Committee on Offshore Science and Assessment (COSA) April Meeting

Briefing Book

April 2-3, 2024

Irvine, California- Hybrid

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

BRIEFING BOOK
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April 2nd & 3rd, 2024

01
Meeting Agenda

Committee on Offshore Science and Assessment (COSA) 2024 Spring Meeting

April 2–3, 2024

MEETING LOCATION

Arnold and Mabel Beckman Center of the National Academies of Sciences and Engineering
Huntington Room
100 Academy Way, Irvine, CA 92617

Zoom link to register for virtual attendance:
https://nasem.zoom.us/meeting/register/tJArd-utqTgsGNWCx0Sfa1fg5jkHwfFke3QB

All times in Pacific Daylight Time

TUESDAY, APRIL 2, 2024

9:00 – 9:30 AM **Welcome and Introductions**
Kevin Stokesbury, UMass Dartmouth, COSA committee chair
Bill Brown, BOEM
Megan Carr, BOEM
Jeff Reidenauer, BOEM

9:30 – 10:45 AM **BOEM 101**
Bill Brown, BOEM

10:45 – 11:00 AM **BREAK**

11:00 AM – 12:30 PM **Introduction to BOEM's Marine Minerals Program**
Victoria Brady, BOEM
Jessica Mallindine, BOEM

12:30 – 2:00 PM **BREAK FOR LUNCH**

2:00 – 3:00 PM **Data Needs for Developing Informed Environmental and Spatial Planning Decisions**
Deena Hansen, BOEM
Ana Rice, BOEM

3:00 – 3:15 PM **BREAK**

3:15 – 3:55 PM **Data Needs (continued)**

3:55 – 4:00 PM **Closing remarks and adjourn day 1**
Kevin Stokesbury, COSA chair

WEDNESDAY, APRIL 3, 2024

9:00 – 10:30 AM	**Marine Minerals Program—Intersections with Coastal Resilience** *Ashley Long, BOEM* *Jennifer Bucatari, BOEM*
10:30 – 11:00 AM	**Not Just Nodules—Critical Minerals on the Federal Seabed** *Paul O. Knorr, BOEM* *Shannon Cofield, BOEM*
11:00 – 11:15 AM	**BREAK**
11:15 AM – 12:25 PM	**Not Just Nodules (continued)**
12:25 – 12:30 PM	**Summary and wrap-up** *Kevin Stokesbury, COSA chair*
12:30 PM	**MEETING ADJOURNS**

02
Statement of Task

Committee on Offshore Science and Assessment

STATEMENT OF TASK

Committee on Environmental Science and Assessment for Ocean Energy Management

The National Academies' Ocean Studies Board and Board on Earth Sciences and Resources have established a committee to provide ongoing assistance to the Bureau of Ocean Energy Management (BOEM) in its efforts to manage development of the nation's offshore energy resources in an environmentally and economically responsible way. The committee will meet regularly to:

- Convene experts from academia, industry, and other organizations to provide independent, technical input on issues of interest to BOEM's environmental studies and assessment programs, and potentially other programs;
- Facilitate stakeholder discussions of controversial issues;
- Enhance the understanding of developments in related fields of science and technology, and if warranted, to develop NRC studies on specific topics;
- Provide a venue for BOEM staff to meet and exchange information with staff from other federal agencies and help BOEM define its unique role in the interagency process; and
- Facilitate the exchange of information and lessons learned with staff from other world class applied environmental studies and assessment programs with a view to assisting BOEM in being the best in such programs.

03
Committee Biographies

Committee Biographies

Kevin Stokesbury (Chair)

Kevin Stokesbury is a professor in the Department of Fisheries Oceanography, School for Marine Science and Technology, at the University of Massachusetts Dartmouth. His research examines the marine ecology of invertebrates and fish, and the impacts of fishing and energy development. He was awarded the David H. Wallace Award from the National Shellfish Association (2013) and the Standard-Times Southcoast Man of the Year (2018) for his two decades of science in the public interest. His research has been published in 69 scientific papers and 5 book chapters. He served the National Academies of Sciences, Engineering, and Medicine on "Fisheries Research and Monitoring for Atlantic Offshore Development" (2017) and "Assessment and Advancement of Science in the Bureau of Ocean Energy Management's Environmental Studies Program" (2021). He is a subject editor for the Journal of Shellfish Research and Reviews in Marine Fisheries and Aquaculture. Previously, Dr. Stokesbury served as an Adjunct Assistant Professor and Co-principle Investigator on the SEA Herring Project at the University of Alaska, Fairbanks' Institute of Marine Science. He received his B.Sc. and M.Sc. from Acadia University in Nova Scotia, Canada, and went on to earn his Ph.D. from Université Laval in Quebec, Canada.

Carin Ashjian

Carin Ashjian is Senior Scientist and current Department Chair in the Department of Biology at the Woods Hole Oceanographic Institution (WHOI). She previously did postdoctoral work at Brookhaven National Laboratory, the University of Miami, and WHOI before joining the scientific staff. Her research has focused on oceanography, zooplankton ecology, and biological-physical interactions in a range of the world's oceans. Her recent work focuses on the impact of climate change on polar ecosystems and the greater Arctic system, including the human dimension. She has served on numerous national committees, including the North Pacific Research Board Science Panel, the Bering Sea Program Science Advisory Board, and the Regional Research Vessel Science Oversight Committee and she is a past chair of UNOLS Arctic Icebreaker Coordinating Committee. Ashjian received the USCG Meritorious Public Service Award (2009), the WHOI Henry Bryant Bigelow Chair for Excellence in Oceanography (2016), and the Alaska Sea Life Center Alaska Marine Research Award (2020). She earned a Ph.D. in Oceanography from the University of Rhode Island in 1991. She previously served on the National Academies' Committee on Emerging Research Questions in the Arctic and the Committee on Polar Icebreaker Cost Assessment.

John A. Barth

John A. Barth is a professor of oceanography in Oregon State University's College of Earth, Ocean, and Atmospheric Sciences. He is also the Executive Director of Oregon State University's Marine Studies Initiative, a program to unite marine-related research, teaching, and outreach and engagement across OSU and the state of Oregon. His research seeks to understand how coastal ocean circulation and water properties shape and influence coastal marine ecosystems. He has led research, technology development and ocean observing system projects off Oregon and around the world. His present research includes a focus on the characteristics and formation of low-oxygen zones off Oregon. His research team uses autonomous underwater gliders, robots beneath the sea surface. From 2013-2016, Dr. Barth served on the

U.S. West Coast Ocean Acidification and Hypoxia Science Panel, and, from 2018-2022, he co-chaired Oregon's Ocean Acidification and Hypoxia Coordinating Council. He is a Fellow of The Oceanography Society and of the American Meteorological Society. He received a Ph.D. in Oceanography in 1988 from the Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program in Oceanography.

Daniel Costa

Daniel Costa is a Distinguished Professor of Ecology and Evolutionary Biology at the University of California at Santa Cruz. He was previously a postdoctoral researcher at the Scripps Institution of Oceanography. His research focuses on the ecology and physiology of marine mammals and seabirds. He has worked with a broad range of air breathing marine vertebrates and has published over 500 scientific papers. His research focuses on the movement and distribution patterns of marine mammals and seabirds to understand their habitat needs and their response to underwater sounds. This research is developing ways to assess the likelihood that a disturbance results in a population consequence. He has supervised 22 master's and 31 doctoral students as well as 18 post-doctoral scholars. He co-founded the Tagging of Pacific Predators program, a multidisciplinary effort to study the movement patterns of 23 species of marine vertebrate predators in the North Pacific Ocean and is a member of the NOAA IOOS Advisory Committee. Costa received a B.A. at UCLA and a Ph.D. at U.C. Santa Cruz. He is a member of the National Academies' Ocean Studies Board and has served on several NASEM committees, including Assessment and Advancement of Science in the Bureau of Ocean Energy Management's Environmental Studies Program.

Rónadh Cox

Rónadh Cox is the Brust Professor of Geology and Mineralogy at Williams College, Massachusetts and a Visiting Professor in the School of Earth Sciences at University College Dublin. Her primary area of research is in wave impacts on rocky coasts, megagravel transport, and distinguishing the deposits of extreme storms from those of tsunami. She also studies the effects of progressive land loss on indigenous communities in coastal Louisiana. Rónadh is a Fellow of the Geological Society of America and of the American Association for the Advancement of Science, as well as an elected Member of the Royal Irish Academy; she also received the Distinguished Service Award from the Geological Society of America. She was awarded a B.Sc.(hons) in Geology from University College Dublin and a Ph.D. from Stanford University.

Jeremy M. Firestone

Jeremy Firestone is a Professor at the University of Delaware (UD). He holds his principal appointment in the School of Marine Science and Policy and is Director of UD's interdisciplinary Center for Research in Wind (CReW). Previously he was an Assistant Regional Counsel for US EPA (1986-89) and an Assistant Attorney General for the State of Michigan (1989-96). In his research and writing, Professor Firestone focuses primarily on understanding public attitudes toward, and human behavior regarding, renewable energy technology, particularly offshore wind power, using survey research and semi-

structured interviews. Other focal areas of research include the rights of indigenous peoples and marine spatial planning, along with domestic and international ocean and coastal law, regulation, and governance. He teaches courses on Offshore Wind Power, Renewable Energy, and Ocean and Coastal Law. He received a Bachelor of Science in Cellular and Molecular Biology and a Juris Doctorate from the University of Michigan and PhD in Public Policy Analysis from the University of North Carolina. In 2010, he served as a Workgroup Member, Panel Moderator and Breakout Session Leader for a National Academy of Sciences Marine Board, Offshore Wind Energy Workshop.

James H. Flynn III

James Flynn joined the faculty at the University of Houston's Department of Earth & Atmospheric Science in 2013 and is currently a Research Associate Professor. His work focuses on atmospheric chemistry and air quality issues so that decision makers can develop informed policies supported by current science. His group has participated in numerous airborne, marine, and ground-based campaigns in the US and abroad as well as maintaining research networks in Texas and developing balloon-based sensors to validate satellite observations of trace gases. In 2022 James became a Senior Member of the National Academy of Inventors. He received his BS in Aviation Science from Baylor University where he continued to work in their airborne air quality research program until 2006. He earned his MS (2009) and PhD (2013) in Atmospheric Science from the University of Houston.

Katrin Iken

Katrin Iken currently is a Professor at the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks, where she is a member of the Marine Biology department. She also is the director of the Kasitsna Bay Laboratory, a coastal lab facility in Kachemak Bay, Southcentral Alaska, which is a NOAA-owned and UAF-operated facility supporting research, teaching, and outreach missions. Iken's primary research expertise is with benthic communities, especially patterns in diversity as well as food web structure. Much of her work focuses on Arctic systems but she is also active in some long-term monitoring efforts in the Northern Gulf of Alaska. She is active on international committees such as the Circumpolar Biodiversity Monitoring Program (CBMP) under the Arctic Council, as well as a member of the international steering committee of EU programs. She earned her degrees at various academic institutions in Germany before coming to the US in 1999 for a post-doctoral position, transiting to the faculty at the University of Alaska Fairbanks in 2002.

John Odin Jensen

John Odin Jensen is an associate professor and coordinator of the graduate program in history at the University of West Florida. Born in Alaska and a former commercial fisherman, Dr. Jensen is a social and policy historian and marine archaeologist whose research areas include historic shipwrecks, cultural heritage management, fisheries, and health and social welfare. A specialist on maritime frontiers and applied cultural landscapes, his expertise and publications encompass multiple areas of the Atlantic, Pacific, and Great Lakes regions of North America. His interdisciplinary monograph Stories from the

Wreckage: A Great Lakes Maritime History Inspired by Shipwrecks received the Wisconsin Historical Society Board of Curators Book of Merit Award for the most valuable contribution to public understanding of Wisconsin's history in 2020. He has served on many professional committees, including the NOAA MPA System FAC (2012-16) and the MPA FAC Cultural Heritage Working Group (2010-2012). Dr. Jensen holds a BA in history from Lawrence University, an MA in maritime history and underwater archaeology from East Carolina University, an MS in history and policy, and a PhD in Social history from Carnegie Mellon University.

Les Kaufman

Les Kaufman is Professor of Biology at Boston University. He has worked for many years on committee assignments and field work with the New England Fishery Management Council, the National Marine Sanctuaries System, Conservation International, the Pew Charitable Trusts, the American Association of Zoological Parks and Aquariums, and the World Conservation Union. Dr. Kaufman is an active researcher in marine benthic ecology with specialization in fisheries and coral reef ecology. He leads the BU program on Coupled Human and Natural Systems (CHANS), with current field projects, modeling, and decision support in the Gulf of Maine, Florida and the Caribbean, the Great Lakes of Africa, and the Lower Mekong Basin. He is engaged in long-term studies of benthic communities, food web dynamics and forage fish population biology with the Stellwagen Bank National Marine Sanctuary and BOEM. He is on the founding science steering committee for NOAA's Mission: Iconic Reefs. Dr. Kaufman was the first Pew Marine Fellow in Conservation and the Environment and has received the Parker-Gentry Award in Conservation Biology. He received a BS and PhD from Johns Hopkins University and did postdoctoral research at Harvard's Museum of Comparative Zoology.

Kelsey T. Leonard

Kelsey Leonard is a Canada Research Chair in Indigenous Waters, Climate and Sustainability and an Assistant Professor in the Faculty of Environment at the University of Waterloo, where her research focuses on Indigenous water justice and its climatic, territorial, and governance underpinnings. Dr. Leonard seeks to establish Indigenous traditions of water conservation as the foundation for international water policymaking.

Dr. Leonard has been instrumental in safeguarding the interests of Indigenous Nations for environmental planning and builds Indigenous science and knowledge into new solutions for water governance and sustainable oceans. In collaboration with a global team of water law scholars Dr. Leonard has published in Lewis and Clark Law Review on Indigenous Water Justice and the defining international legal principle of self-determination under the United Nations Declaration on the Rights of Indigenous Peoples.

Her recent scholarship explores legal personhood for water and you can watch her TEDTalk here: TEDTalk "Why lakes and rivers should have the same rights as humans".

Ruth M. Perry

Ruth M. Perry is the Head of Regulatory Affairs for Shell Renewables and Energy Solutions Offshore Power Americas. In this role, she is responsible for leading and executing the permitting and regulatory

advocacy, policy and research strategies for Shell's renewable power generation portfolio in the Americas. On behalf of Shell, she develops and leads public-private science collaborations, such as real-time monitoring programs, to improve industry's knowledge of the offshore marine environment and is helping to lead similar industry-wide collaborations. More so she establishes sustained ocean observation and research partnerships between offshore wind, governments, and ocean users, including the NGO community and fishing industry, to support responsible energy planning and development. Dr. Perry represents the energy sector as a member of NOAA Advisory Committees and Councils, including the IOOS Federal Advisory Committee, the Flower Garden Banks National Marine Sanctuary Advisory Council, and the NOAA Science Advisory Board. She has also recently been recognized as A Word About Wind's 2022 Top 100 North American Power leaders in offshore wind. Dr. Perry has over 15 years of ocean technology research and system implementation and ocean policy experience. She earned a Ph.D. in Oceanography from Texas A&M University in 2013. Dr. Perry previously served on the National Academies Ocean Studies Board, the Committee on Advancing Understanding of Gulf of Mexico Loop Current Dynamics, and as a representative to the U.S. National Committee for the UN Decade of Ocean Science for Sustainable Development.

Kevin St. Martin

Kevin St. Martin is a Professor and Chair in the Department of Geography at Rutgers-University. He is a human geographer whose work is at the intersection of economic geography, political ecology, and critical cartographies. His work includes critical analyses of economic and resource management discourse as well as participatory projects that work to rethink economy and foster economic and environmental wellbeing. Dr. St. Martin's projects have in common the regulation and transformation of the marine environment. He uses the paradigmatic case of fisheries in the U.S. Northeast to better understand the power of discourse, data, and devices to shape economic and environmental outcomes. He co-edited Making Other Worlds Possible: Performing Diverse Economies, he is an editor of the Diverse Economies and Liveable Worlds book series, is an associate editor for the journal Maritime Studies, and serves on the advisory board of the Floating Laboratory of Action and Theory at Sea (FLOATS). Dr. St. Martin received his PhD from Clark University's Graduate School of Geography.

Lori Summa

Lori L. Summa is a geologist with 40 years of experience in geoscience, basin formation research, and petroleum-systems analysis. She retired as a senior technical consultant with ExxonMobil Upstream Research Company in 2016. In this position, she advised corporate management on strategic geoscience issues to ensure appropriate research was performed in support of business objectives. She is currently an adjunct faculty member in the Department of Geosciences at Rice University and a research collaborator at the University of Texas, Jackson School of Geosciences. Her background is in basin analysis and numerical modeling, but she has done significant applied research in oil and gas exploration and drilling. She has chaired committees for both American Association of Petroleum Geologists and Geological Society of America (GSA) and has led numerous student short courses for the GSA, for which she received a 2016 Distinguished Service Award. Dr. Summa earned a B.S. in geology with honors from the University of Rochester and a Ph.D. in geology from the University of California, Davis in 1986. She participated in NASEM's 2016 Committee on Future Directions for the U.S. Geological Survey's Energy

Resources Program, and NRC's 2011 Committee on Scientific Ocean Drilling: Accomplishments and Challenges.

04
Marine Minerals Program

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America's Offshore **Critical Mineral Resources**

The U.S. has potential offshore critical minerals to supply our strategic need, but they are currently an underexplored and untapped resource.

Why do we care?

The United States is wholly import dependent for 17* of the 35 minerals defined as critical by the U.S. Geological Survey (USGS). To address this shortfall, the U.S. is pursuing A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals published in response to Executive Order 13817. For its part the Bureau of Ocean Energy Management (BOEM) is leading the development of a National Offshore Critical Mineral Inventory to address the potential for offshore critical minerals.

*from USGS Mineral Commodity Summaries 2019

Critical Minerals Occurring Offshore

Yellow = Occur in marine minerals within the US Exclusive Economic Zone

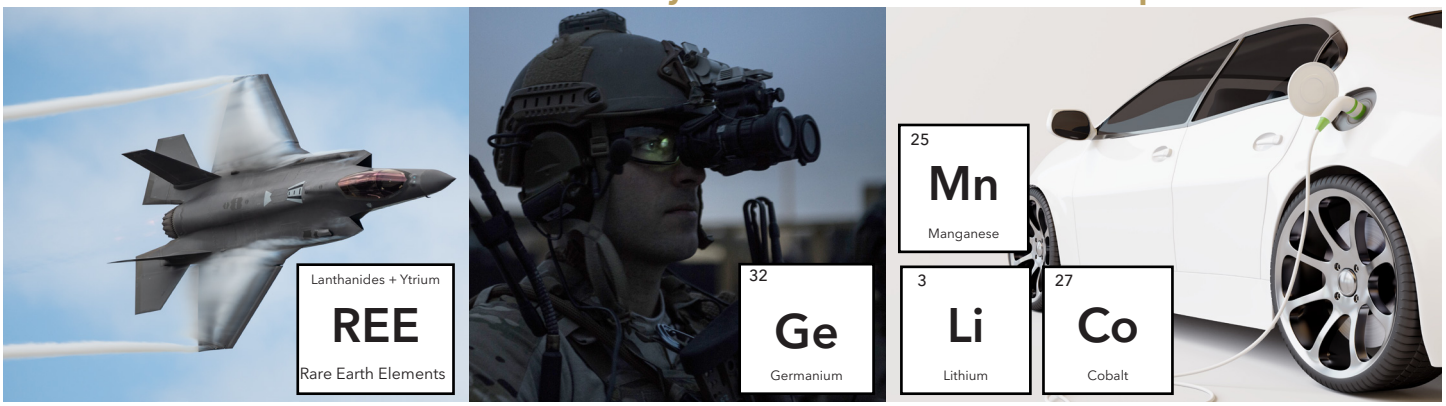
- Aluminum (bauxite)
- **Antimony**
- Arsenic
- Barite
- Beryllium
- **Bismuth**
- Cesium
- Chromium
- **Cobalt**
- Fluorspar
- **Gallium**
- **Germanium**
- Graphite (natural)
- Halfnium
- Helium
- Indium
- **Lithium**
- **Magnesium**
- **Manganese**
- **Niobium**
- **Platinum group metals**
- Potash
- **Rare earth elements**
- Rhenium
- Rubidium
- **Scandium**
- Strontium
- Tantalum
- **Tellurium**
- **Tin**
- **Titanium**
- Tungsten
- **Uranium**
- **Vanadium**
- **Zirconium**

The types of critical minerals that occur in offshore deposits are used in transportation **(lithium, cobalt, manganese)** and defense and national security **(germanium, rare earth elements)**

Table adapted from 83 FR 23295

It is not just about consumer electronics...

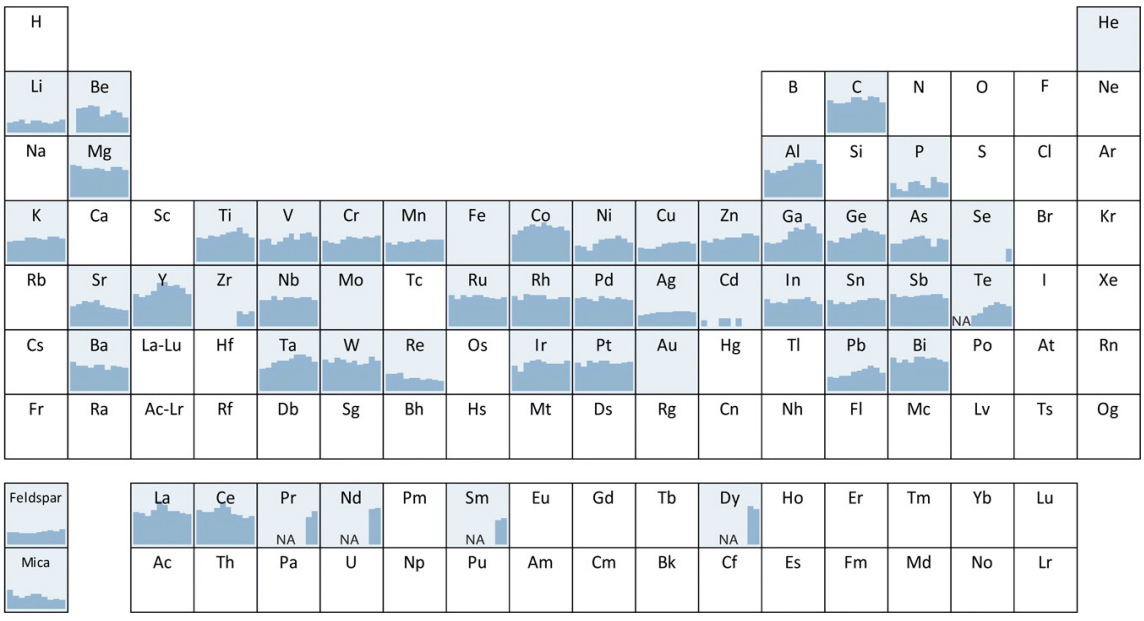
Defense and National Security | **Transportation**



While the need for critical minerals in the manufacturing of cell phones and other consumer products is well known, there is growing domestic demand for critical minerals in high-tech industry, transportation, and defense applications.

Domestic production of critical minerals will assure a resilient supply chain (see below for graphical depiction of supply risk) and represents a potential revenue source for the U.S. Government. Critical minerals are essential to the production of high-tech equipment in a wide variety of sectors including energy production, national defense, battery technology, information technology, and health care.

BOEM is developing an evaluation of hard mineral resources on the Outer Continental Shelf, in conjunction with the USGS. The inventory of hard mineral resources will include identification of offshore areas with high economic potential. These areas can be evaluated further for potential exploration and leasing, including consideration of environmental risk.



Supply Risk scores for all commodities examined for the years 2007–2016, each bar represents one year with the height of the bar ranging from 0 (no supply risk) to 1 (high supply risk). Adapted from Nassar et al., Sci. Adv. 2020; 6: eaay8647

What Marine Deposits Contain Critical Minerals?

Five main categories:

nearshore minerals, phosphorites, manganese nodules, ferromanganese crusts, and hydrothermal deposits

NEARSHORE MINERALS

include placers, which are heavy minerals concentrated by moving water, and offshore extensions of continental deposits

- Water Depth: Typically, < 500 ft
- Occurrence: Continental margins
- Habitat: Soft sediment (e.g., sand, mud) with burrowing invertebrates and bottom-dwelling fish
- Location: Close to terrestrial mineral deposits
- Minerals **(Critical Minerals in Bold):** **Titanium**, tin, **platinum**, gold, silver, and **rare earth elements**


Photo: Carleton Bern, USGS

PHOSPHORITES

- Water Depth: 0.5 to 2 miles
- Occurrence: Along continental shelves and slopes, also comingled with crusts on seamounts
- Habitat: Hard surface possibly populated by sponges and corals
- Location: Atlantic and Pacific continental margins and seamounts
- Minerals: Phosphorous, **rare earth elements, possibly uranium**


Photo: Amy West, USGS

MANGANESE NODULES

- Water Depth: 2 to 4 miles
- Occurrence: Nodules occur in soft sediments of abyssal plains and provide hard substrate
- Habitat: Deep sea corals, worms, and crustaceans
- Location: All ocean basins, most abundant in central Pacific
- Growth Rate: 2-10 mm / million years
- Minerals: Nickel, copper, **cobalt, manganese, rare earth elements**, possibly **titanium, tellurium, lithium**

Photo: Jim Hein, USGS

FERROMANGANESE CRUSTS

- Water Depth: 0.5 to 4 miles
- Occurrence: Sides and summit of seamounts
- Habitat: Crusts are potential hard substrate for deep water corals and other sessile organisms; seamount ecosystems host fish, crustacean, and other fauna
- Location: Most extensive in central and western Pacific
- Growth Rate: 1-4 mm / million years
- Minerals: **Manganese, cobalt,** nickel, copper, **rare earth elements , possibly tellurium, scandium, platinum**

Photo: Jim Hein, USGS

HYDROTHERMAL DEPOSITS

- Water Depth: 0.5 to 4 miles
- Occurrence: Undersea volcanoes and mid-ocean spreading centers
- Habitat: Active hydrothermal vents host vent-fluid dependent animals including snails, crustaceans, and worms
- Location: Globally along active tectonic boundaries
- Growth Rate: Variable up to approximately 2 cm / day
- Minerals: Copper, zinc, gold, silver, and potentially **antimony,** bismuth, **gallium, tellurium, germanium**

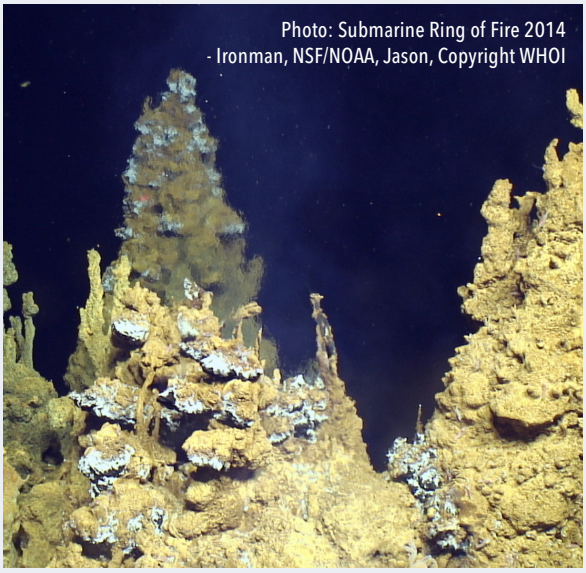
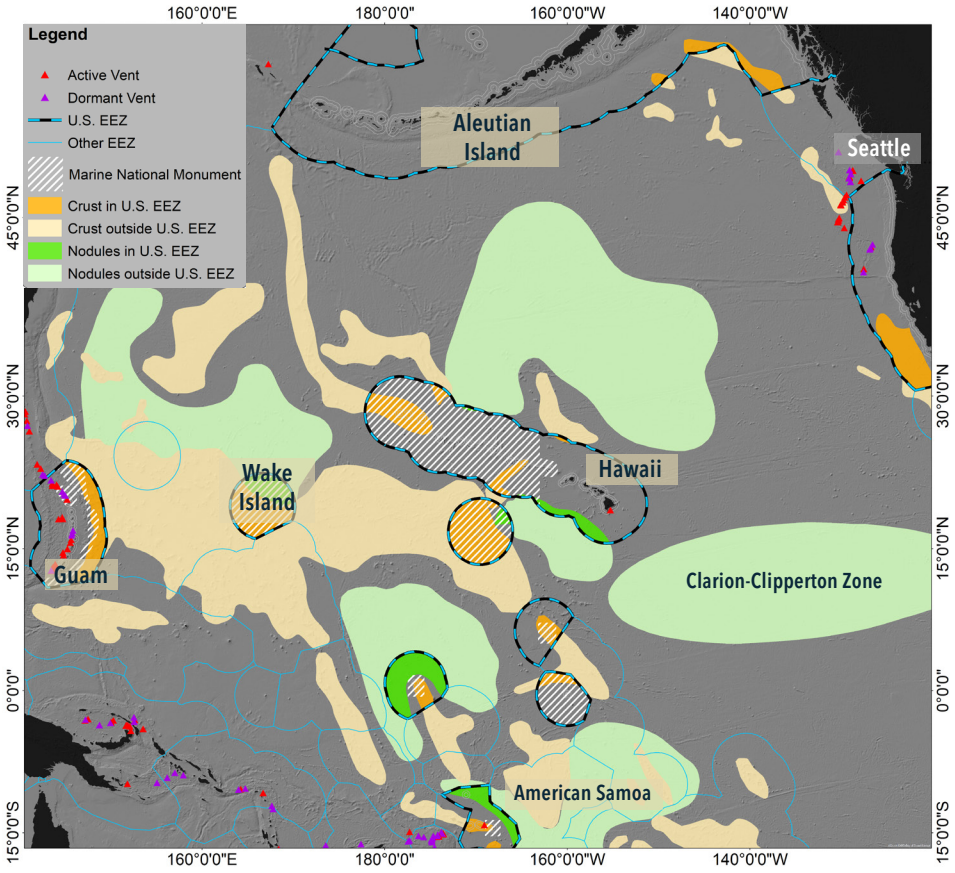


Photo: Submarine Ring of Fire 2014 - Ironman, NSF/NOAA, Jason, Copyright WHOI

Where are they found in the U.S.?



Resources areas colored by type and highlighted with darker colors within the U.S. Exclusive Economic Zone (EEZ) from Hein et al., 2013 doi: 10.1016/j.oregeorev.2012.12.001

- Throughout the U.S. exclusive economic zone but mostly in the Pacific (off California, Alaska, U.S. territories).
- Nearshore minerals are currently leased in U.S. state waters, including active gold leases in Alaska.
- Of the deep ocean minerals, manganese nodules are the most likely to be exploited first (based on interest in international waters). Nodules are likely present off U.S. territories. Hydrothermal deposits occur offshore California and possibly Alaska, but are of unknown size and location.

What Can Be Done to Facilitate Development of Offshore Critical Minerals?

Consider statutory and regulatory changes to simplify commercial mineral leasing.

BOEM Bureau of Ocean Energy Management

- Current U.S. law limits scope of mineral leasing to the Outer Continental Shelf, which includes areas offshore U.S. states but not offshore U.S. territories.
- BOEM's current regulations require that a developer obtain an initial exploration permit, but this permit does not convey the exclusive right to lease the prospecting area.
- Assess and recommend statutory as well as regulatory changes to give prospecting companies exclusive, or preferential, rights to lease the prospecting area, taking into consideration international regulatory approaches.

Increase scientific information in areas with the highest potential for resources:

USGS science for a changing world

- Characterize U.S. exclusive economic zone with modern remote sensing systems to find areas favorable for critical minerals.
- Characterize priority areas to determine mineral resource extent and composition through systematic sampling; collect data regarding the potential impact on other natural resources from extractive activities.

Which Federal Agencies are Working on Offshore Critical Minerals?

- BOEM, USGS, and NOAA are working closely together to leverage available funds and coordinate Federal offshore critical mineral activities.

- The National Ocean Mapping, Exploration, and Characterization Council, formed as a result of the November 2019 Presidential Memorandum on Ocean Mapping, will coordinate interagency activities and working groups and support collaboration with non-government partners and stakeholders.

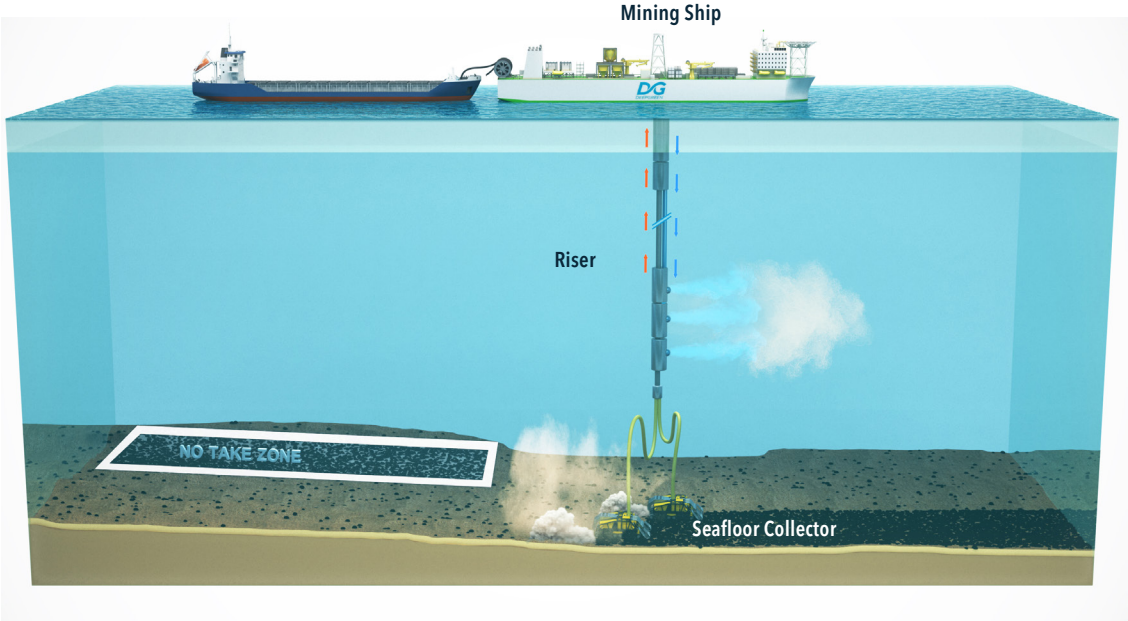


Image depicts a proposed deep sea nodule mining operation with mining ship, seafloor collector, and riser system photo credit: DeepGreen

What Critical Mineral Activities are Planned for International Waters?

- In areas beyond national jurisdiction, companies sponsored by other countries are working to begin mining nodules in the central Pacific Ocean in the next 5 to 7 years under the governance of the International Seabed Authority. The Unites States legislation on seabed mining, the Deep Seabed Hard Mineral Resources Act (under NOAA jurisdiction), establishes an interim domestic licensing and permitting regime for deep seabed hard mineral exploration and mining in international waters pending adoption of an acceptable international regime. The U.S. has two active exploration licenses, USA-1 and USA-4, both held by Lockheed Martin for five-year terms that were last reissued for 2017-2022.

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MARCH 3, 1849

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Bureau of Ocean Energy Management

Marine Minerals Program

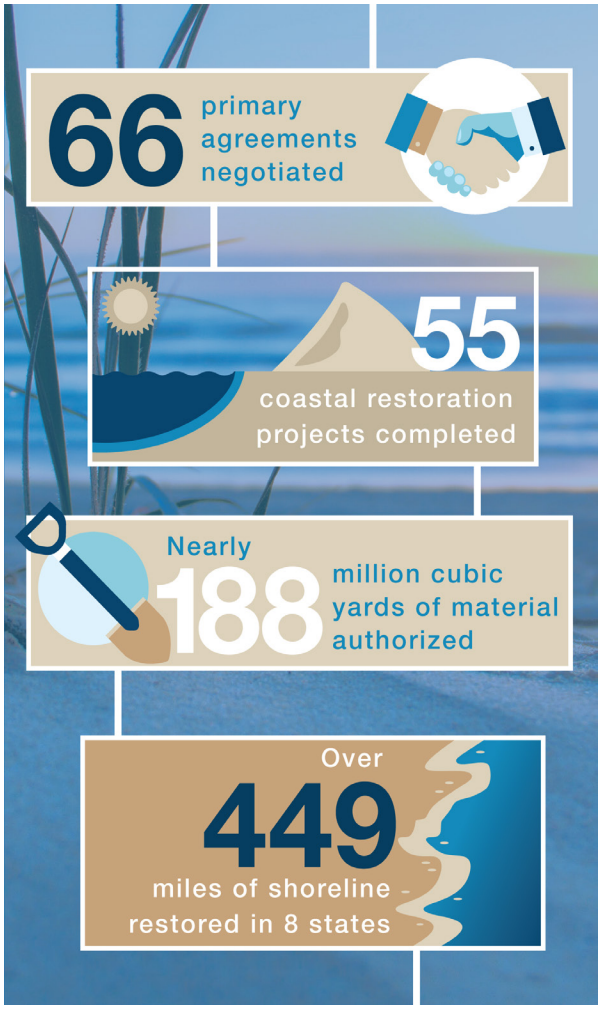
Preserving and Restoring the Nation's Beaches and Promoting Coastal Resilience

BOEM's ***Marine Minerals Program*** (MMP) manages Outer Continental Shelf mineral leasing (primarily sand and gravel) for coastal restoration, and commercial leasing of gold, manganese, and other hard minerals. Pursuant to ***Executive Order 13817,*** the MMP and the U.S. Geological Survey (USGS) are ***collaborating*** to determine which 35 critical minerals are located on the OCS.

BOEM ensures that the removal of any mineral resource is conducted in a safe and environmentally sound manner, and that any adverse environmental impacts are avoided or minimized.

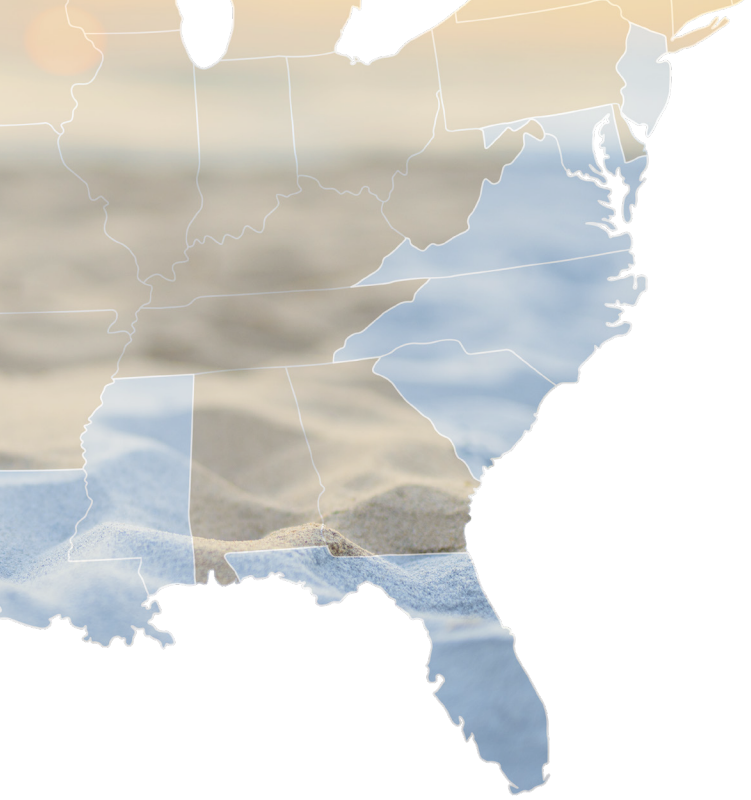
What are the primary uses of marine minerals? Marine minerals are used primarily in coastal restoration projects, including beach nourishment and habitat restoration, with increased attention to building resilience to deal with future storms and rising sea levels.

Why is this program beneficial? Access to and identification of OCS sand resources is critical for the long-term success and cost-effectiveness of shore protection, beach nourishment, and habitat restoration projects. Erosion of the nation's beaches, dunes, and coastal wetlands affects natural resources, energy, defense, public infrastructure, and tourism, which are important to healthy ecosystems and the economy at all levels.



What is the demand for marine minerals? In recent years the bureau has experienced a significant increase in the volume of sediment requested and the number of requests to use OCS sand resources. This trend is most likely due to a diminishing supply of available material in state waters, increased coastal erosion due to more frequent and intense storms, and sea level rise. BOEM maintains a ***National Offshore Sand Inventory,*** including data housed within a GIS-based ***Marine Minerals Information System (MMIS)*** that helps identify sediment quality, quantity, location, and accessibility. The inventory informs planning, improves response time, and bolsters preparedness.

Where are projects located? OCS material has been used for coastal restoration projects in Florida, Louisiana, Maryland, Mississippi, New Jersey, North Carolina, South Carolina, and Virginia.



Taking a regional approach, the MMP sponsors new offshore surveys from Maine to Texas and California. Projects generally consist of four phases: identifying sand resources and conducting environmental reviews prior to project approval; dredging to obtain sand and/or gravel; placing it along the shoreline; and engaging with partners and stakeholders to monitor dredging site and placement conditions.

Who are our stakeholders and partners?

The MMP works with local governments, state geological surveys and environmental agencies, the U.S. Army Corps of Engineers, USGS, NOAA Fisheries, U.S. Fish and Wildlife Service, National Park Service, and NASA. We actively engage fisheries groups, non-profits, and tribes in workshops, Sand Management Working Groups, and other settings.

How does BOEM evaluate environmental impacts?

The bureau must review all environmental impacts and prepare either an environmental assessment or environmental impact statement. BOEM requires mitigation measures and other stipulations to protect physical, biological, and cultural resources. Stipulations often include dredging time-frame constraints, dredge location constraints, lighting requirements, equipment requirements, monitoring requirements for threatened and endangered species, and buffers surrounding cultural resources and hard-bottom habitat.

Photos: U.S. Army Corps of Engineers

Ship Island restoration through the Mississippi Coastal Improvement Project is a joint effort between BOEM, the National Park Service, the U.S. Army Corps of Engineers Mobile District, and the State of Mississippi. In 1969, Category 5 Hurricane Camille cut Ship Island in two, creating the Camille Cut. Restoring Ship Island will protect coastal communities and ecosystems. Once complete, Ship Island will be the largest BOEM coastal restoration project to date.

For more information, visit: ***http://www.boem.gov/Marine-Minerals-Program/***

Marine Minerals Program

MISSION

Facilitate access to and manage the Nation's Outer Continental Shelf (OCS) non-energy marine minerals through environmentally responsible stewardship, prudent exploration and leasing activities, coordination with governmental partners, stakeholder engagement, and mission-focused research to improve decision-making and risk management.

VISION

Serve as the lead agency proactively addressing the Nation's current and long-term interests in OCS non-energy marine minerals:

- Act as the Nation's steward and scientific expert for OCS non-energy marine mineral sources.

- Identify, assess, and sustainably manage resources to ensure future availability.

- Promote strategic stakeholder engagement to facilitate planning and information sharing.

- Develop forward-looking science strategies to fulfill critical information and data needs.

- Foster ecosytem health and restoration while addressing the Nation's evolving marine mineral resource needs.

- Prepare comprehensive marine resource impact assessments, adopt integrated adaptive management principles, and develop practicable mitigation to avoid and minimize impacts.

BOEM

Bureau of Ocean Energy Management

NATIONAL ACADEMIES Sciences Engineering Medicine

Links to Other MMP Resources:

MMP video: https://www.boem.gov/marine-minerals/promoting-coastal-resiliences

Dredge Videos

- **Trailing suction hopper dredge:** https://www.youtube.com/watch?v=MhysyOJHY8A
- **Cutter suction dredge:** https://www.youtube.com/watch?v=PvwUitZewvw

Critical minerals: https://www.boem.gov/marine-minerals/offshore-critical-mineral-resources

Elko et al 2021 paper: https://www.sciencedirect.com/science/article/abs/pii/S0964569120303136