Scripps Institution of Oceanography scientists find cause of big earthquakes

Bradley J. Finkes, Escondido North County Times, 8-30-12

Catastrophic earthquakes can be triggered when certain regions of a fault weaken, according to new research from UCSD's Scripps Institution of Oceanography. The weakening produces slippage that jolts normally stable parts of the fault into shaking.

The phenomenon is called "melt welts" by the researchers. Their findings were published Wednesday in the journal Nature. The researchers say the study could lead to better maps of faults, and improvements in engineering buildings to withstand earthquakes.

Studies were conducted at SIO using a rotary shear device that pushed a stationary surface against a rotating surface, combining pressure and movement to simulate how faults operate. Despite being smooth, the surfaces didn't slip smoothly. Certain regions moved first, the regions called the "melt welts", jolting the rest of the surface into movement.

"It is reasonable to assume that if extreme stress and temperature heterogeneities are developing and growing spontaneously on a nominally flat frictional interface in carefully controlled laboratory experiments, they are also present on rough fault surfaces during seismic slip," the study stated.

"Melt welts appear to be working as part of a complicated feedback mechanism where complex dynamic weakening processes become further concentrated into initially highly stressed regions of a fault," said researcher Kevin Brown in a study press release. "The process allows highly stressed areas to rapidly break down, acting like the weakest links in the chain. Even initially stable regions of a fault can experience runaway slip by this process if they are pushed at velocities above a key tipping point."

Brown is first author of the study and a professor in the Geosciences Research Division at Scripps.

Coauthor Yuri Fialko said in the press release that the study "addresses the question of how these ruptures become energetic and dynamic and run away for long distances. Fialko is a professor in the Cecil H. and Ida M. Green Institute of Geophysics and Planetary Physics at Scripps.

A big earthquake could hit the southern San Andreas fault at any time, according to a 2006 study by Fialko, also published in Nature. That study indicated the fault region, that cuts through San Bernardino, Riverside and Palm Springs, has accumulated enough stress to produce an earthquake the size of the 1906 earthquake that devastated San Francisco.

The new study was supported by funding from the National Science Foundation.