Study shakes up scientists' view of San Andreas earthquake risk

Researchers find major quakes on the southern section, on average, every 88 years — three times as often as previously thought. It's the strongest evidence yet that we're overdue for a massive quake.

Rong-Gong Lin II, Los Angeles Times, 8-21-10

Southern California is long overdue for a major earthquake along the San Andreas Fault, according to a landmark study of historic seismic activity released Friday.

The study, produced after several years of field studies in the Carrizo Plain area about 100 miles northwest of Los Angeles, found that earthquakes along the San Andreas Fault have occurred far more often than previously believed.

For years, scientists have said major earthquakes occurred every 250 to 450 years along this part of the San Andreas. The new study found big temblors on the fault every 88 years, on average.

The last massive earthquake on that part of the fault was in 1857, leading scientists to warn that another such temblor is likely in Southern California.

"The next earthquake could be sooner than later," said Lisa Grant Ludwig, a UC Irvine earthquake expert and co-author of the study, which was published online in the journal Geology. "It was thought that we weren't at risk of having another large one any time soon. Well, now, it might be ready to rupture."

Other seismic experts described the revelation as a major change in the way they think about earthquake risks along the southern San Andreas Fault.

Thomas Jordan, director of the Southern California Earthquake Center, said the fault is "locked and loaded. It's been a long time since an earthquake has occurred on that fault — over 150 years."

To reach the new conclusion, scientists dug trenches deep into the Carrizo Plain. They used carbon dating and sophisticated imaging technology known as lidar to find signs of earth movements. They were able to detect earthquakes dating back to the 15th century, creating a far more complete record than had previously been known.

The research found that earlier examinations of the San Andreas had badly undercounted the number of major earthquakes. Those were based on observations made in the 1970s when scientists used measuring tape to look for evidence of past earthquakes.

"Now we have better techniques," Grant Ludwig said. "We can see there's actually more earthquakes."

Scientists now estimate that earthquakes occurred on that section of the fault in 1417, 1462, 1565, 1614 and 1713.

The finding adds weight to the view of many seismologists that the San Andreas has been in a quiet period and that a major rupture is possible. A 2009 study, which Grant Ludwig also participated in, suggested that the San Andreas was overdue for a rupture. But Friday's report offers a much more grim estimate of how frequently

quakes have occurred on that segment of the fault.

The San Andreas Fault is considered one of the most dangerous in Southern California, partly because it is so long that its southern section is capable of producing a temblor as large as magnitude 8.1.

By contrast, earthquake experts consider 1994's destructive 6.7-magnitude Northridge quake, which occurred on a different fault, to be a medium-sized quake.

The San Andreas is a sleeping giant. It's hard to imagine the power of a huge quake on the southern section because the last one occurred more than a century ago when the area was sparsely populated. Just 4,000 people lived in Los Angeles at the time.

The 1857 temblor, with an estimated magnitude of 7.9, is known as the Fort Tejon quake, but that's a bit of a misnomer because it is thought to have started farther north, way up in Parkfield in Monterey County. The quake then barreled south on the San Andreas for about 200 miles, through Fort Tejon near the northern edge of what is now Los Angeles County, then east toward the Cajon Pass in San Bernardino County, near what is now the 15 Freeway.

The quake was so powerful that the soil liquefied, causing trees as far away as Stockton to sink. Trees were also uprooted west of Fort Tejon. The shaking lasted 1 to 3 minutes.

The study was conducted by scientists at UC Irvine and Arizona State University. As preliminary data went out for peer review, other earthquake scientists immediately took note.

The U.S. Geological Survey was so concerned that it dispatched its own team of investigators to the Carrizo Plain to look over the initial findings and review the evidence in the trenches.

"These investigators really were challenged by their scientific peers," said Ken Hudnut, a geophysicist at the U.S. Geological Survey. "And they made it through. They ran the gantlet and came through with a really solid paper."

Hudnut said the "Big One" wouldn't compare to most quakes Californians have endured. Such a large quake on the San Andreas, generally above a magnitude 7, would send enormous V-shape energy waves spreading out from the fault. If the earthquake energy hit the Los Angeles Basin, the soft sediment underneath it could actually amplify the waves, making the shaking worse.

Hudnut said the study offers both "bad news and good news," noting that it also concluded future earthquakes along that section of the San Andreas could be smaller than the 1857 quake.

"It's not the kind of news that ought to make people crawl into the fetal position. Rather, it's the kind of information that ought to once remind people about basic earthquake preparedness," Hudnut said.

Grant Ludwig said her research should motivate people to prepare.

"If you're waiting for someone to tell you when we're close to the next San Andreas earthquake, just look at the data," she said. "If we look at the only data we have, it's not very comforting. I'm preparing for that possibility."