Odds are about 1-in-3 that a mega-earthquake will hit the Northwest in the next 50 years

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The major earthquakes that devastated Chile earlier this year and which triggered the catastrophic Indonesian tsunami of 2004 are more than just a distinct possibility to strike the Pacific Northwest coast of the United States, scientists say.

There is more than a one-in-three chance that it will happen within the next 50 years.

New analyses by Oregon State University marine geologist Chris Goldfinger and his colleagues have provided fresh insights into the Northwest's turbulent seismic history - where magnitude 8.2 (or higher) earthquakes have occurred 41 times during the past 10,000 years. Those earthquakes were thought to generally occur every 500 years, but as scientists delve more deeply into the offshore sediments and other evidence, they have discovered a great deal more complexity to the Cascadia Subduction Zone.

"What we've found is that Cascadia isn't one big subduction zone when it comes to major earthquakes," Goldfinger said. "It actually has several segments - at least four - and the earthquake activity is different depending on where a quake originates. The largest earthquakes occur in the north and usually rupture the entire fault. These are quakes of about magnitude-9 and they are just huge - but they don't happen as frequently.

"At the southern end of the fault, the earthquakes tend to be a bit smaller, but more frequent," he added. "These are still magnitude-8 or greater events, which is similar to what took place in Chile, so the potential for damage is quite real."

Based on historical averages, Goldfinger says the southern end of the fault - from about Newport, Ore., to northern California - has a 37 percent chance of producing a major earthquake in the next 50 years. The odds that a mega-quake will hit the northern segment, from Seaside, Ore., to Vancouver Island in British Columbia, are more like 10 to 15 percent.

"Perhaps more striking than the probability numbers is that we can now say that we have already gone longer without an earthquake than 75 percent of the known times between earthquakes in the last 10,000 years," Goldfinger said. "And 50 years from now, that number will rise to 85 percent."

Understanding the Cascadia Subduction Zone history is further complicated by the possibility that major earthquakes in the northern segment have occurred in "clusters." A thousand years may go by without a major event, and then an earthquake would occur every 250 years or so.

"We're just starting to understand the whole idea of clusters and there isn't consensus on whether we are in one or not," Goldfinger said, "but that possibility does exist, which further suggests that we may experience a major earthquake sooner than later."

The last major earthquake to hit the Cascadia Subduction Zone was in January of 1700, and scientists are aware of the impact because of written records from Japan documenting the damage caused by the ensuing 30-foot tsunami. Their knowledge about what happened in

Oregon and Washington is more speculative, but the consensus - gleaned from studies of coastal estuaries, land formations, and river channels - is that the physical alteration to the coast was stunning.

Goldfinger, who is a professor in OSU's College of Oceanic and Atmospheric Sciences, is one of the leading experts on the Cascadia Subduction Zone and his comparative studies have taken him to the Indian Ocean and, most recently to Chile. In 2007, he led the first American research ship into Sumatra waters in nearly 30 years to study similarities between the Indian Ocean subduction zone and that off the Northwest coast.

When a major offshore earthquake occurs, Goldfinger says, the disturbance causes mud and sand to begin streaming down the continental margins and into the undersea canyons. Coarse sediments called turbidites run out onto the abyssal plain; these sediments stand out distinctly from the fine particulate matter that accumulates on a regular basis between major tectonic events.

By dating the fine particles through carbon-14 analysis and other methods, Goldfinger and colleagues can estimate with a great deal of accuracy when major earthquakes have occurred.

Goldfinger has used the technique to recreate the seismic history of the Cascadia Subduction Zone over the past 10,000 years. Going back further than 10,000 years has been difficult because the sea level used to be lower and West Coast rivers emptied directly into offshore canyons, he pointed out. Because of that, it was difficult to distinguish between storms debris and earthquake turbidites.

The OSU professor is convinced that the Pacific Northwest is at risk for an earthquake that could meet - or exceed - the power of seismic events that took place in Chile, as well as Haiti. If a magnitude-9 earthquake

does strike Cascadia, he says, the ground could shake for several minutes. Highways could be torn to pieces, bridges may collapse, and buildings would be damaged or even crumble. If the epicenter is just offshore, coastal residents could have as little as 15 minutes of warning before a tsunami could strike.

That immediacy is why engineering and coastal communities are exploring different ways of evacuating low-lying areas, including the construction of high-rise, tsunami-resistant facilities.

"It is not a question of if a major earthquake will strike," Goldfinger said, "it is a matter of when. And the 'when' is looking like it may not be that far in the future."

Provided by Oregon State University

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