Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Minerals and Ecosystems of the Remote Pacific (MM-23-02)
Administered by	Marine Minerals Program (MMP), Pacific Outer Continental Shelf (OCS) Region
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Procurement Type(s)	Interagency Agreements
Conducting Organization(s)	U.S. Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA)
Total BOEM Cost	$3,280,000
Performance Period	FY 2023–2027
Final Report Due	June 30, 2027
Date Revised	October 26, 2023
Problem	Baseline environmental data are required to support BOEM analyses and decision-making about OCS resources. For example, there is interest in better understanding the distribution of polymetallic nodules on abyssal plains throughout Pacific areas where very limited environmental data exist.
Intervention	The MMP and Pacific OCS Region are opportunistically providing leveraged funding to USGS to help provide BOEM/DOI with objective scientific information about seabed mineral resources. There are multiple at-sea opportunities to leverage interagency partnerships to collect additional baseline environmental data collection, including seafloor mapping and associated geological and biological classifications, water column profiling, and physical sample collection.
Comparison	This study will provide important baseline environmental data in areas for which there may be polymetallic nodules, such as the southernmost extent of the Hawaiian Exclusive Economic Zone (EEZ).
Outcome	These data will provide essential information on uncharacterized abyssal plain benthic habitats to support BOEM analyses and decision-making, as well as USGS critical minerals prospectivity models.
Context	U.S. EEZ throughout the Pacific, e.g., south of the Hawaiian Islands

BOEM Information Need(s): BOEM needs baseline environmental data in areas of anticipated OCS resources to inform required analyses under regulations such as the National Environmental Policy Act and the Magnuson-Stevens Fishery Conservation and Management Act (i.e., Essential Fish Habitat). Results from this study will provide initial mapping and characterization of abyssal plain benthic habitats and significantly add to our knowledge base of the EEZ in deeper waters. Specifically, geological, physical, chemical, and biological information will be collected in places with anticipated high resource potential for critical minerals, particularly polymetallic nodule fields. These data are crucial to assess the

potential impacts of development of OCS resources. Additionally, resulting information will inform USGS prospectivity models to better predict critical mineral deposits and support sustainable development of the OCS in other areas.

Background: MMP and Pacific OCS Region are co-funding a USGS-led resource evaluation expedition to evaluate potential seafloor geological resources for areas in the Pacific. In addition to resource evaluation, BOEM needs baseline environmental data for its analyses and regulatory requirements. This profile is intended to complement the BOEM-funded resource evaluation effort and provide funding for an environmental component designed to leverage the high cost of deep-water expeditions.

Polymetallic nodule fields lie on abyssal plains (4,000–6,000-m water depth) underneath oligotrophic waters with extremely slow sedimentation rates that allow for nodule formation (Dutkiewicz et al. 2020). The Clarion-Clipperton Zone is a nodule-dense, 4.5 million km^2 abyssal plain in close proximity to the southern Hawaiian EEZ. Polymetallic nodules contain high amounts of Ni, Cu, Co, Mo, Zr, Li, Y, and rare-earth elements that are valuable for technology and energy applications (Hein et al. 2013). These vast nodule fields play an important role in global ocean health (e.g., the marine carbon cycle; Smith et al. 2008), host a diverse community of organisms (Amon et al. 2016; Laroche et al. 2020), and provide a myriad of ecosystem services (Armstrong et al. 2012). Benthic habitats associated with polymetallic nodules have shown limited capacity to recover from disturbance within several decades (Simon-Lledó et al. 2019; Vonnahme et al. 2020; see also BOEM study "Investigation of an Historic Seabed Mining Site on the Blake Plateau"). Studies in the Hawaiian Islands area have been limited to the upper 2,000-m water depth, which is much shallower than where abyssal nodules occur.

Objectives: This study will inform BOEM environmental analyses and USGS models to better evaluate baseline environments and potential impacts of any future development of OCS resources. It leverages existing planned cruises and targets high-priority areas of interest. This specific funding will contribute to the following environmental objectives:

- Measure environmental parameters (e.g., dissolved oxygen, turbidity, nutrients) to assess the oceanographic regime associated with abyssal plains.
- Characterize the diversity and distribution of biological communities, including any sensitive or important habitats, in relation to polymetallic nodule occurrences.

Methods: BOEM is partnering with USGS and NOAA to conduct geological and environmental investigations. A joint BOEM-NOAA Ocean Exploration seafloor mapping effort will first provide needed bathymetry and backscatter data, limited seafloor and water column water samples, and imagery, which will be used to inform deployment of a boxcore on a second expedition led by USGS. The boxcore will be deployed at areas with highest mineral resource potential to obtain physical sediment samples for geological (e.g., nodules, sediment composition, grain size) and biological (e.g., epifaunal and infaunal diversity, abundance, distribution, meiofauna, genetic) analyses. By collecting baseline environmental data in tandem with resource evaluation, BOEM can begin to characterize habitats associated with abyssal plains and polymetallic nodules.

Specific Research Question(s):

1. What seafloor and sub-seafloor features exist throughout the abyssal plain?
2. What environmental structures and processes are characteristic of the prospective nodule area?

3. What are the diversity, abundance, and distribution of the benthic biological community, including infauna? Are there indicator taxa and/or sensitive habitat, e.g., corals, sponges?

Current Status: This study is supporting two field efforts: one in collaboration with NOAA Ocean Exploration to map an area of interest in the southern Hawaiian EEZ (completed November 2023), and one led by USGS to collect boxcore samples and environmental data in the same area (scheduled for fall 2024).

Publications Completed: N/A

Affiliated WWW Sites: https://nautiluslive.org/cruise/na157

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