

Dig deep to learn about early earthquake

Marty Giles, Coos Bay (Ore.) World, 1-30-11

Three hundred and eleven years ago this week. This past Wednesday, Jan. 26, as a matter of fact, between 9 and 10 p.m.

That night, a huge earthquake significantly changed the edge of Oregon. (Estimated to be a nine on the Richter Scale, the January 1700 earthquake here was about the same magnitude of the Indonesian earthquake of December 2004.)

That huge earthquake released pressure on the leading edge of the westward-moving North American tectonic plate. The pressure had forced the land's edge to bow up; the sudden release caused the land's edge to drop a meter or more, inducing the shoreline to subside and plunging many of the beaches and marshes below sea level.

The epicenter of the 1700 "subduction zone" earthquake was off-shore, where the North American Plate is overriding the adjacent ocean plate (the Juan de Fuca Plate), and the movement of the sea-bottom created a tsunami. The tsunami spread in all directions from the earthquake's epicenter, rushing to land and driving ocean water and sand up the river mouths; the sand covered the marshes and tideflats that had subsided during the earthquake minutes before.

Analysis of the growth rings in trees that were buried in that last big earthquake-induced subsidence and tsunami showed the trees died between the summer of 1699 and spring of 1700.

How do we know the exact day and time of the earthquake?

The first people throughout the Pacific Northwest have stories about the earth shaking or giant waves or sudden floods - indeed, some say the story about the young girl that was swept out to sea to become Face Rock in Bandon is a story about a tsunami. Those stories don't have specific dates, however.

But the Japanese had been writing for hundreds of years before 1700, and were in the habit of keeping detailed records. Familiar with the high waves that sometimes followed earthquakes, people in Japan were puzzled by the tsunami that came in the middle of one winter's night without a preceding earthquake - an "orphan tsunami." And they wrote about it.

Those writings helped U.S. Geological Survey geologist Brian Atwater and a team of Japanese scientists to pinpoint the earthquake. Written records noted precisely when the tsunami occurred; scholars translated old Japanese into modern English to give us the year and day and time of the tsunami. The records also documented the damage, both by locations and amount.

The parent for that orphan earthquake was guessed to be the Pacific Northwest. Atwater's computer models demonstrated that it was. Further, we know that tsunamis travel at "jetliner speeds," about 500 miles an hour: Japanese records indicated the tsunami landed there about midnight, so it left here - as it was generated by an earthquake here - between 9 and 10 p.m. the night before.

Continents don't stop moving after such shudders. After the pressure was released, North America continued to override the adjacent ocean plate and snagged again, forcing the land to bow up and eventually to give way.

Digging deeper, literally, researchers have identified many such sand layers under Pacific Northwest marshes, each layer evidence of earlier sudden subsidence and tsunami.

Judging by the depth of the layers, it appears such earthquakes (and their tsunamis) have struck our region in clusters of several earthquakes, with an average of about 300 years between earthquakes in each cluster.

Happy Anniversary?

Details of Atwater's thorough and fascinating journey to solve the mystery are published in *The Orphan Tsunami of 1700: Japanese Clues to a Parent Earthquake in North America*, 2005, available in several local libraries. Details are also available online, for example at www.livescience.com/environment/051220_orphan_tsunami.html.