Times Standard

Not My Fault: There's a Hole and a Bump in the Bottom of the Sea

Lori Dengler for the Times-Standard
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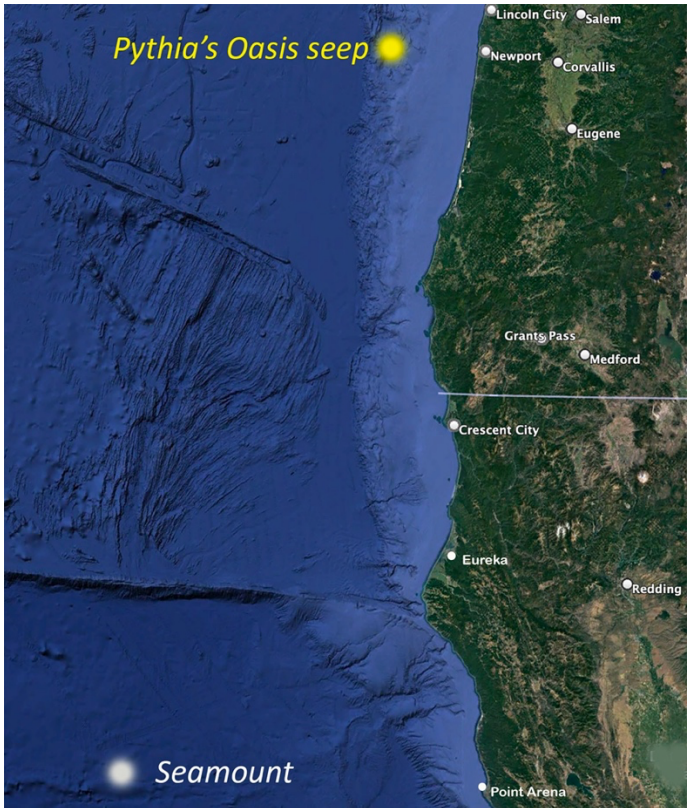

Google Earth imagery of the Pacific seafloor showing approximate locations of Pythia's Oasis and the newly discovered seamount.

I went to a wonderful camp in my youth. Kennolynn Camp was in the Santa Cruz Mountains, offering a cool respite from summers in Palm Desert and plenty of horseback riding. Those campfire songs are etched into my memory. Two recent discoveries on the seafloor off the West Coast reminded me of one song.

"There's a Hole in the Bottom of the Sea" is a silly ditty about a hole, a log, a bump, and a frog in the bottom of the sea. If you don't know it, refrain from a Google search as the tune will stick in your ear for the rest of the day. But it is a fitting reminder of how little we actually know about the bottom of the sea and the many surprises that lurk there.

The two studies describe both a hole and a bump in the seafloor. The hole is off the coast of Central Oregon where fluids are pumping into the ocean. The bump is an odd-shaped seamount offshore of Point Arena. Neither discovery is ominous and media reports that hype

them as the beginning of Armageddon grossly exaggerate. Rather, they both give an interesting glimpse into the great unknown that lies just off our coast and a reminder that there are more unknowns in the depths than there are knowns.

In January 2023, a group of scientists led by Brendan Philip of the University of Maryland reported on the discovery of Pythia's Oasis, a fluid seep on the continental shelf about 50 miles off the coast of Newport Oregon (https://www.science.org/doi/10.1126/sciadv.add6688). Fluid seeps are not unusual in the seafloor but this one had several interesting features and its location near the leading edge of the Cascadia subduction zone prompted a small media flurry.

To the casual observer, the only dynamic part of the ocean is its surface. But there's a lot going on the seafloor that you can't see. Tectonic activity is the main culprit. "Sea floor spreading," first described by scientists Harold Hess and Robert Dietz in the early 1960s describes how ocean floor is pulled apart along great rift zones in areas of nearly continuous volcanic activity.

The seafloor is more dynamic than the land. Continents ride like rafts on the surface as oceans form, grow and eventually die. Plate motions split continents apart producing new oceans and slap them back together destroying them, continually reshaping our planet's surface. The process stretches, squeezes, and shears the seafloor.

Vents and seeps are one of the consequences of these tectonic processes. Most fall into two categories; cold seeps and hot vents. Cold seeps are places where hydrocarbon-rich fluids seep of flow out of small vents onto the sea floor. Only a few degrees warmer than the surrounding ocean temperature, they create unique ecosystems fueled by the properties of the vent. While most common at plate boundaries, they can occur anywhere.

Hydrothermal vents eject gasses and fluids into the ocean at much higher temperatures. Some vents are over 700° Fahrenheit, hot enough to melt metal. They are located along oceanic rift zone and seafloor hotspots. The vents contain an array of metals and minerals which create distinctive white or dark plumes and support an ecosystem entirely independent of the sun.

Pythia's Oasis is the name of the newly discovered seep offshore of Oregon. First discovered by Brendan Philips as a University of Washington grad student in 2015 when he noticed unusual methane bubble activity on the seafloor. Nothing happens quickly in oceanography. It took another four years to mount a sampling expedition and a further trip in 2021 to demonstrate that this spot fell into neither the hot or cold category and is venting fluids at the highest rate seen anywhere in the northeastern part of the Pacific.

The seep, named after Pythia, the oracle of Delphi in classical Greece (no relation to Pythias for whom the Knights of Pythias and Arcata' Pythian Castle are named), is unusual in more than its temperature and flow rate. It contains low-salinity hydrocarbon-rich fluids unlike any seen elsewhere. The vent itself is tiny, a hole in the seafloor only inches across that is pumping out fluids about 15° F warmer than the ocean around it.

It's early in the research history of Pythia's Oasis. The research group argues that the fluid is coming from the Cascadia subduction zone interface and offers a unique look into the properties of the leading edge of the interface. It is a long-lived feature, showing little change from 2015 to the present and, based on the size of deposits nearby, has likely been venting for

at least 1500 years. A recently awarded National Science Foundation Grant will allow the group more intensive studies and continued monitoring.

And now for the bump. In February, the National Oceanographic and Atmospheric Administration (NOAA) reported finding a new seamount offshore of Mendocino County roughly 180 miles southwest of Cape Mendocino. Described by a number of media sources as a 'mountain,' this newly discovered feature rises 3,300 feet above the surrounding sea floor. Seamounts, the common name given to underwater mountains, are common on the ocean bottom. Created by volcanic processes at spreading centers, they are left as scars as the plates on either side spread away from the ridge.

The new seamount is unusual in its shape, a nearly round plug-like feature with very steep sides and its location in a relatively smooth and featureless surrounding. Most seamounts have a gentler shape, reflecting the many small eruptions that built them over millennia. To get such a steep-sided feature, it was likely formed very quickly in a more voluminous eruption. It poses no threat today. The seamount is now hundreds of miles away from the ridge that once formed it and has likely been extinct for many millions of years.

The most interesting thing about the new seamount is how it was discovered. In the past decade NOAA has added a new tool to ocean exploration. Called saildrones (https://www.pmel.noaa.gov/ocs/saildrone), these autonomous floating research stations measure ocean temperatures, currents, salinity, and in some cases, map the seafloor. They remain at sea for up to a year, controlled remotely from land-based stations.

Glancing at Google Earth may make you think we have a pretty good picture of the ocean seafloor. In truth, we know about ten percent of it; the Google imagery is compiled from ocean survey lines and smoothed to fit the data. There are many more undiscovered holes and bumps that remain to be found. Seafloor depth and shape (bathymetry) have consequences. It's what controls the speed and amplification of tsunamis and why some areas are more tsunami vulnerable than others. Tsunami hazard modeling is limited by bathymetry accuracy.

I am excited to see what new technology reveals about the ocean – who knows, a more detailed look might reveal the log and the frog too.

Lori Dengler is an emeritus professor of geology at Humboldt State University, an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times--Standard's. All Not My Fault columns are archived online at https://kamome.humboldt.edu/taxonomy/term/5 and may be reused for educational purposes. Leave a message at (707) 826-6019 or email Kamome@humboldt.edu for questions and comments about this column, or to request a free copy of the North Coast preparedness magazine "Living on Shaky Ground."