World's Oldest Oil Spills: Asphalt 'Volcanoes'

These undersea mounds of asphalt have been leaking oil for tens of thousands of years.

By Larry O'Hanlon
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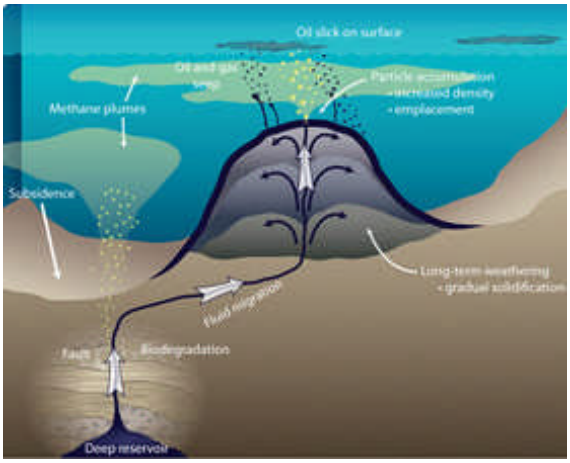
THE GIST

- The "asphalt volcanoes" were found 700 feet down off the shores of southern California.
- The asphalt is at least 35,000-years-old and may contain remains of ancient organisms.
- Massive and deadly eruptions of methane probably accompanied the asphalt.



The active movement of the San Andreas and other faults allows oil and gas from subterranean reservoirs to seep up to the ocean floor.
Jack Cook, Woods Hole Oceanographic Institution

The world's largest and oldest piles of asphalt have been found on a sea floor basin off Santa Barbara, Calif.

The six-story-tall "volcanoes" of crumbly, tarry stuff found 700 feet (213 meters) down are not a highway department waste dump. Rather, they are the result of natural oil seepage from the sea floor over tens of thousands of years.

What's more, rather than being an oily death trap, the mounds are teeming with animal life.

The approximately 35,000-year-old volcanoes are also potential treasure troves of ancient sea organisms, said David Valentine of the University of California at Santa Barbara and lead author on a paper about the discovery in the latest issue of the journal *Nature Geoscience*.

"These are very much like the Brea Tar Pits," said Valentine, referring to the famous terrestrial site filled with the bones of extinct land animals. "Things fall into them when they died. We might be able to get fresh DNA from organisms (buried in and protected by the asphalt)", he said.

The asphalt volcanoes are found beside large pits thought to be the dregs of large, sudden methane releases. These rapid emissions are thought to be responsible for huge die-offs of marine life in the area, as well as possibly contributing to past global climate changes, given that methane is a potent greenhouse gas.

"I can see that this mechanism related to asphalt volcanism -- seepage of heavy oil -- may account for punctuated events of methane release in the history of the basin," observed Kai-Uwe Hinrichs, professor of organic geochemistry at the University of Bremen, Germany.

Hinrichs' research has focused on sudden eruptions of methane from the sea floor. The pits beside the asphalt volcanoes also pencil out an amount of methane in the same ballpark of what Hinrichs estimated came out of the sea floor during an event 44,000 years ago, he said.

As for how something like oil can build up as asphalt on the ocean floor, that's something researchers think they might have worked out.

"Ultimately it's got to get more dense than sea water, or it's going to float away," said Valentine.

What appears to have happened is that the sticky oil seeps from the seafloor already packed with sand, shells and other debris. This already makes it a lot less buoyant. Exactly this sort of debris-laden oil has been seen in other places forming strings as tall as five or six feet, Valentine explained.

Over time the oil in the strings loses the most lightweight and buoyant molecules and picks up even more debris drifting past, eventually causing the gooey clusters to collapse onto the sea floor and accumulate.

Among the other scientific lessons being taught by the ancient asphalt is exactly which chemicals in natural crude oil can survive in the oceans over the long haul. This is particularly important to those people studying how oil naturally breaks down after man-made spills.

"I live in a world of days, hours and minutes," said oil spill expert Christopher Reddy, director of Woods Hole Oceanographic Institution's Coastal Ocean Institute and a co-author on the paper.

Reddy works with Valentine to study natural seeps in order to learn about the first few hours and days of man-made spills. The asphalt volcanoes are at the extreme far end of that oil spill timescale, which is instructive as well.

"This is the greatest stress test... of how long a molecule can survive in the environment," said Reddy. "I basically learned who is the toughest molecule on the block."

Interestingly, the molecules that dominate the asphalt volcanoes are found only in trace amounts in freshly leaked oil, Reddy said. But over millennia, the more volatile molecules have floated away, leaving only the toughest residue.