Scientists focus on Salton Sea as possible earthquake risk

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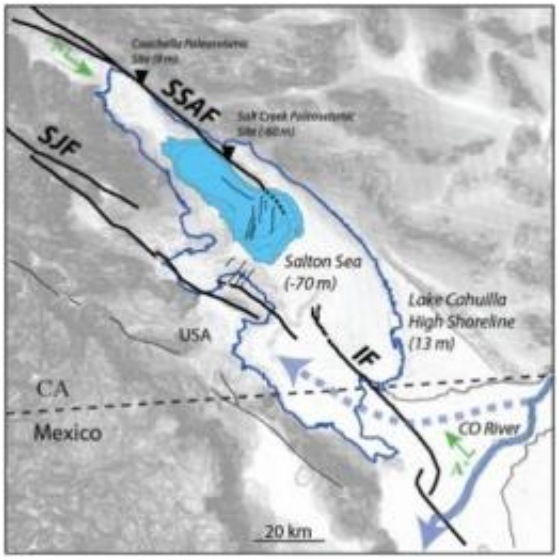
Then-Scripps graduate student Danny Brothers surveys sediments near Salton Sea in 2007. Credit: Scripps Institution of Oceanography, UC San Diego

(PhysOrg.com) -- In a bit of coincidental news, no sooner had earthquake scientists posted warnings about the instability of the southern part of the San Andreas Fault hidden beneath the Salton Sea, than an earthquake struck; albeit it, a rather small one, in just that part of southern California. The study, by the Scripps Institute for Oceanography, just published in *Nature Geoscience*, points out the alarming fact that the fault beneath the Salton Sea has a track record of producing serious earthquakes with regularity every 180 years or so, but has now gone without producing one for 325.

The recent earthquake occurred near the Salton Sea, in conjunction with another across the Mexican border near Mexicali, and was small, measuring just 3.0 on the Richter scale; not enough to cause any real

damage, but it does back up the claims made by the Scripps Institute scientists.

The Salton Sea, the largest lake in California, with a salt concentration higher than the ocean, is in the Imperial Valley, and is about a three hour drive east from either Los Angeles or San Diego, and has only recently come under scrutiny by earthquake scientists due to the discovery that the lake was covering a portion of the infamous San Andreas Fault. Another complicating factor is the fact that the Salton Sea only came to exist in 1905 when above average amounts of snowmelt caused flooding of the Colorado River, filling the huge saltwater basin.



This map shows the current Salton Sea boundaries and outline of Lake Cahuilla at its peak size as well as locations of major area faults. Credit: Scripps Institution of Oceanography, UC San Diego

In their paper, the oceanographers from Scripps, point out not only the fact that the fault below the Salton Sea is about due to set off an earthquake as large as 7.5 that could very well effect Los Angeles if the

shaking moves from south to north following the fault line, but that such a quake could also cause the soil in the local bays and estuaries to liquefy; something that could cause nearby buildings to sink into the earth, such as that which happened in Japan's latest earthquake.

The researchers also raise the question of whether the relatively recent creation of the lake might have altered the time-table of earthquakes in the region, as the massive weight of all that water sits atop the fault, possibly holding everything in place, until such forces become too great, which could of course mean, the area would be in for an earthquake of historical proportions, if it does finally give way.

More information: Loading of the San Andreas fault by flood-induced rupture of faults beneath the Salton Sea, *Nature Geoscience* (2011) doi:10.1038/ngeo1184

Abstract
The southern San Andreas fault has not experienced a large earthquake for approximately 300 years, yet the previous five earthquakes occurred at ~180-year intervals. Large strike-slip faults are often segmented by lateral stepover zones. Movement on smaller faults within a stepover zone could perturb the main fault segments and potentially trigger a large earthquake. The southern San Andreas fault terminates in an extensional stepover zone beneath the Salton Sea—a lake that has experienced periodic flooding and desiccation since the late Holocene. Here we reconstruct the magnitude and timing of fault activity beneath the Salton Sea over several earthquake cycles. We observe coincident timing between flooding events, stepover fault displacement and ruptures on the San Andreas fault. Using Coulomb stress models, we show that the combined effect of lake loading, stepover fault movement and increased pore pressure could increase stress on the southern San Andreas fault to levels sufficient to induce failure. We conclude that rupture of the stepover faults, caused by periodic flooding of the palaeo-Salton Sea and

by tectonic forcing, had the potential to trigger earthquake rupture on the southern San Andreas fault. Extensional stepover zones are highly susceptible to rapid stress loading and thus the Salton Sea may be a nucleation point for large ruptures on the southern San Andreas fault.