Large, distant quakes can trigger changes in the San Andreas Fault, new study finds

Paul Rogers, Bay Area News Group, 5-11-11

Distant earthquakes -- even thousands of miles away -- have far more impact on California's San Andreas Fault than scientists previously realized, new research has found.

Large quakes such as the magnitude 9.1 event in Sumatra that triggered tsunami waves across the Indian Ocean in 2004 and the 8.8 quake in Chile last year caused parts of the San Andreas Fault deep underground to suddenly slip, setting off small tremors, according to a study released Tuesday by seismologists with the U.S. Geological Survey in Menlo Park.

There's still no evidence that large quakes in one part of the world can set off large quakes right away on different faults thousands of miles away, said David Shelly, a USGS scientist.

But learning how deep sections of the San Andreas can react when they are hit with seismic waves is all part of unlocking the mysteries of how earthquakes work -- a search that could one day help scientists predict quakes, he added.

"Big earthquakes are triggering an acceleration of the fault that can last for hours or days," Shelly said. "You are triggering something that lasts longer than the seismic waves that are coming through. Over time, that can increase the stress on neighboring patches on the fault, which can generate tremors."

The research was published this week in the journal Nature Geoscience. As part of the work, Shelly and USGS seismologist David Hill, along with University of Georgia researchers Zhigang Peng and Chastity Aiken, studied the impact of major earthquakes from 2001 to 2010 on the San Andreas Fault near Parkfield, a tiny community in the ranchlands of southern Monterey County.

For more than a decade, the USGS has been installing sensitive scientific equipment deep in the fault to measure quakes before, during and after they happen. In Tuesday's study, the researchers looked at seismometers placed in about a dozen bore holes 300 feet below the surface.

They found that 17 quakes around the world caused the fault to suddenly slip in its deep reaches between 10 and 20 miles underground. Those quakes included massive events such as the 8.8 quake in Chile last year, and quakes as small as a 5.4 quake centered near Alum Rock in San Jose in 2007. The 9.0 quake that rocked Japan in March was not part of the study, but its seismic waves did cause minor tremors on the San Andreas, Shelly said.

Because the San Andreas Fault is located at the intersection of two large plates moving about an inch in opposite directions every year, such minor tremors are common, and may well have happened anyway. But the seismic waves racing through from other quakes "speed up the clock," Shelly said, and make them happen sooner.

Whether those changes increase the chances of a large California quake -- or perhaps make it likely to happen sooner than it otherwise would -- is not yet known.

"That question is still completely an open question," said Mary Lou Zoback, vice president of Risk Management Solutions, a risk modeling firm in San Francisco.

"But this study has given us much better insight into the mechanics of the lower crust. It may be that leading up to the next earthquake, whether on the Hayward Fault or San Andreas Fault, we may see a dramatic change in the character of the tremors leading up to that," she said.

The triggered tremors continue for days after the seismic waves have passed.

Although scientists have studied earthquakes seriously for more than 100 years by monitoring cracks in the Earth, fault lines and other changes on the surface, it's only recently that they have begun imaging and measuring quakes underground. By putting instruments deep below the surface, geologists are just beginning to understand the deep reaches of the Earth, free from interference from wind, traffic and other surface events that can cause shaking. Years more research will be needed to understand fully the cause and effect between quakes and distant faults, but the science is advancing every year.

"The big question is, 'What causes earthquakes?' " Zoback said. "And how can we recognize some signal before one happens? One of the ideas is that there is some process occurring in the lower crust just before an earthquake."