

Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Seamount Benthic Mapping and Characterization, in support of Critical Minerals and Deep Corals of the Aleutian Island (MM-21-04)
Administered by	Marine Minerals Program and Alaska OCS Region
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Procurement Type(s)	Inter-agency Agreements
Conducting Organization(s)	NOAA, USGS
Total BOEM Cost	\$1,497,000
Performance Period	FY 2025-2028
Final Report Due	TBD
Date Revised	March 7, 2025
Problem	Seafloor areas along the Aleutian Islands are likely to contain seamounts and other seafloor areas with hydrothermal activity. This region may be rich in marine critical minerals deemed essential to the economic and national security of the United States and has also been identified as an interagency geographic priority area. The associated benthic communities include sensitive deep-sea corals, chemosynthetic communities and sponges that may contain important natural product such as biopharmaceutical compounds. Yet both geological and biological types of resources remain poorly explored and characterized.
Intervention	Guided by previous mapping and exploration expeditions that have identified priority areas for sampling, BOEM, USGS, and NOAA will closely coordinate to implement this new 21-day exploration and characterization mission on the global-class R/V <i>Atlantis</i> with HOV <i>Alvin</i> submersible dives to precisely collect physical samples. Synthesis of laboratory analyses will dramatically improve baseline information about benthic ecosystems and seafloor mineral deposits in this important but under-sampled region.
Comparison	This study will enable comparison of the biodiversity and community composition associated with critical minerals habitats in the Aleutian Arc and enable comparisons of relative value and potential impact.
Outcome	Focused observations in areas of the OCS in the Aleutian Arc to aid in evaluation of biological communities in the context of marine critical minerals, seamounts, hydrothermal vents and chemosynthetic seep sites. Collected data, including seafloor acoustic mapping and optical imagery, and direct sampling (e.g., geologic and biologic samples, eDNA, sediment and water chemistry), will directly inform NEPA-required analyses for any potential future lease sales in these types of environments.
Context	The Aleutian Arc within the Alaska OCS, which is thought to contain permissive regions for marine mineral types that are of interest for base (Zn, Cu), critical (Co, Mn, REE, Sb, Te) and precious (Au, Ag, Pt) elements.

BOEM Information Need(s): The 2017 Executive Order 13817 “A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals” requires “...increasing activity at all levels of the supply chain, including exploration, mining, concentration, separation, alloying, recycling, and reprocessing.” Subsequent Executive Orders (14017 - “America’s Supply Chains”, 13953 – “Addressing the Threat to the Domestic Supply Chain from Reliance on Critical Minerals from Foreign Adversaries and Supporting the Domestic Mining and Processing Industries,” and 14154 - “Unleashing American Energy”) have further emphasized the US government’s need to identify additional critical mineral resources. This study would help implement these standing Presidential directives by providing baseline and exploratory seafloor observations in targeted areas of Alaska in the Aleutian Arc that hold potential marine minerals. Improving limited scientific understanding of the mineral-associated benthic ecosystems at seamounts and hydrothermal vents will directly inform NEPA-required environmental analyses (Affected Environment, Impacts) related to potential future lease sales and any potential extractive activities in these types of systems, not just in Alaska but in other areas with seamounts and hydrothermal vents.

Background: Despite contributing the largest area to the U.S. Exclusive Economic Zone (EEZ), Alaska waters remain one of the least explored areas in the United States. Within the Outer Continental Shelf (OCS), the Aleutian Islands are a significant unmapped, ice-free priority region for exploration of natural resources (geological and biological). The Aleutian Islands are the only oceanic-arc subduction zone in the continental OCS, a type of plate boundary that is highly permissive for critical minerals associated with seafloor hydrothermal systems. Seafloor hydrothermal fields in volcanic arcs may be particularly rich in antimony, an element important for corrosion resistance in alloys and batteries. Mapping, exploration and characterization of identified priority areas in the Aleutian Islands is needed to address BOEM’s mission, statutory obligations (OCSLA, NEPA, NHPA, and others), and the above-listed Executive Orders.

Additionally, the 2019 Presidential Memorandum “Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska” created the National Ocean Mapping, Exploration, and Characterization Strategy and a subsequent interagency working group’s Strategic Priorities report that identified the Aleutians as a consensus top geographic priority of multiple subject area expert groups including marine resource, natural hazards, and benthic ecology. A series of interagency coordinated and funded expeditions commenced—with agency funding and expertise contributed by BOEM, NOAA, and USGS. A 2022 Saildrone Surveyor mission mapped 6,276 sq mi of unmapped seafloor including previously unknown hydrothermal vents, and a 2023 NOAA’s Okeanos Explorer mission that continued mapping and ROV dive exploration, discovering species new to science. BOEM has been funding multiple ongoing and coordinated agreements with USGS geologists and ecologists to help identify critical mineral and associated ecosystem areas of interest, and with NOAA Office of Ocean Exploration and Research and its Ocean Exploration Cooperative Institute.

Guided by these previous mapping and exploration expeditions and scientific analyses that have identified priority areas for sampling, BOEM, USGS, and NOAA will closely coordinate to implement this final-phase 21-day exploration and characterization mission on the US Navy-owned global-class Research Vessel *Atlantis* and famous Human Occupied Vehicle *Alvin*, both operated by OECI member Woods Hole Oceanographic Institution. The *Alvin* submersible enables extremely precise, human-controlled physical sample collection. Analytical synthesis/reporting of subsequent laboratory work will dramatically improve baseline information about benthic ecosystems and seafloor mineral deposits in this important but under-sampled region.

Reflecting the broad utility of this expedition to multiple agency mission needs and programs, substantial new funding for this mission is being provided to offset increased 2025 transit and day rate costs by new funding partners from the Office of Naval Research and Navy-National Oceanographic Partnership Program and the National Science Foundation. The USGS through its BOEM/USGS OCS Land Management Research Program is providing substantial in-kind funding enabling key contributions of data acquisition, sample processing, and personnel. This new funding supplements the prior BOEM and NOAA Ocean Exploration awards.

Objectives:

- Develop a detailed sampling plan and purpose-capable science party, making use of previously collected datasets including identified locations of seamounts and associated hydrothermal activity.
- Conduct precise exploration and characterization (sampling) of benthic communities including deep sea corals, hydrothermal vent communities, and sponges that may have biopharmaceutical potential, and determine whether any are endemic to these types of critical mineral habitats.
- Provide baseline biological/geological/chemical information regarding benthic habitats, endemic species, and critical minerals needed to sufficiently understand and evaluate potential environmental impacts associated with any seabed mining activities at seamounts and hydrothermal systems.

Methods: This study will visit up to 16 unexplored or poorly explored sites along the Aleutian Arc using the *Atlantis* and *Alvin*. The sites span a wide range of depths (200m-2460m) and extend 1,370 km along the Aleutians from Unalaska in the east to Sunday Basin in the west. The proposed project will be accompanied by seafloor mapping and water column investigation using multibeam sonar collecting both water column and seafloor backscatter to fill in data gaps. The general location of dive sites will be selected using the previously collected bathymetric and oceanographic data.

CTD rosette sampling will occur at dive sites and other locations. CTD instrumentation will include a transmissometer and methane sensor, and specialized environmental DNA samples will be preserved for later processing to help understand species distribution. Operations will include ship-based multibeam bathymetry to fill mapping data gaps, HOV video transects, and targeted specimen, sediment, and water sampling. Observation will include video and acoustic recordings; sampling will include geology grab samples, push-cores, biology suction samples, hydrothermal fluid samples, and seawater samples for further chemical and biological assessment.

Specific Research Question(s):

1. Are there additional undiscovered seamounts/hydrothermal vents/seeps along the Aleutian Arc?
2. Are those seamounts/vents/seeps host to seafloor mineral deposits? What types?
3. What types of biological communities exist at or near seafloor mineral deposits?
4. Are there specific biological communities endemic to the seafloor mineral deposits? If so, do they seem abundant throughout the region? Can any unique or unusual relationships be discerned?

5. What are some of the fauna that could potentially be impacted by potential marine mineral recovery activity in these types of environments?

Current Status: Expedition AT50-38 scheduled for June/July 2025 out of Dutch Harbor, AK. Science party selected and draft science and expedition plans complete. BOEM-USGS IA science awards made in FY24; USGS OCS in-kind approved for FY25-26. Majority of BOEM and NOAA shiptime funding has been previously obligated in FY23. Final BOEM supplemental funding (\$390k) for ship and submersible time in procurement as an FY25 IA modification. Navy-NOPP and NSF will directly fund their shiptime contributions to WHOI/UNOLS.

Publications Completed: N/A

Affiliated WWW Sites:

https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/MM-21-04_2.pdf

<https://noaa.gov/nomec>

https://www.noaa.gov/sites/default/files/2025-01/NOMECEC_OEC_Priorities_Report.pdf

<https://oceanexplorer.noaa.gov/news/oer-updates/2022/uncrewed-saildrone-alaskan-waters.html>

<https://oceanexplorer.noaa.gov/oceanos/explorations/seascape-alaska/media-resources/media-resources.html>