Biodiversity surprises at bubbly deep-sea cold seeps along Cascadia fault

December 6 2017

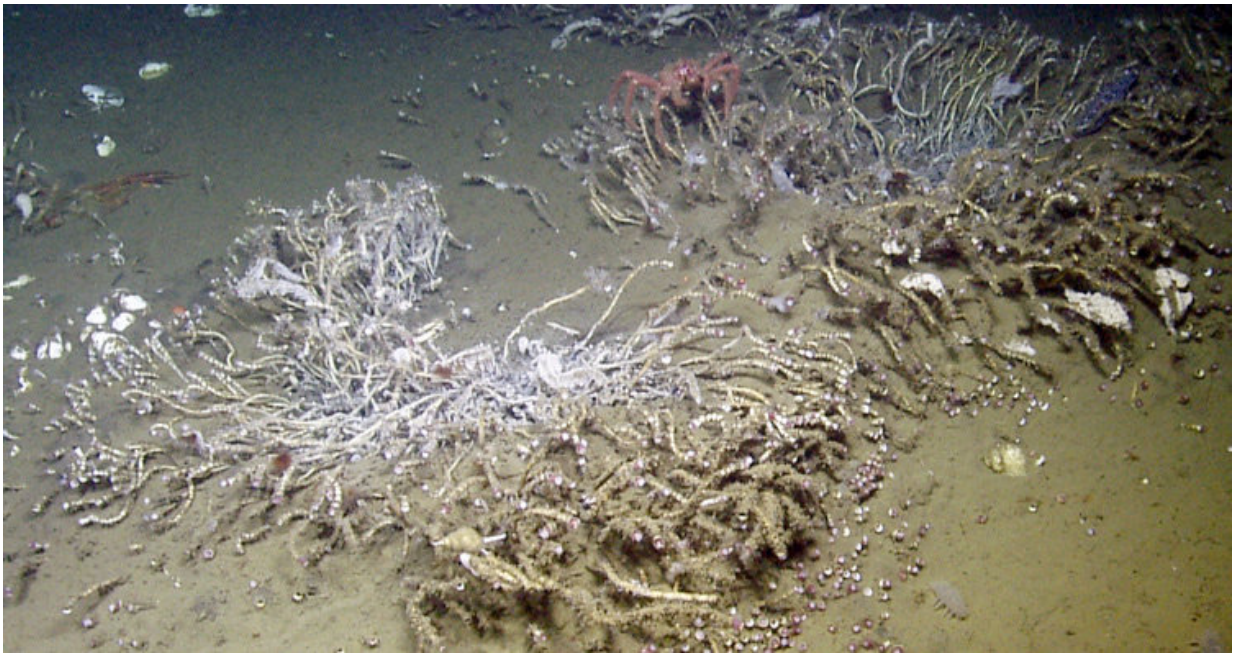

Figure 1: Tubeworm bushes were discovered at the Hecata cold seep off the coast of Oregon in 2016. Cold seeps along the Cascadia Margin attract surprisingly rich and diverse microbial and animal communities, including crabs (top middle). Credit: Ocean Exploration Trust

A new study led by Oregon State University (OSU) graduate student Sarah Seabrook that uses scientific data and samples from Ocean Networks Canada (ONC) focuses on the extent, variability, and complexity of species—from microbes to tubeworms—found at deep-

sea cold seep habitats along the Cascadia fault off the west coast of North America.

The study reports for the first time on the surprisingly rich and diverse microbial and animal communities at eight recently discovered cold seeps, comparing these new sites off the coasts of Washington, Oregon, and northern California with two known seeps off the coast of British Columbia at Barkley Canyon and Clayoquot Slope—both monitored by ONC's cabled offshore observatory.

New animal groups that have been identified at these cold seep habitats—which act as islands of biodiversity in the deep ocean—include tubeworms, mussels, barnacles, crabs, rockfish, anemones, and clams.

"The discovery of tubeworm bushes [vestimentiferan siboglinid] at the Heceta seep off the coast of Oregon in the persistent oxygen minimum zone was a very interesting finding," says Seabrook. "This is the first report of these tubeworms from this region, and is particularly notable as it was believed that their absence at other seeps in the region was due to similar low oxygen concentrations."

The study also unexpectedly found a south-to-north trend in species richness at cold seep habitats, with richer, more diverse microbial communities located at northern sites—particularly the seeps off the B.C. coast at Barkley Canyon and Clayoquot Slopes.

Seabrook's research was based on samples collected during three oceanographic expeditions by ONC and Ocean Exploration Trust (OET) with the aid of two remotely operated vehicles (ROVs). Video footage collected by the ROVs was used to investigate communities of larger animals such as invertebrates and fish. Seafloor sediment samples were also collected by the ROVs, and microbial communities within the sediment were analyzed.

"This is truly remarkable and comprehensive research, where cold seep ecosystems were studied along a very broad geographical range in the northeast Pacific," says ONC staff scientist and University of Victoria (UVic) adjunct assistant biology professor Fabio De Leo, who co-authored the study. "The new discoveries will robustly guide future research on how these habitats interact with the surrounding ocean environment."

The cold seeps are found along the Cascadia fault, where tectonic activity enhances methane production. Temperatures at cold seeps are approximately the same as the surrounding seawater, ranging from 2-4 degrees Celsius along the Cascadia fault. By contrast hydrothermal vents, which also host their own unique biological communities, are at least 60 C and can be as high as 400 C.

Methane—the main component of natural gas— and other hydrocarbons form the basis of cold seep ecosystems, acting as a chemical energy source that fuel microbes through a process called chemosynthesis. Microbes within sediment at these sites convert chemicals released at the seep into forms that can be used by other species and animal communities while also creating a filter that absorbs greenhouse gases, which would otherwise be released.

Cold seeps are often marked by bubble streams of methane rising through seafloor sediment. Along the Cascadia fault there are more than 1,000 known bubble streams, spanning a distance of 800 kilometres, that are associated with cold seep habitats.

First discovered in 1983 on the Florida Escarpment in the Gulf of Mexico, cold seeps are now known to be located in all major oceans along continental margins. Hydrothermal vents, better-known and -studied, have been investigated since the late 1970s.

The study, titled "Heterogenity of methane seep biomes in the Northeast Pacific," is a collaboration among scientists and researchers at OSU, ONC, UVic, OET, and the National Oceanic and Atmospheric Administration. The results will be published in an upcoming issue of "Deep Sea Research Part II: Topical Studies in Oceanography."

More information: Sarah Seabrook et al. Heterogeneity of methane seep biomes in the Northeast Pacific, *Deep Sea Research Part II: Topical Studies in Oceanography* (2017). DOI: 10.1016/j.dsr2.2017.10.016

Provided by Ocean Networks Canada