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Why Japan's Massive Earthquake Surprised Scientists

While seismologists expected Japan's next big earthquake to strike near Tokyo, today's major tsunami-creating quake happened out at sea and on a different fault line. Here's why scientists didn't see it coming.

BY SARAH FECHT



Japanese Fishing boats and vehicles are carried by a tsunami wave at Onahama port in Iwaki city, in northern Japan on March 11, 2011.

Fukushima Minpo/AFP/Getty Images

A tremor happens every five minutes in Japan. The country rests along one of the most active fault lines in the world, the so-called "Ring of Fire," and every year the Japanese feel 2,000 earthquakes. So why was the March 11 quake so unexpected? It all boils down to the inexact science of earthquake prediction.

"Earthquakes are never unexpected in Japan," Roland Burgmann, geophysicist at University of California, Berkeley, says. "What was unexpected was how large it was. There have been large earthquakes sprinkled over the plate in the last hundred years, but none of them were nearly as big as this one."

The tectonic plate that supports the Pacific Ocean has been shoving itself underneath Japan for millions of years. If this were a smooth, well-oiled dive, the Pacific Rim wouldn't be so freckled with volcanic and seismic activity. But it's not smooth. The plates rub against each other and because of the resistance, the Pacific plate gets "stuck." Movement stops, but the plate still pushes. As tension builds; something eventually has to snap.

Early Monday morning, something finally gave in the Japanese fault line. And once one part of the fault collapsed, the pent-up energy from the plates' butting heads exploded outward. Japan's fault ripped for 250 miles straight—much larger than seismologists would expect on a fault line that's as jagged and contorted as Japan's.

Scientists who study earthquakes often say that an area is "overdue" for a big one, based on how often earthquakes have rumbled in the past, how much the plates are moving, and how long it's been since the most recent quake. But in Japan, most scientists (mistakenly) had their money on the Tokai fault line near Tokyo, showing that these predictions require a lot of guesswork.

"We're not able to put our finger on the segment where or when the 'big one' is likely to strike next," says Susan Hough, geophysicist at the U.S. Geological Survey. "Even in terms of identifying the overdue segment, we start to think that we can do that, but we keep getting these earthquakes in other places."

This new quake, which was centered to the east of Japan's largest island, Honshu, was unexpected because that area had been earthquake-free for decades at least, according to John Rundle, geophysicist at University of California, Davis.

"I think this is telling us that mega-quakes can happen in more places than we had thought," Hough says. She and Rundle suggest that, based on the frequency of uncommonly large earthquakes in the past decade, maybe it's time to change our expectations of where earthquakes will occur and how large they will be.

"It is opening a debate about how we deal with hazard and risk, and how we design buildings for the expected earthquakes," Hough says. "Do we want to rethink that? Because even though these events are uncommon, when they do happen, they have a high impact."

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