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Tremors rock earth deep beneath San Andreas Fault Puzzling vibrations baffle researchers

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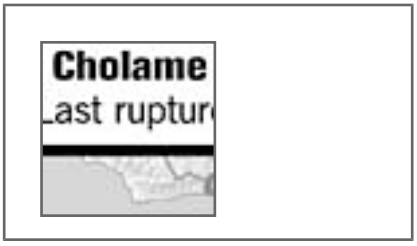

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Mysterious tremors deep beneath the San Andreas Fault near the quake- prone town of Parkfield are shaking the earth's brittle crust, far below the region where earthquakes normally strike -- and scientists say they can't understand

what's happening or what the motions mean.

Seismic researchers are monitoring the strange vibrations closely. But whether the faint underground tremors -- termed "chatter" by some seismologists -- portend an increased likelihood of a major quake in the area is an unsolved puzzle.

Robert Nadeau, a geophysicist at the UC Berkeley Seismological Laboratory, has charted more than 110 of the faint vibrations since they were first detected by the lab's High Resolution Seismic Network in Parkfield three years ago. What concerns Nadeau and his colleagues is that the epicenter of the great 1857 Fort Tejon earthquake, whose magnitude has been estimated at 7.8 to 8, was located almost exactly where the deep tremors are now occurring -- beneath the San Luis Obispo County village of Cholame, some 17 miles south of Parkfield.

The episodes of chatter last from four to 20 minutes and are being recorded from as deep as 40 miles beneath the surface -- up to four times the depth of normal earthquakes, which originate in what scientists call the "seismogenic zone." That zone reaches no deeper than 9 or 10 miles below the Earth's surface.

What's most striking is that deep tremors like

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the Cholame series have never been recorded before on a strike-slip fault such as the San Andreas, Nadeau said.

"We see this kind of tremor activity inside volcanoes like Mount St. Helens," Nadeau said, "but that's due to the movement of rising magma, and in the tremors we've recorded there's no evidence of volcanism and no seismic waves typical of ordinary earthquakes."

Nadeau and David Dolenc, a graduate student in his lab, are publishing the first report on the mysterious sequence of deep tremors today in Science Express, the online edition of the journal Science. They conclude that "future increases in San Andreas Fault tremor activity may signal periods of increased probability for the next large earthquake on the Cholame segment."

The Fort Tejon event rocked the ground violently and ruptured the fault for 225 miles, from northwest of Parkfield to San Bernardino. It was at least as large as the 1906 San Francisco quake. But because the Cholame region was virtually unpopulated at the time, it killed only two people and destroyed only the Tejon Army post, midway along the affected section of the fault.

The area is still sparsely populated; Cholame itself boasts only 2,125 inhabitants. But Paso Robles, with a population of more than 25,000, is only 25 miles west of the village -- and it was badly damaged by a magnitude 6.5 quake only a year ago.

Scientists have estimated that the Cholame segment of the fault has ruptured in a large quake roughly every 140 years. It is now 148 years since the Fort Tejon event, so the possibility of another one may be steadily increasing, they say.

Similar deep tremors have been detected

recently along the coast of the Pacific Northwest, known as the Cascadia Subduction Zone, as well as in Japan -- and there, too, scientists are struggling to understand what their import is. In those areas, giant slabs of the earth's crust are dipping downward and sliding ponderously beneath other great crustal slabs, and scientists believe that fluids -- most likely seabed water saturating the slabs -- are causing the tremors, according to Herbert Dragert of Canada's Geological Survey in British Columbia and Kazushige Obara of Japan's National Research Institute for Earth Science and Disaster Prevention.

In an interview, Dragert said the tremors appear to add stress to a major thrust fault in the Puget Sound region, and that scientists in Canada and Washington are trying to determine whether the tremors might "play a significant role in triggering great earthquakes."

In California, the most mystifying feature of the unexplained tremors is that they are occurring right on the deepest part of the San Andreas -- a fault that does not involve subduction or volcanic activity. Instead, two sides of the earth's crust are sliding horizontally past each other in a motion seismologists call "right-lateral strike slip." In an earthquake, that slip can be an abrupt jolt, and in big quakes, a violent one.

The tremors are occurring at such great depth, Nadeau said, that they must be at the very bottom of the brittle crust -- where the earth's hot, viscous upper mantle begins -- which has been under stress for millions of years.

It's possible that the mantle there resembles something like Silly Putty, Nadeau said, with great chunks of embedded rock grinding against each other to generate the tremor signals. That's purely a speculation, Nadeau conceded, but so far it's the only one around.

"No one really knows what the tremors mean," said David Schwartz, a geophysicist at the U.S. Geological Survey in Menlo Park. "As to what they imply for the possibility of some future quake, we can't tell, and right now we can only wait and see."

A long-awaited magnitude 6 quake struck Parkfield in September at a depth of about 5 miles. That quake was seen as the latest in a series of quakes that have hit around Parkfield on an average of every 22 years between 1857 and 1966.

The Parkfield section of the San Andreas, in southern Monterey County, is the most intensively instrumented seismic danger region in the United States. A borehole 2 miles deep, carrying an array of instruments and called the San Andreas Fault Observatory at Depth, is to be completed next summer.

Whether its instruments solve the mystery of the tremors and determine whether they portend a future Cholame earthquake remains to be seen.

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