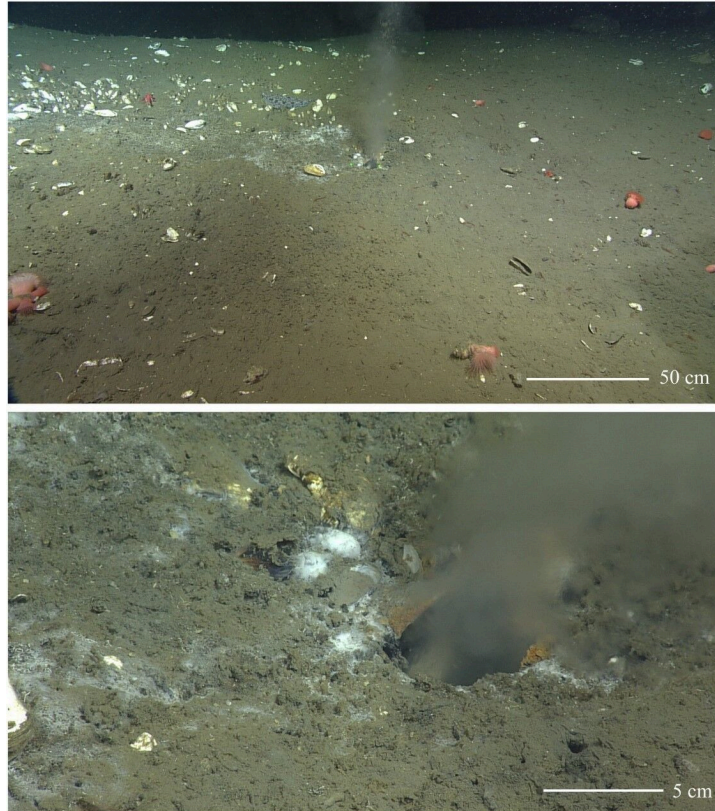


Ocean Leak: What researchers are finding along the Oregon Coast

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The discovery of a leak at the bottom of the Pacific Ocean off the coast of Oregon has been making headlines in recent weeks, but the cause and what it means may not be as dramatic or sinister as originally thought.

When University of Washington (UW) researchers released a paper in January that announced there was a leak about 50 miles off the Oregon Coast that was spewing mineral-rich liquid into the ocean, media outlets were quick to wonder whether this was a precursor to the long-foretold giant earthquake that would erupt from the Cascadia Subduction Zone.

The seep has been named Pythia's Oasis, after the Greek oracle. Associate Professor Evan Solomon, who co-wrote the paper detailing the discovery for the University of Washington, said this is largely overblown.

"Many news organizations have sensationalized the University of Washington press release," Solomon said. "The seep we discovered is a persistent, long-term part of the Cascadia subduction system. It is not a new feature (just newly discovered). Our work shows that the seep has been active for at least 1,500 years."

Discovering Pythia's Oasis

The seep was discovered in 2014 when the Research Vessel Thomas G. Thompson experienced a weather delay on its research cruise in 2014, about 50 miles west of Newport. While in a holding pattern, the ship's sonar picked up unexpected columns of bubbles rising up from the seafloor.

"The seep site was discovered by a graduate student working in my lab group, Brendan Philip, during routine mapping onboard UW's research vessel, the R/V Thompson, in 2014," Solomon said. "The seep was first investigated with the remotely operated vehicle ROPOS in 2015."

The Oregon Department of Geology and Mineral Industries (DOGAMI) has also monitored the seep. According to DOGAMI's Geology Hazard Specialist, Dr. Lalo Guerrero, further investigation revealed that these bubbles originated along a ridge that is 0.6 miles long and located along the transition from the shallower continental shelf to the deeper abyssal plain off Oregon's coast.

Further study indicated that this is not a single seep but a series of small seeps where the warmer and methane-rich water is escaping from the seafloor. The size of the largest seep is about 2 inches in diameter.

The forces behind the leak

The mineral-rich water escaping from Pythia's Oasis is different from Hydrothermal (hot water) vents near undersea volcanoes and mid-ocean ridges that have been observed throughout the world. The Hydrothermal vents produce super-heated water that escapes thanks to the high temperature that forces the water upwards, Guererro said.

The seeps at Pythia's Oasis result from high pressure in the subduction zone where the Juan de Fuca Plate collides with the North American Plate and is pushed downwards.

"The fluid seep indicates that the rocks and sediment found at a greater depth beneath Pythia's Oasis and the subduction zone are under a tremendous amount of pressure, and that pressure "squeezes" the water contained within these rocks up into the ocean," Guererro said. "The significance of this is that the fluids that are contained within the earth's crust and rocks play a fundamental role as a lubricant in allowing rocks that are under pressure to slide past each other (such as Cascadia)."

One of the notable aspects of Pythia's Oasis is that the flow rate of liquid coming from the leak is the highest recorded at a seep site anywhere in the world to date, according to Solomon. The flow at the site is "persistent," and they have recorded constant flow rates of about 0.5 liters of water per second for the last seven years.

"The very high rates of fluid flow mean that Pythias sits on top of a very permeable fault zone. Pythias is co-located with a strike-slip fault that extends from the trench to the upper slope," Solomon said. "This strike-slip fault is vertical and intersects the plate boundary at depth. This allows water to migrate from the plate boundary to the seafloor regulating pressure at depth."

The regulation of pressure, in turn, affects stress along the plate boundary. The results suggest that drainage of water to the seafloor at high rates contributes to locking along the fault.

Putting the findings to use

The study will help researchers in this area better understand the role of fluids in subduction zone earthquakes and, as a result, help agencies like DOGAMI, USGS, and others to better communicate the hazards posed by geologic hazards such as Cascadia to the public, Guerro said.

While the initial reaction to the study was that this could be an indication of the mega thrust earthquake that scientists have forecasted, Solomon and researchers do not believe there is a correlation.

"This does not change our understanding of the risk of an earthquake, but it does shed light on one process that controls stress at Cascadia," Solomon said. "This will be helpful for models of the Cascadia subduction zone, which may eventually be helpful for predicting earthquakes (this is still a long way out)."

This discovery will help provide a better understanding of how the Cascadia subduction system operates, and it will inspire future studies for not only different parts of Cascadia (which extends from Northern California to the north end of Vancouver Island, BC) but in other subduction zones around the world, Guerro said.

Read the extensive report at <https://www.science.org/doi/10.1126/sciadv.add6688>.