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U.S. NEWS

New Study Rethinks Danger of Large Quakes From Deep-Sea Faults

Researchers Propose Model to Determine Maximum Magnitude of Temblors Possible in Given Time Periods

By TAMARA AUDI

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A boat sits atop a building in Otsuchi, Japan, after a March 2011 earthquake and tsunami devastated a vast area of Japan's Pacific coast. *Associated Press*

Most deep-sea faults in the Pacific Ocean may be capable of generating earthquakes greater than magnitude 9.0, according to new research to be released Tuesday.

The study comes as seismologists are rethinking the danger posed by such deep-sea faults, called subduction zones, which can produce some of the earth's most powerful quakes.

The quakes in these zones generate tsunamis, as one tectonic plate is thrust beneath another and massive swaths of the ocean are violently moved.

The devastating magnitude-9.1 quake in Sumatra in 2004 and the magnitude-9.0 quake that struck northeastern Japan in 2011 occurred in subduction zones that weren't previously believed to have high

probabilities of producing such powerful temblors. Scientists had thought those faults and others like them were too old, among other reasons, to unleash such deadly power. Since those quakes occurred, scientists have been searching for ways to better calculate potential hazards of such faults, which are located throughout the Pacific and near some major cities.

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"Jakarta [in Indonesia] is sitting on top of a subduction zone that is almost identical to the one in northeast Japan," which caused the 2011 tsunami that led to a nuclear disaster in that country, said Chris Goldfinger, a co-author of the study

and a paleoseismologist at Oregon State University. "For decades the assumption had been that zone won't produce a magnitude-9 quake. Well, you know, it might. And this has big implications for other places around the world."

The new study, to be published in the Bulletin of the Seismological Society of America, proposes a model to determine the maximum magnitude possible of an earthquake in these zones during a given time period, by combining the ancient quake record with data of more recent quakes. The authors of the study suggest the occurrence of large quakes over certain time intervals in these zones is based on the total energy accumulated by plate movement, as opposed to other dynamics such as the geological makeup of the region or the angle or age of the plates.

The study's results indicate most of the subduction zones around the Pacific can generate quakes of magnitude 8.5 or greater over a 250-year period, magnitude 8.8 or greater over 500 years, and magnitude 9.0 or greater over 10,000 years.

"Just because a subduction zone hasn't produced a magnitude 8.8 in 499 years, that doesn't mean one will happen next year," said Yufang Rong, a co-author of the study and a seismologist at the Center for Property Risk Solutions of FM Global, a commercial and industry property insurer. "We are talking about probabilities."

The new research isn't the first to suggest that some deep-sea faults may be more deadly than previously thought or to attempt to assign maximum probable magnitudes in such zones. A study published last year in the scientific journal *Physics of the Earth and Planetary Interiors* ranked the danger of deep-sea fault zones based on factors including stress and angle of the plates.

The new study's researchers used the record of quakes recorded with instrumentation in the past century and combined it with paleoseismology—a record of ancient quakes locked in the soil beneath the oceans. That marriage is complicated but promising, scientists who worked on the study said. For one thing, obtaining and reading the ancient record is difficult. The sediment can sometimes be misinterpreted as large storms instead of quakes.

"Historical earthquake catalogs are too short, and paleoseismic data are far from complete," the study notes.

The submarine samples are collected by deep-sea ships that propel a core-sample collector into the sea floor like a dart. The earth that is pulled up in the core sample contains 10,000 years of geological history inside, said Dr. Goldfinger. Scientists used such measurements taken from the Cascadia subduction zone, a deep-sea fault that stretches from Vancouver to northern California, where three tectonic plates are being driven under the North American Plate.

Scientists believe that subduction zone released a 9.0 quake in 1700, which caused a tsunami that flooded villages in Japan. According to the formula used in the study, the Cascadia zone could unleash a magnitude-8.8 quake within 500 years, and a 7.9 quake within 50 years.

The scientists who authored the study said additional work needs to be done to take more samples around other subduction zones across the Pacific to test the formula and build a more complete record of ancient quakes.

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