UC SANTA BARBARA

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Ecosystems of Oil

Generally oil forms deep underground, where deposits are capped by impermeable layers of rock. However, in seismically active continental margins, like Southern California, tectonic activity can lift oil pockets toward the surface and fracture the layers above, leading to oil seeps.

“Offshore from Santa Barbara we have a situation where oil was beginning to form naturally, and then tectonics lifted all that back up and created faults – cracks in the earth – to allow for the oil and gas to seep out,” said David Valentine, a professor of Earth science and biology at UC Santa Barbara.

California’s oil seeps create geographic features in an environment in which the seafloor is otherwise relatively flat. Many of these provide cover and nourishment for microorganisms. Large formations even attract animals. “There’s a whole lot of stuff growing on and around these features, especially the hard spots on the seafloor that things can root into,” Valentine explained. Many of these features are coated in sponges and other animals, and he’s even seen wolf eels taking up residence among massive tar mounds.

Valentine will discuss some of the unique ecosystems that grow around petroleum features offshore on Tuesday, April 30, from 4–5:30 p.m. in the UC Santa Barbara Library’s Pacific Room (located on the eighth floor). The presentation, which is free and open to the public, is part of the Pacific Views: Library Lecture Series, and related to an ongoing exhibition about the 50th anniversary of the 1969 Santa Barbara oil spill.

It can be a complex topic, Valentine noted, but he promised he won’t venture too far into the seaweeds.

There’s a location deep in the Santa Barbara Channel that Valentine calls the “gopher flats.” It’s an area filled with 50 to 70 short, conical tar mounds, each surrounded by concentric rings. Many of them have petrified tar whips extending from the top of the cone. At first these ropes were a complete mystery, but Valentine believes he’s figured out how they form.

Sampling these features has challenged Valentine and his colleagues time and again. The hard, glassy tar is incredibly tough. In fact, the researchers had to develop a new tool just to break pieces off. The team effectively attached a shiv to the submarine’s manipulator arm and stabbed away at the cone. When they got through they were shocked to find out the cones were hollow and packed with pressured gas.

Bringing samples up from the seafloor proved just as difficult. There’s so much compressed gas trapped in the tar that samples shatter from expansion when Valentine brings them up. Essentially, the samples suffer from the bends.

The oil deposits off the California coast formed fairly recently: no more than 23 million years ago. “It’s among the most recent of the oils that you’ll commonly find,” Valentine said, “and that’s because the whole process was short-circuited by plate tectonics.”

For this reason, California oil has slightly different chemistry than many other oils. For instance, it is relatively high in sulfur. But oils contain a dizzying number of different compounds. “There are thousands of different things in oil,” said Valentine. “Thousands, tens of thousands, hundreds of thousands sometimes.” Most of them are hydrocarbons, but it’s amazing how many permutations of carbon and hydrogen the universe can create.

Ultimately, Valentine wants to shed light on how the mingling sea life and oil seeps create distinctive ecosystems off shore. “I’m hoping people walk away with an appreciation for the bizarre ecosystems that exist on the deep ocean floor off the California coast, and the unusual interplay between oil and gas and biology,” he said.

About UC Santa Barbara

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