-situ data collection will be developed that includes 4-5 sample areas in both control and impact sites. A "natural experiment" framework will be developed for examining impacts that will be applicable to other BOEM planning areas. This plan is to determine the approach that can be used for a future study (see 3 and 4 below).

If successful, an additional study will be proposed for the FY 2022 National Studies List that will use the field survey plan and experimental design developed above and also include:

1. In-Situ Data Collection: Geological, sediment, water and biological samples collection at a number of discrete locations in both the disturbed areas and control areas.
2. Data Analysis and Hypothesis Testing: Sample processing and analysis to characterize and statistically compare control and impacted sites.

Specific Research Question(s):

1. Can the impacts of experimental mining activities be identified, mapped and quantified using remote sensing technologies?
2. What is the extent, severity, and possible long-term recovery of the impacts of mining activities at the site?
3. How do impact areas compare to control areas that were not impacted by mining?
4. What is a cost-effective, useful sampling methodology/design for in-situ data collection to examine environmental impacts?

Current Status: Ongoing

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(3):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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