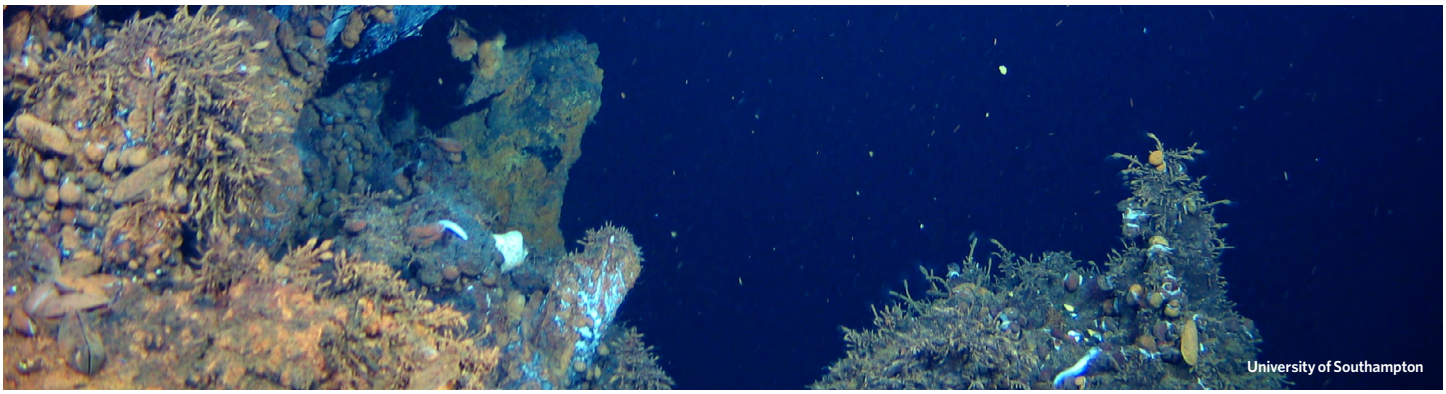



Active vent zones are only 50 square kilometers in total, half the size of Disney World.

# Deep-Sea Mining on Hydrothermal Vents Threatens Biodiversity

Protections could safeguard ecosystems that lie beyond national jurisdiction

## Overview

Hydrothermal vents are unusual seafloor formations where superheated fluids from deep in the Earth have been or are being released into the water column. Hydrothermal vent zones are found at various depths, ranging from shallow waters to 4,000 meters (13,000 feet) below the surface. Vent zones contain polymetallic sulfides rich in copper and zinc. Some vent zones feature substantial concentrations of gold and silver. These mineral riches are prompting discussions on whether hydrothermal vent zones might be mined on a commercial basis.

Hydrothermal vents can be active, inactive, or somewhere in between. Active vent zones—generally found in areas of underwater volcanic activity and seafloor spreading—are often dramatic. Superheated fluids of 350 degrees Celsius (662 degrees Fahrenheit) and above rise from within the Earth's crust through cracks in the seabed and are ejected into the water column through smoking chimneys. Within and around these active smokers are an abundance of chemosynthetic life forms that derive their energy from chemicals, in the absence of sunlight, in contrast to photosynthetic organisms. Next to familiar creatures such as fish, shrimp, mussels, and snails, one also finds stalked barnacles (first described in 2018), yeti crabs (2015), scaly footed snails (2015) and other surprising species that do not owe their existence to sunlight.

Hydrothermal vent zones occupy a tiny fraction of the total ocean floor. Active vent zones are even less extensive: 50 square kilometers (19.3 square miles) in total, half the size of Disney World.

Many hydrothermal vent zones lie on the international seabed beyond national jurisdiction. The International Seabed Authority (ISA) is the organization established by the United Nations Law of the Sea Treaty with authority to determine whether and how vent zones on the international seafloor can be exploited for the metals they contain. The ISA is considering regulations that would govern vent zone mining. Many scientists are concerned, arguing that all vent zones, active or inactive, should be afforded strong environmental protections and that the active zones should be covered by a general no-mining prohibition.

## Vent-zone vulnerabilities

Mining an active vent site would destroy the organisms living there—many of them rare species known only from active vents—and gravely alter their critical habitat. Biodiversity losses could be severe. Leading vent scientists and other experts have proposed that active sites be protected from mining in perpetuity. They also note that mining any vent site, active or inactive, would inflict additional damages to neighboring species and habitats by the sediment plumes that extraction would create. There has been little research into such plumes and it is yet unknown how they would travel, settle, or what level of smothering by plumes would kill vent animals. Given the paucity of plume studies, the ISA should postpone any exploitation of vent sites until more research is conducted.

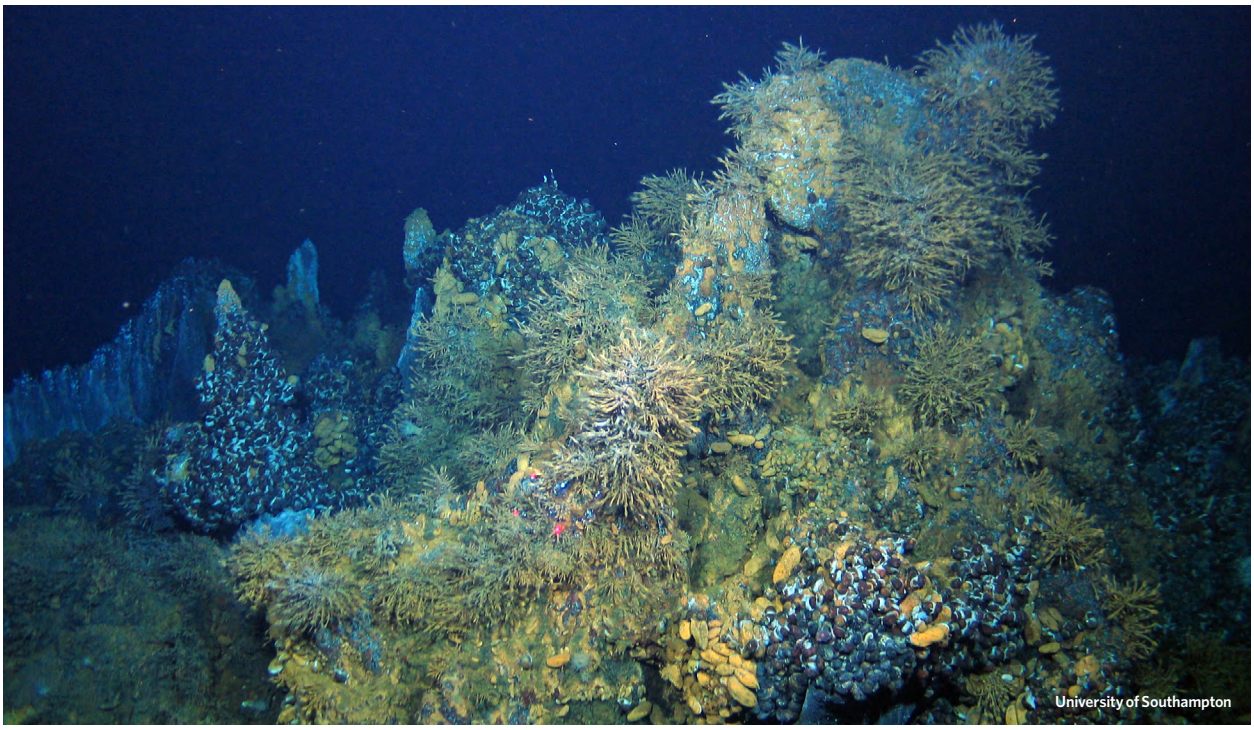
## International obligations

Recognition of the rarity and vulnerability of vents is not new. The U.N. General Assembly has called for States to manage risks to the marine biodiversity of hydrothermal vents[1] and has committed States to protect vulnerable marine ecosystems, including hydrothermal vents.[2] Parties to the Convention on Biodiversity recognized hydrothermal vents as "ecologically and biologically significant areas" where enhanced conservation and management measures would be needed. Any new vent-protection requirements issued by the ISA would be in keeping with multilateral precedent.[3]

## Beneficial uses

Active hydrothermal vents can yield information and provide goods for natural and human benefit. Mining them could mean forgoing new scientific information and future applications that could benefit humankind.

- Active vents demonstrate the viability of ecosystems largely independent of photosynthesis.
- Studies of vents could yield new knowledge and new products. Discovery of the scaly foot snail has led to biologically inspired engineering applications, while studying vent tubeworms' oxygen transport systems prompted improved organ transplant preservation.
- Discoveries of marine genetic resources from vent zones have already led to new medical and industrial applications, and more are anticipated.
- Investigations of vent zones have transformed studies on the origin of life on Earth and may help uncover clues for finding life on other planets.[4]
- Microbial communities on vents contribute to the global cycling of carbon, nitrogen, sulfur, and heavy metals.[5]




Seafloor imagery from the Longqi Vent Field, Southwest Indian Ridge. Studying vents can yield new knowledge and new products.

# Next steps

Near-term actions could safeguard active hydrothermal vent sites and ensure better protection for the seabed. The ISA and its stakeholder community should:

- Determine criteria for delineating active and inactive vents.
- Employ an accessible, updatable scientific information database that identifies and characterizes all known vent sites.
- Ensure that ISA decision-makers have sufficient information on active hydrothermal vents and the likely consequences of habitat destruction.
- Put in place ISA management measures that prohibit mining on active vents and ensure that they are not affected by other ISA-approved activities.
- Adopt similar rigorous protective measures for any other deep-sea environment under consideration for commercial mining.

# Endnotes


1 U.N. General Assembly, "Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks" (1995), https://www.un.org/documents/ga/res/50/ares50-24.htm.

2 U.N. General Assembly, "Sustainable Fisheries, Including Through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and Related Instruments" (2006), https://daccess-ods.un.org/TMP/4512573.18258286.html.

3 C.L. Van Dover et al., "Scientific Rationale and International Obligations for Protection of Active Hydrothermal Vent Ecosystems From Deep-Sea Mining," *Marine Policy* (2018): 20-8, https://doi.org/10.1016/j.marpol.2018.01.020.

4 Woods Hole Oceanographic Institution, "Study Tests Theory That Life Originated at Deep Sea Vents," news release, April 9, 2014, https://www.whoi.edu/press-room/news-release/study-tests-theory-that-life-originated-at-deep-sea-vents.

5 L. Levin et al., "Hydrothermal Vents and Methane Seeps: Rethinking the Sphere of Influence," *Frontiers in Marine Science* (2016), https://doi.org/10.3389/fmars.2016.00072.


## For further information, please visit:

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