

## The next great quake

by Bend\_Weekly\_News\_Sources

The 2004 Sumatra-Andaman earthquake and resulting tsunami are infamous for the destruction they wrought. But at the time, many scientists thought the area unlikely to witness a quake of such size.

Now, a geophysicist is urging the public and policymakers to treat as "locked, loaded, and dangerous" all geological structures like the one that spawned that quake. These dangerous zones are at tectonic boundaries, borders between segments of Earth's crust that gradually move relative to each other, according to the scientist, Robert McCall of Rensselaer Polytechnic Institute in Troy, N.Y.

A tsunami can occur when one of the many tectonic plates that make up Earth's outer shell descends, or "subducts," under an adjacent plate. Above, in the first step, the overriding plate, stuck to the subducting plate, gets squeezed. Its leading edge is dragged down, while an area behind bulges upward. This movement goes on for decades or centuries, slowly building up stress. An earthquake results when the leading edge of the overriding plate breaks free and springs upward, raising the sea floor and the water above it. (Courtesy U.S. Geological Survey)

McCall issued his warning in an article in the March 23 issue of the research journal *Science*. Culprits in the most powerful quakes are typically subduction-type boundaries, he explained. These are where one plate generally slips under another, causing friction, cracking, and lifting of plates. Such zones are typically responsible for the magnitude 9 quakes, the most powerful on record, McCall said. "Seismologists have long tried to determine which subduction boundaries are more likely than others to break," he wrote. "Yet, the great earthquake of 2004 ruptured a segment that was thought to be among the least likely to go." On Dec. 26 of that year, the earth under the Indian Ocean buckled and broke, unleashing one of history's worst quakes, logged at magnitude 9.2. Its shock waves created a wall of rushing water that shattered communities up to 1,000 miles away. A magnitude 9 event can result from just 20 meters (22 yards) of slip between two converging plates, less than the length of an 18-wheeler truck, but its impact can be global, McCall said. Slips of this length only occur every 200 to 1,000 years or more at a given boundary, he added; complete records of such events are available for only the past century. Scientists had widely accepted that the age and speed of the subducting plate is important in creating magnitude 9 quakes, based primarily on this 100-year record. But this narrow understanding put the Sumatran subduction zone in a very low risk category, McCall noted. Such limited records cannot map a trend in events that could be several centuries or more apart, he added. In 2004, "Earth gave us a stark reminder of the important difference between improbability and impossibility," McCall wrote. "Our understanding of where and when the next great earthquake will happen is in its infancy at best." Several subduction zones "are near densely populated land areas, and the potential impacts of shaking and tsunamis cannot be overstated," he added. Warning systems must be created with input and support from many countries, in addition to educational outreach to coastal communities, McCall said. "These systems need to be strong and they need to be maintained over the long term, because we have no way of knowing when the next great earthquake will hit."

Courtesy Rensselaer Polytechnic Institute and World Science staff

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