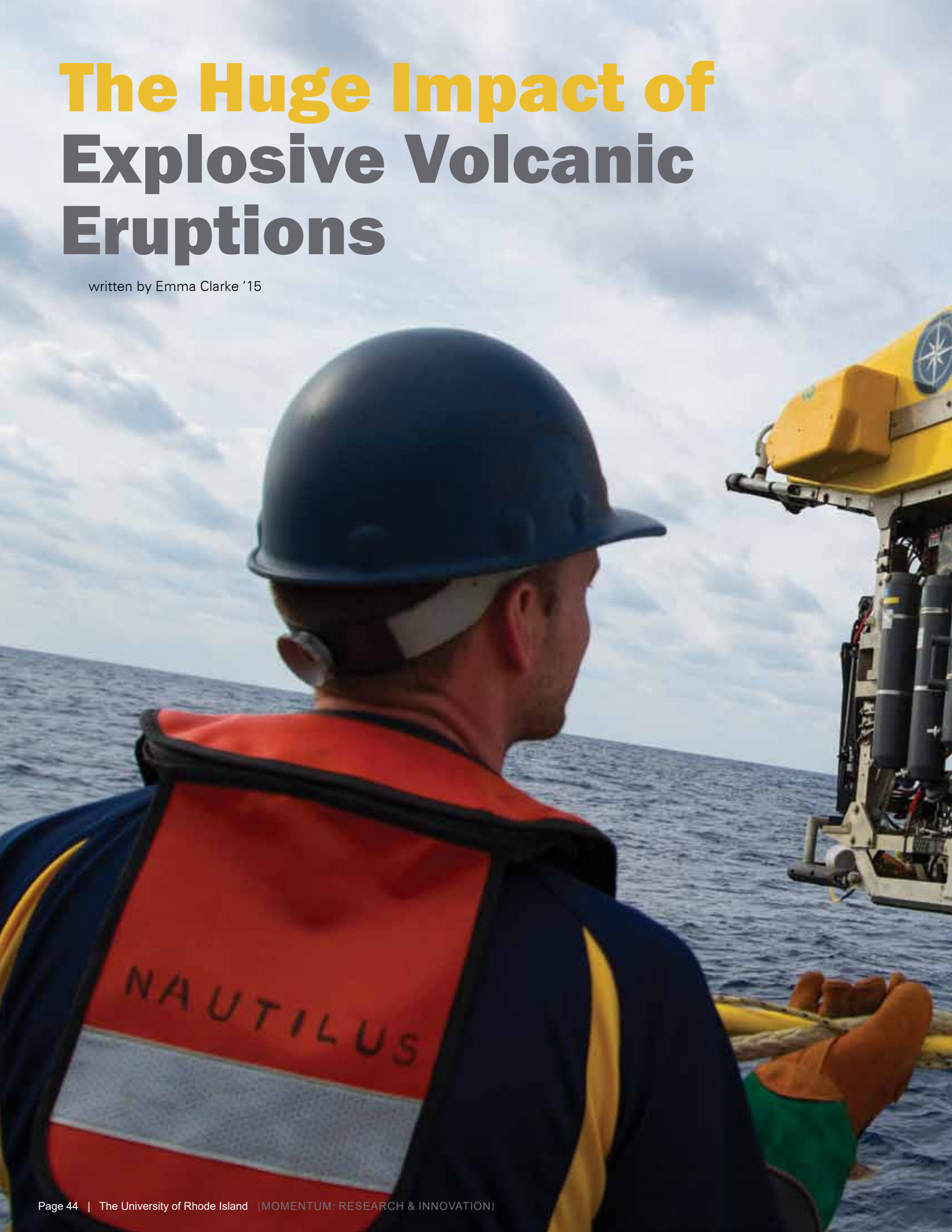
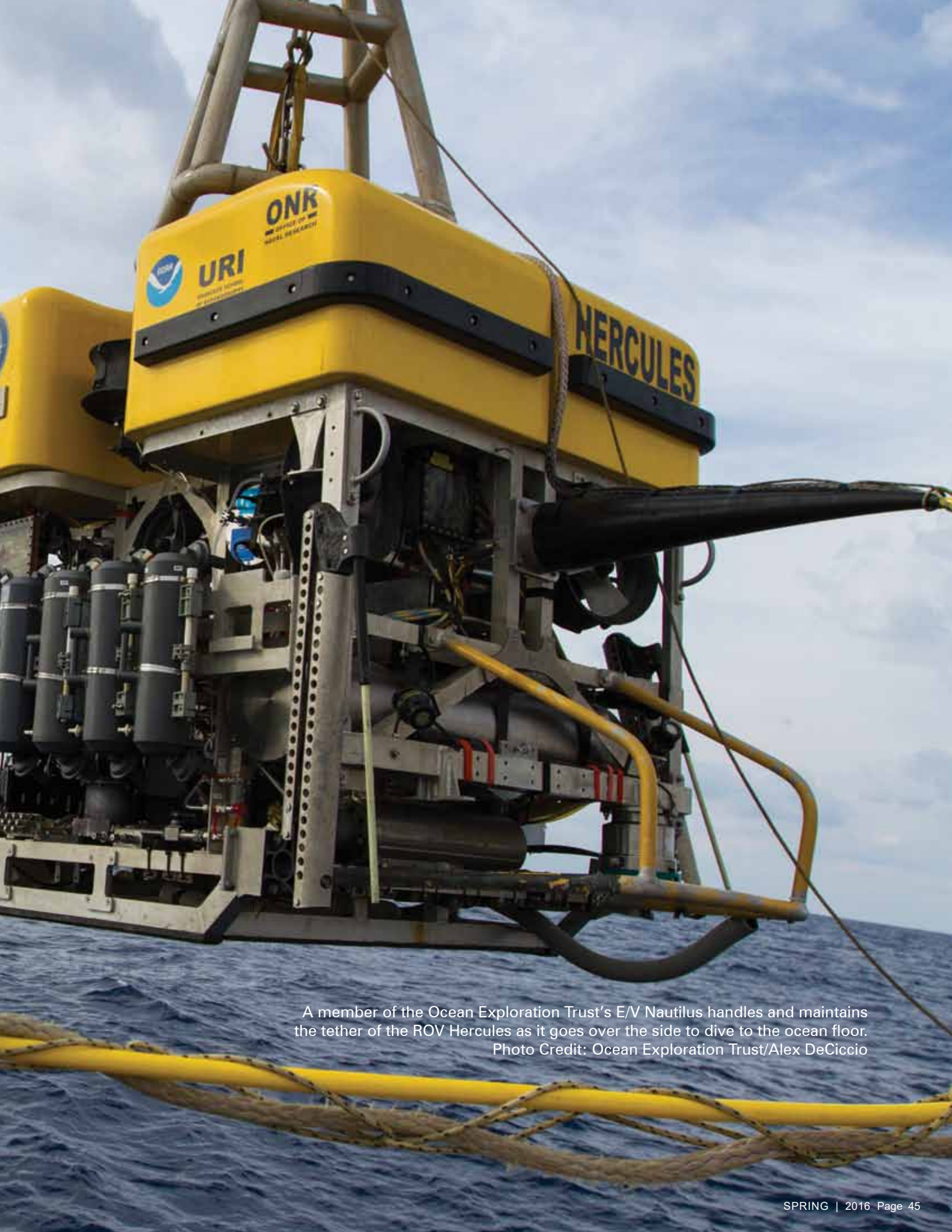
The Huge Impact of Explosive Volcanic Eruptions

written by Emma Clarke '15





A member of the Ocean Exploration Trust's E/V Nautilus handles and maintains the tether of the ROV Hercules as it goes over the side to dive to the ocean floor.
Photo Credit: Ocean Exploration Trust/Alex DeCiccio

Submarine explosive eruption from the West Mata volcano in the western Pacific Ocean.

When Mount Tambora in Indonesia erupted in 1815, the impact rippled across the world. Spewing gas and ash into the air, the volcanic explosion blocked sunlight and ushered in a spell of global cooling. In North America, 1816 became the "year without a summer;" newspapers reported frost into July and failed crops.

"Explosive volcanic eruptions impact the global climate and human populations," says Steven Carey, professor of oceanography at the University of Rhode Island's (URI's) Graduate School of Oceanography. "They can trigger the spread of disease and cause famine."

Although alarming, the destruction these eruptions cause is not unique.

"When I was a graduate student in 1980, Mount St. Helens erupted and I went out there about a week after the eruption. I was blown away by the scale and magnitude of this event," he says. "It was an 'aha' moment for me. I made the decision that I wanted to study this type of volcano."

For the first 20 years of his career Carey studied many aspects of volcanoes and their eruptions, including the factors that determine the style and magnitude of the blasts, a practice he refers to as "forensic" volcanology.

"A detective goes to a crime scene and tries to unravel what happened," Carey explains. "That's exactly what we do. We look for clues about what the volcano did in the past, to try to figure out what it'll do in the future."

Forecasting is critical. If experts make the right predictions they can save lives.

Many people know the infamous story of Mount Vesuvius, the volcano that erupted and destroyed the Italian city of Pompeii in 79 AD, which killed more than 15,000 people.

Carey was part of a team that traveled to Vesuvius in the late 1980s to study the eruption to understand why this event killed thousands of people. "How did the city become entombed and how did those people die?" were among the principal questions researchers sought to answer. They were able to reconstruct the timing of when hot blasts of gas and ash struck Pompeii and killed its inhabitants.

More recently, Carey is taking his expertise to new depths – underwater

volcanoes. One may not think that a landmass at the bottom of the ocean could mean much for people on land, but underwater volcanoes affect our lives, ecosystems and economies. Explosive blasts from submarine volcanoes can cause tsunamis, such as the 1883 eruption of Krakatau in Indonesia that killed about 36,000 people. Tsunamis can be devastating to coastal communities, especially today since an increasing proportion of the world's population is developing and living in these areas.

Carey explains that the most exciting thing about underwater volcanoes is that so little is known about them.

"Our understanding of land volcanoes is sophisticated," he says. "The ocean is the new frontier for volcanology."

To perform his research on these volcanoes, Carey has teamed up with Robert Ballard, a URI professor of oceanography, who is perhaps most famous for discovering the *RMS Titanic* shipwreck in 1985. Carey and Ballard, along with other oceanographers, geologists and scientists, use robots to explore the ocean floor and collect rock samples, which they bring back to URI to study.

"We've been looking at why and how these volcanoes erupt," Carey explains. "But now I'm also very interested in hydrothermal venting."

Hydrothermal vents are cracks in the ocean floor, where water heated from inside the Earth escapes. On land such vents include hot springs and geysers. Underwater, they can host biologically exotic communities of giant tube worms and clams of great interest to researchers for their ability to survive in extreme conditions. These vent systems usually occur where tectonic plates are separating, near volcanically active locations, but are also present where plates are colliding such as around the "Ring of Fire" in the Pacific Ocean. In addition to the strange biology, the vents are also sites where new mineral deposits rich in gold, silver, and copper are being formed.

According to Carey, these hot vent mineral deposits create a new frontier of economic opportunity and are likely to become the basis for an entirely new industry. Although, he says, there are concerns about the methods used for mining these minerals; some mining methods could wipe out entire vent communities that need to be studied.

These vents also can provide insight about how climate change will affect our planet in the future. Water around hydrothermal vents typically is highly acidic, allowing researchers to study how organisms react. These conditions provide a window into what may happen with ocean acidification brought on by buildup of green houses gases in the atmosphere.

"When you go to these submarine volcanoes, you get a sense of how species are impacted by acidic water," Carey says. "Organisms can't survive because it's toxic."

Carey's research shows how truly significant this vast, unexplored frontier — the ocean — really is.

Submarine lava flow from West Mata volcano in the western Pacific Ocean.

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