Article: Earthquake Fault Heightens California Tsunami Threat, Experts Say

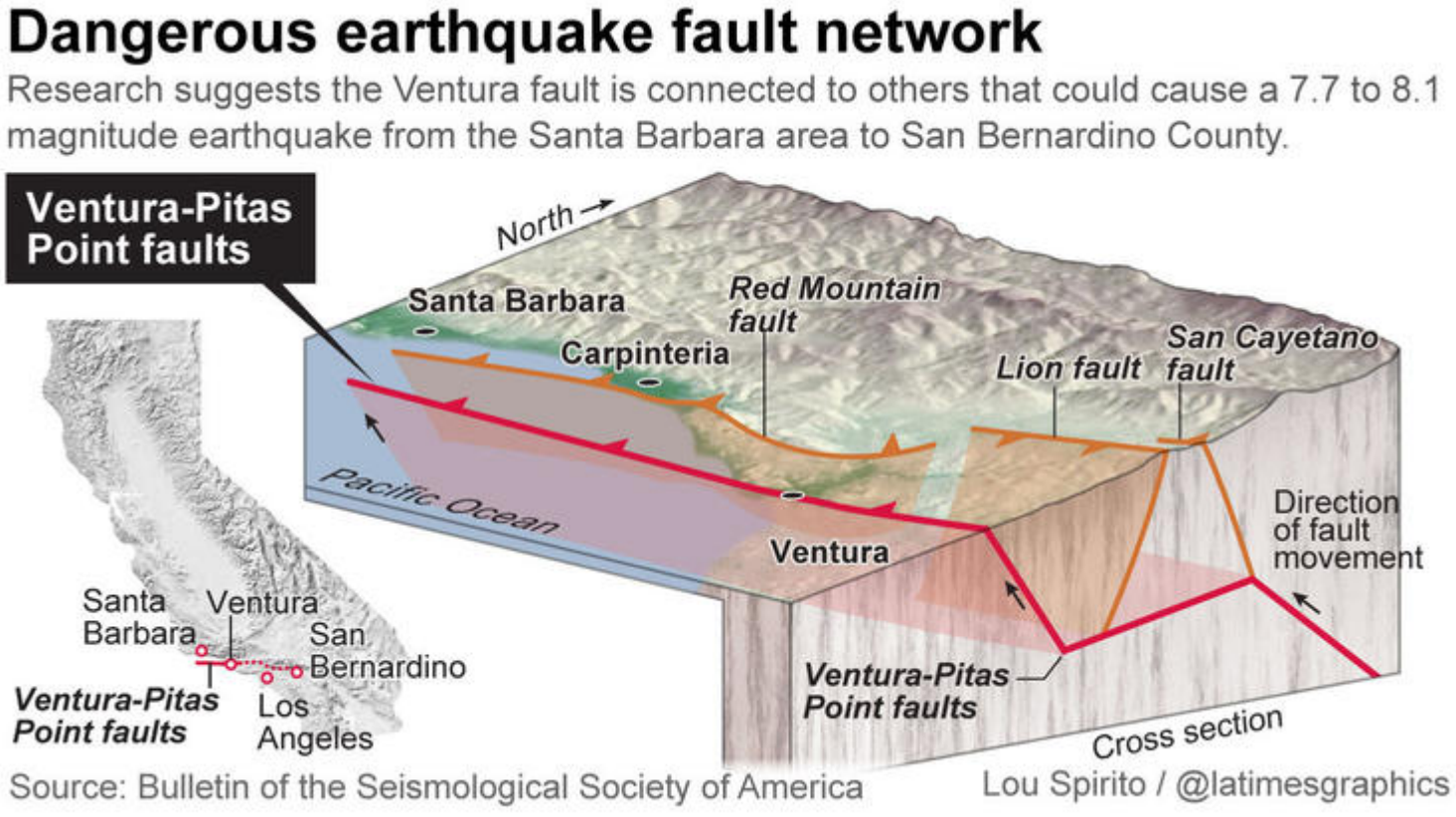
The earthquake fault cuts through the heart of Ventura's quaint downtown, past the ornate hilltop City Hall and historic Spanish-era mission before heading into the Pacific Ocean.

For decades, some seismic experts believed the Ventura fault posed only a moderate threat and was incapable of producing a major temblor.

But research in recent years shows that the fault is extremely dangerous, capable of producing an earthquake as large as magnitude 8 as well as severe tsunamis that until now experts didn't believe were possible from a Southern California quake.

Such a big earthquake on the fault estimated to occur every 400 to 2,400 years, experts said. The last sizable quake on the Ventura area hit about 800 years ago. Large temblors occur on this fault less frequently than on the San Andreas fault, which has long been considered the state's most dangerous.

The California Geological Survey is studying whether it needs to revise tsunami hazard maps because of the researchers' findings. One study found that the inundation would be "severe right along the coast" but didn't call for redrawing evacuation zones farther inland.



"We're not done looking at it," said Rick Wilson, a California Geological Survey senior engineering geologist. "If new information comes forward, we'll change the lines to make sure the communities are as safe as possible."

Scientists have long known the San Andreas fault was capable of producing an 8.0 quake. But because that fault is so far inland in Southern California, the San Andreas does not pose a tsunami risk. The worst tsunami risk comes from a mega-quake from Alaska, which would give Californians hours of time to evacuate.

A huge quake on the Ventura fault could create a tsunami that would begin "in the Santa Barbara Channel area, and would affect the coastline … of Santa Barbara, Carpinteria, down through the Santa Monica area and further south," said Tom Jordan, director of the Southern California Earthquake Center and USC earth sciences professor, who was not involved in the research.

Scientists from Harvard University, USC, the U.S. Geological Survey and San Diego State used underground oil data, cutting-edge earth imaging and research on ancient beach mapping to form their conclusions, which were published last year in the Bulletin of the Seismological Society of America.

One key finding is that the fault now appears to be connected to a network of others that stretch from the Santa Barbara coast and into eastern Ventura County.

A major earthquake on the Ventura fault could then cause shaking along nearby faults to the east, along the foothill suburbs of Los Angeles and San Bernardino counties.

Such a worst-case scenario would mean a 7.7 to 8.1 earthquake ripping from Ventura underneath the San Fernando Valley, Altadena, Azusa and east through to Rancho Cucamonga in San Bernardino County.

"The Ventura fault goes right through downtown Ventura, so … clearly there would be a lot of damage," Jordan said. "But the shaking of an event of this magnitude would affect an area for hundreds of kilometers around it. So it's not just right there in Ventura — it's the whole, effectively, coastal Southern California from Santa Barbara to L.A."

U.S. Geological Survey geophysicist Ken Hudnut, who is also not affiliated with the study, said the findings have changed how scientists view how dangerous this fault is.

"People should stand up and take notice," Hudnut said. "It used to be nobody would've ever claimed magnitudes of earthquakes along this fault system that were in that size range."

Finding more about the Ventura fault took on new urgency after the destructive 2011 Japan earthquake and tsunami. Experts had not foreseen a magnitude 9 earthquake occurring where it did.

As a result, Hudnut said, scientists in Southern California began asking themselves, "What are the big things we're missing?"

That earthquake "informed all of us that, basically, we should really question our assumptions more," he added. "We know it in our minds as scientists that events could occur that are sort of off the charts and blow away all of our prior assumptions — and usually that's because we never saw anything like that happen in historical time."

The first clue to exceptionally large earthquakes on the Ventura fault came from observations of old sections of shoreline west of Ventura. The Pitas Point and Punta Gorda areas were "yanked out of the surf zone by large uplift events," growing between 16 feet to 26 feet suddenly, said San Diego State geology professor Thomas Rockwell.

Such huge movements of earth — as high as a freeway overpass — could be explained only by a mega-quake. "You need really large faults to get large earthquakes," Rockwell said.

But it wasn't immediately obvious what fault could produce it, because there weren't any obvious big faults nearby.

So to better understand what was going on, scientists created an image of the underground Ventura fault, based on old oil well data and an imaging technique known as seismic reflection.

Scientists discovered two key things. First, the fault extends much deeper than some originally thought, said the study's lead author, Judith Hubbard, who worked on this study as she obtained a geology doctorate at Harvard.

Second, at that depth, the Ventura fault could connect with other faults, and they could join together to create a mega-earthquake.

"The only way you can get such large earthquakes on the Ventura-Pitas Point faults is to have it rupture simultaneously, with mechanically interlinked faults to the east or the west," said USC earth sciences professor James Dolan, a coauthor of the study.

To get a 7.7 to 8.1 earthquake, several connected faults including the Ventura would need to slip at the same time, potentially including such faults as the Santa Susana, which runs along the western part of the San Fernando Valley, and even the Sierra Madre fault zones, which extend along the foothill suburbs such as Altadena, Azusa and Fontana.

Such an earthquake along this fault system would produce 32 to 126 times more energy than the 1994 Northridge earthquake, which was a magnitude 6.7.

That scenario is conceivable but rare, Dolan said. A more likely scenario of the Ventura fault rupturing with its neighbors involves the San Cayetano fault, which runs up along the Ventura basin and ends just north of Magic Mountain, or various thrust faults that extend to the west, along the coast of Santa Barbara County.

Evidence has been accumulating for years that earthquake faults previously seen as separate could join together to create an earthquake more powerful than expected.

In 1992, the magnitude-7.3 Landers earthquake that was centered in the Mojave desert occurred on five faults that hadn't been known to be related to each other, said Chris Wills, supervising engineering geologist with the California Geological Survey.

Something similar happened in the 2005 Kashmir earthquake, a magnitude 7.6, that killed at least 86,000 in Pakistan; and the magnitude-7.9 earthquake that struck China in 2008 that killed at least 69,000, Dolan said.

"This is a story that is going to become more and more common," Wills said. "There is a potential on many parts of the fault network for a number of faults to go together and generate a big earthquake."

The last mega-earthquake to hit Southern California was in 1857. The magnitude-7.9 earthquake started up in Parkfield in Monterey County and barreled south on the San Andreas fault for about 200 miles, through Fort Tejon and then east toward the Cajon Pass in San Bernardino County. The quake was so powerful that the soil liquefied, causing trees to sink or be uprooted. The shaking lasted one to three minutes.

In a true Big One, there will be "intense shaking at many more locations" than in the Northridge quake, said U.S. Geological Survey seismologist Lucy Jones. "As you get to the bigger and bigger earthquakes, you're involving a bigger area."

"All it will change is how many other communities are going to be competing for resources," Jones said.

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http://www.latimes.com/local/california/la-me-ventura-fault-20150420-story.html April 20