



The tremor that struck central Mexico on 19 September levelled buildings in Mexico City.

SEISMIC HAZARDS

Deadly Mexico earthquakes not linked

Despite close timing, researchers doubt that the first big tremor set off the second.

BY ALEXANDRA WITZE

When a magnitude-7.1 earthquake struck central Mexico on 19 September, seismologists immediately wondered whether the tremor had any connection to the much larger jolt that hit off the country's west coast 12 days earlier. Preliminary studies suggest that there is no direct link, but the pair of events this month has drawn renewed attention to Mexico's seismic hazards.

The two quakes struck in a geologically surprising area — in the middle of the Cocos tectonic plate. This piece of Earth's outer shell dives beneath the North American plate off the country's Pacific coast, which is where most of the region's quakes tend to occur. But farther to the east, beneath Mexico itself, the Cocos plate flattens out for hundreds of kilometres under the North American plate before taking

a second, steeper dive into Earth's depths. This month's quakes happened at two different spots in this flat section, owing to geological stresses from the weight of the plate as it plunges downward.

SHIFTING GROUND

The 19 September earthquake, which has killed more than 320 people, struck about 120 kilometres south of Mexico City, much of which is built on an ancient lake bed. That location makes the city vulnerable because tremors shake the sediments like a bowl of jelly (V. M. Cruz-Atienza *et al. Sci. Rep.* **6**, 38807; 2016).

At the National Autonomous University of Mexico (UNAM) in Mexico City, scientists

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clocked the highest ground accelerations recorded at the site since measurements began in 1964, says Victor Cruz-Atienza, head of the UNAM seismology department. The acceleration was nearly double that seen on 19 September 1985, when a magnitude-8.0 quake along the coast of Michoacan sent seismic energy rippling into the capital, killing more than 5,000 people.

Because the epicentre of the 19 September 2017 quake was so much closer to Mexico City than the one in 1985, which struck 350 kilometres away from the city, the shaking was much stronger. At least 45 buildings collapsed in the capital after last week's quake.

If the 19 September tremor had lasted longer, the damage and death toll could have been even worse. UNAM calculations suggest that the magnitude-7.1 quake ruptured a section of the Cocos plate about 40 kilometres long and took only about 10 seconds, says Cruz-Atienza, so structures didn't shake for long enough to cause more of them to fall. Building regulations have also been considerably strengthened since the 1985 disaster.

Some 95 people lost their lives in the magnitude-8.1 quake on 7 September. It was Mexico's largest earthquake in more than a century, tearing about 80 kilometres of the Cocos plate and lasting for more than 40 seconds.

LOOKING FOR LINKS

The occurrence of two earthquakes in such a short time in the middle of the Cocos plate had some scientists wondering whether they could be linked. But others are sceptical: “We don't think there is a causal relationship between the events,” says Cruz-Atienza.

In the long term, big earthquakes can increase the risk of nearby seismic activity by transferring stress within Earth's crust to adjacent geological faults. But that sort of ‘static stress’ transfer would normally not happen at a distance as great as the 650 kilometres between the first and second quakes, says Gavin Hayes, a seismologist at the US Geological Survey in Golden, Colorado. Initial calculations by seismologists Ross Stein at Temblor — a California technology firm in Redwood City that runs an earthquake education app — and Shinji Toda of Tohoku University in Sendai, Japan, suggest that the static-stress increase after the first quake was negligible.

A large earthquake can also set off another by ‘dynamic triggering’ as its seismic waves ripple outwards, affecting geological faults at much greater distances than static-stress transfer does. But dynamic triggering usually happens within hours or days of the initial quake, making the 12-day gap between the 7 September event and the 19 September tremor hard to explain, says Eric Fielding, a geophysicist at NASA's Jet Propulsion Laboratory in Pasadena, California.

“If that happened, the question is why it waited so long to go,” he says. ■