UCI spots odd slippage in San Andreas

Gary Robbins, Orange County Register, 1-31-10

Many scientists have long believed that key sections of the San Andreas fault slip at a fairly uniform rate, enabling researchers to suggest a period when the system is most likely to produce a significant earthquake. Or, the "Big One," as many call it. But new research by UC Irvine geologist Lisa Grant Ludwig challenges dogma on the San Andreas, and will could lead others to re-evaluate how far, and how often, the fault slips.

Grant's team also confirmed a broad belief among scientists that the San Andreas is basically "locked," meaning that it is overdue to produce a large earthquake.

But back to the basic research, which was conducted in the Carrizo Plain, or central segment, of the fault, in San Luis Obispo County, about 140 miles north of Orange County.

"Our research addresses two fundamental questions in earthquake science," Grant Ludwig said in an email. To wit: "What happens at the surface of the earth when a fault slips in major earthquake? and, Is there a pattern of fault slip that repeats from earthquake to earthquake? The answers to these questions are important for figuring out when, where and how the next "Big One" will occur.

"To answer these questions, we studied the San Andreas fault in the Carrizo Plain because that is where the (magnitude 7.9) 1857 quake originated and because, in layman's terms, it has a reputation among scientists as being the birthplace of the big ones for California earthquakes.

"Our findings are simple: 1) the San Andreas fault in the Carrizo Plain did NOT slip the same amount in each of the last 5 earthquakes. The pattern of slip was variable. 2) none of the last 5 earthquakes had more than 5-6 meter slip, and most of them had less.

"The first finding is important because it is likely to change the way seismic hazard is assessed for the San Andreas fault, and possibly many faults around the world. The second finding is important because the San Andreas fault is now "loaded" with the same amount of strain - or more - than it released in the last 5 Carrizo earthquakes, including the "great" 1857 quake.

"These findings will probably motivate scientists to revise, or even dismantle, some of their favorite fault models. For emergency planners, public safety officials and engineers, I think it is a reminder that the San Andreas is not a friendly neighbor. But as long as we live here, we need to learn to live with some rumbling and take action to protect ourselves. The sooner the better!"

I asked Grant Ludwig, "Wouldn't the slip rate vary because the size of the last five quakes varied?"

She replied, in an email, "NO. I think you are mixing up slip and slip rate. Slip rate is an average derived from measurements of strain release (i.e. slip) divided by the time period. For the average to make sense, it has to be measured over several earthquakes. This part of the San Andreas fault has a constant slip rate.

"What we TRIED to measure is the slip in individual earthquakes. That is quite tricky. What we succeeded in doing was to show that the slip varied, and to place upper and lower limits on the slip per earthquake. The upper limit was 5-6 m (from the 1857 earthquake). The lower limit was about a meter.

“This probably seems like finding that the prior earthquakes were smaller. But that is not necessarily the case. The slip in 1857 was about half of what we previously thought - but that didn’t change the magnitude of the 1857 quake. It just changed our knowledge of the slip that was released.

“For some of the earlier quakes, the lower slip value COULD mean that the earthquakes were smaller magnitude - at least smaller than 1857. But it doesn’t have to be the case. Even in a big earthquake, the slip is relatively low near the ends of the rupture. So, it could mean that the location of the rupture was different than what happened in 1857.

“Unfortunately, by looking at slip, we can’t tell how big an earthquake was - unless the slip was very large. Then we know for certain that the earthquake was also large. In the case of 1857, we already knew the earthquake was large because of the historical records of shaking and fault rupture. So we don’t downgrade the magnitude or significance just because we have measured a lower value of slip in one place (the Carrizo).”