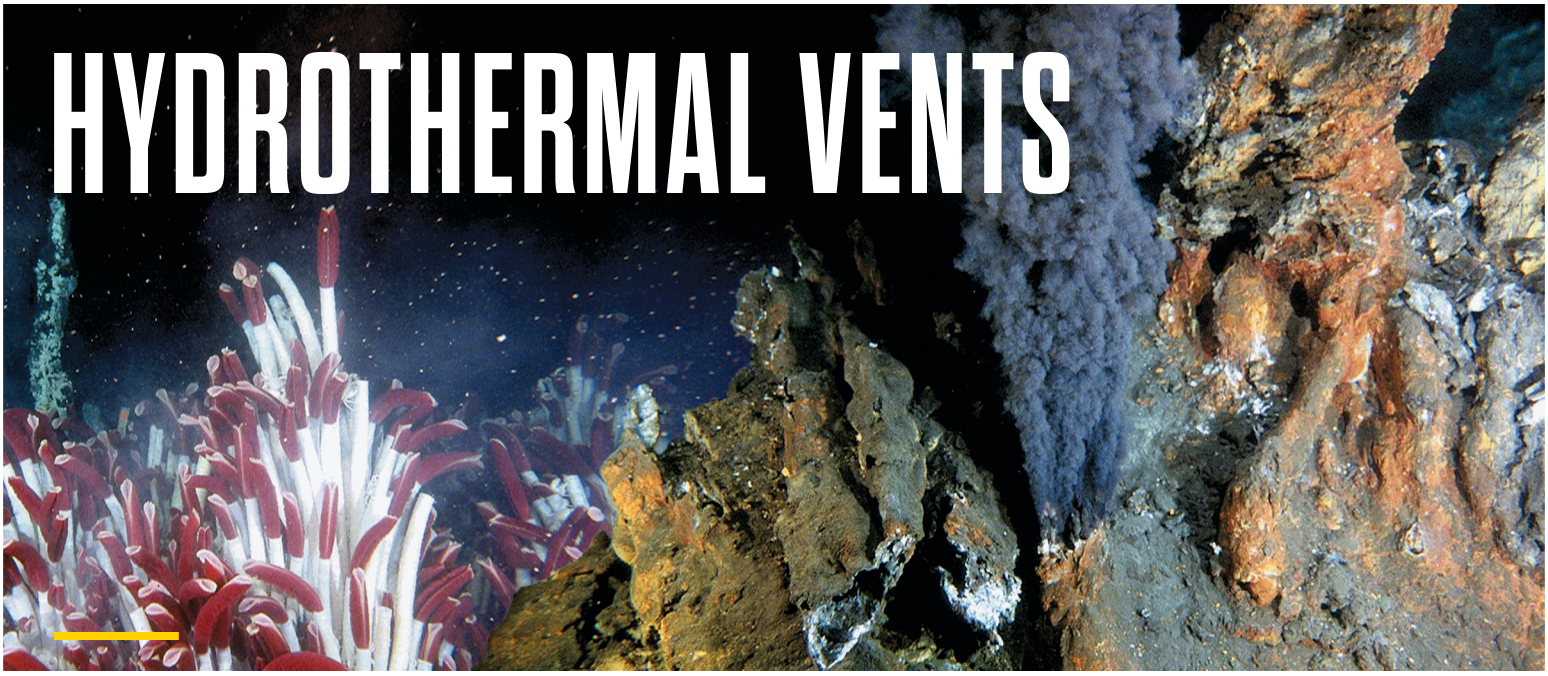
HYDROTHERMAL VENTS



WHAT ARE HYDROTHERMAL VENTS?

In 1977, scientists made a discovery on the bottom of the Pacific Ocean: vents pouring hot, mineral-rich fluids from beneath the seafloor. They later found the vents were inhabited by previously unknown organisms that thrived in the absence of sunlight. These discoveries fundamentally changed our understanding of Earth and life on it.

Hydrothermal vents and their low-temperature cousins, cold seeps, form in many places on the seafloor. Water flows down through cracks and is heated by hot rock deep below, sometimes to more than 400°C (750°F). The hot fluid reacts with minerals in the rocks and rises back to the surface, gushing or gently flowing from the seafloor.

Hydrothermal fluid contains dissolved metals or other chemicals that feed microbes through a process called chemosynthesis. These microbes form the base of the food chain at hydrothermal vents and seeps and support a wide range of other life, including tubeworms, shrimp, and mussels—much as photosynthesis in plants and algae kickstarts the food chain on the sunlit surface. Scientists now think that if ocean worlds like Europa or Enceladus have hydrothermal systems, we stand a good chance of also finding life there.

WHY DO THEY MATTER?

Hydrothermal vents and cold seeps support complex ecosystems of exotic organisms that have developed unique biochemical adaptations to environmental conditions we would consider unbearable. Learning about these organisms can teach us about the evolution of life on Earth and the possibility of life elsewhere in the solar system and the universe.

Hydrothermal vents also act as natural plumbing systems that transport heat and chemicals from the interior of the Earth and help regulate global ocean chemistry. In the process, they accumulate vast amounts of potentially valuable minerals on the seafloor.

Understanding vent sites can inform what risks may be involved in deep sea mining of precious minerals. Vents also support complex ecosystems of exotic organisms that have developed unique biochemical adaptations to high

temperatures and environmental conditions we would consider toxic. Learning about these organisms can teach us about the evolution of life on Earth and the possibility of life elsewhere in the solar system and the universe.

WHAT IS WHOI DOING?

WHOI operates a wide range of underwater vehicles and sensors that can withstand the harsh environment around vents. The human-occupied vehicle *Alvin* can bring scientists directly to vents to study them in person, while remotely operated or autonomous vehicles can perform sophisticated mapping, collect samples, and bring back video and photography of vent life. With these tools, WHOI scientists are studying every aspect of these ecosystems. And scientists are also studying the microbial life at to develop new drugs to treat cancer, inflammation, and nerve damage. Some WHOI scientists even look to hydrothermal vents on Earth for insight into how life might exist on oceans we know exist elsewhere in our own solar system.

LEARN MORE:
go.whoi.edu/hydrothermal

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