Fault system off San Diego, Orange, Los Angeles counties could produce magnitude 7.3 quake

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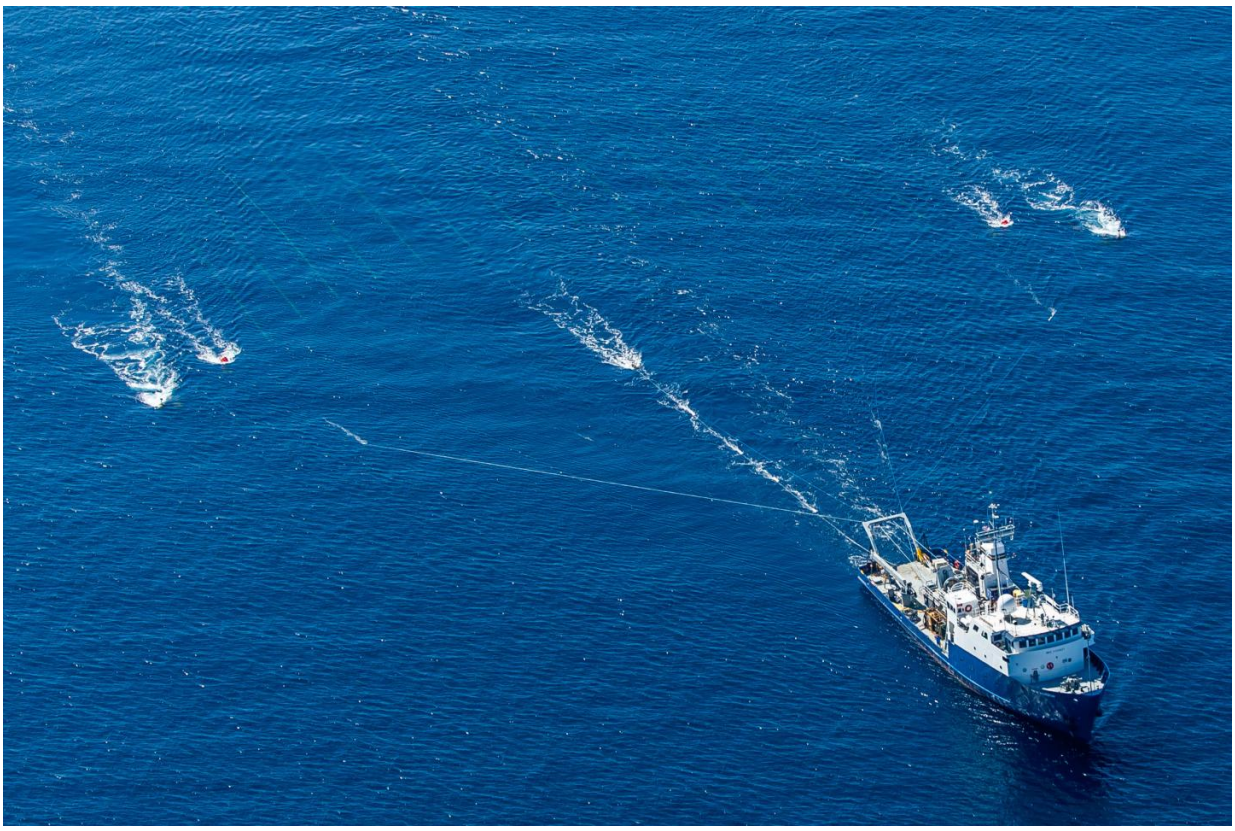

In 2013, Scripps research vessel New Horizon towed a hydrophone array to map the bathymetry of the Newport-Inglewood/Rose Canyon fault zone. Credit: Scripps Institution of Oceanography at UC San Diego

A fault system that runs from San Diego to Los Angeles is capable of producing up to magnitude 7.3 earthquakes if the offshore segments rupture and a 7.4 if the southern onshore segment also ruptures, according to an analysis led by Scripps Institution of Oceanography at the University of California San Diego.

The Newport-Inglewood and Rose Canyon faults had been considered separate systems but the study shows that they are actually one continuous fault system running from San Diego Bay to Seal Beach in Orange County, then on land through the Los Angeles basin.

"This system is mostly offshore but never more than four miles from the San Diego, Orange County, and Los Angeles County coast," said study lead author Valerie Sahakian, who performed the work during her doctorate at Scripps and is now a postdoctoral fellow with the U.S. Geological Survey. "Even if you have a high 5- or low 6-magnitude earthquake, it can still have a major impact on those regions which are some of the most densely populated in California."

The study, "Seismic constraints on the architecture of the Newport-Inglewood/Rose Canyon fault: Implications for the length and magnitude of future earthquake ruptures," appears in the American Geophysical Union's *Journal of Geophysical Research*.

The researchers processed data from previous seismic surveys and supplemented it with high-resolution bathymetric data gathered offshore by Scripps researchers between 2006 and 2009 and seismic surveys conducted aboard former Scripps research vessels New Horizon and Melville in 2013. The disparate data have different resolution scales and depth of penetration providing a "nested survey" of the region. This nested approach allowed the scientists to define the fault architecture at an unprecedented scale and thus to create magnitude estimates with more certainty.

They identified four segments of the strike-slip fault that are broken up by what geoscientists call stepovers, points where the fault is horizontally offset. Scientists generally consider stepovers wider than three kilometers more likely to inhibit ruptures along entire faults and instead contain them to individual segments - creating smaller earthquakes. Because the stepovers in the Newport-Inglewood/Rose Canyon (NIRC) fault are two kilometers wide or less, the Scripps-led team considers a rupture of all the offshore segments is possible, said study co-author Scripps geologist and geophysicist Neal Driscoll.

The team used two estimation methods to derive the maximum potential a rupture of the entire fault, including one onshore and offshore portions. Both methods yielded estimates between magnitude 6.7 and magnitude 7.3 to 7.4.

The fault system most famously hosted a 6.4-magnitude quake in Long Beach, Calif. that killed 115 people in 1933. Researchers have found evidence of earlier earthquakes of indeterminate size on onshore portions of the fault, finding that at the northern end of the fault system, there have been between three and five ruptures in the last 11,000 years. At the southern end, there is evidence of a quake that took place roughly 400 years ago and little significant activity for 5,000 years before that.

Driscoll has recently collected long sediment cores along the offshore portion of the fault to date previous ruptures along the offshore segments, but the work was not part of this study.

In addition to Sahakian and Driscoll, study authors include Jayne Bormann, Graham Kent, and Steve Wesnousky of the Nevada Seismological Laboratory at the University of Nevada, Reno, and Alistair Harding of Scripps. Southern California Edison funded the research at the direction of the California Energy Commission and the California Public Utilities Commission.

"Further study is warranted to improve the current understanding of hazard and potential ground shaking posed to urban coastal areas from Tijuana to Los Angeles from the NIRC fault," the study concludes.

More information: Valerie Sahakian et al, Seismic Constraints on the Architecture of the Newport-Inglewood/Rose Canyon Fault: Implications for the Length and Magnitude of Future Earthquake Ruptures, *Journal of Geophysical Research: Solid Earth* (2017). DOI: 10.1002/2016JB013467

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