Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

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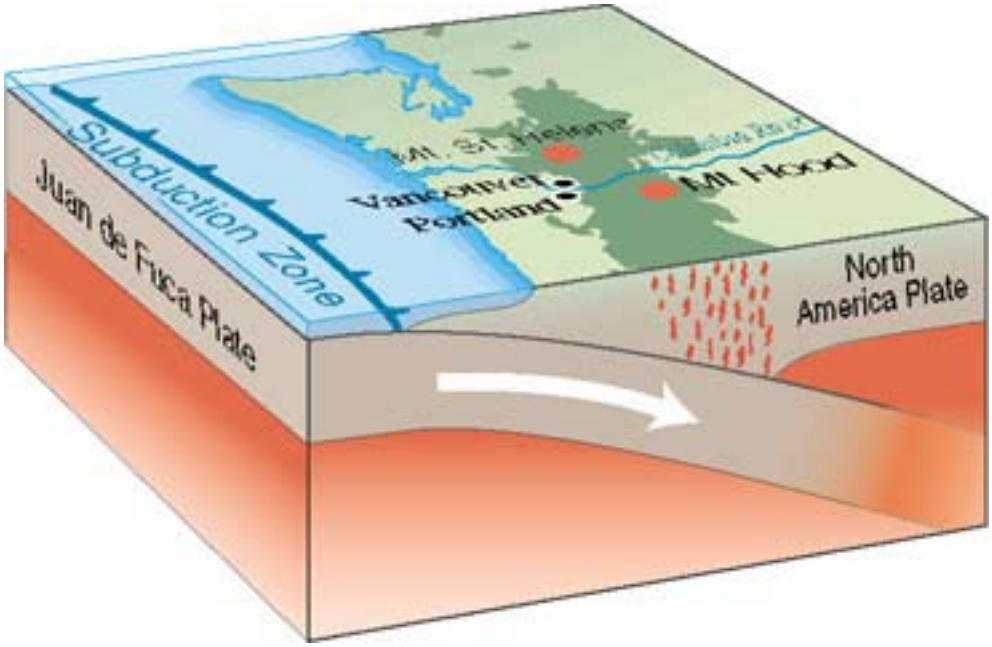
Cascadia–A sleeping Giant



The Cascadia Subduction Zone extends from Cape Mendocino in California to Vancouver Island.

Pounding El Niño storm waves during the winter of 1997-98 exposed an ancient drowned forest along the central Oregon shoreline. Over 200 tree stumps dating to the time of Jesus became an instant tourist attraction. Through dendrochronology, or the study of tree rings, scientists have been able to confirm that these spruce and cedar trees were submerged during a massive earthquake along the offshore Cascadia subduction zone about 300 years ago. Exposure to salt water killed but preserved the trees and sand dunes and estuarine mud then buried them for 300 years.

Geological observations combined with Carbon-14 dating and dendrochronology from sites along the coastlines of northern California, Oregon and Washington provide clear evidence for a great earthquake in 1700 that ruptured at least 600 miles of the Cascadia subduction zone that produced a large tsunami. The sand deposited by this and other tsunamis in estuaries of the Pacific Northwest record seven big earthquakes in the past 2000 years, or one every 333 years on average. It

has now been over 30o years since the last great earthquake, so odds are gradually increasing for another large event.

If the next big earthquake is anything like the last, we could expect 600 miles of rupture with up to 50 feet of slip. The coastline from Cape Mendocino to Vancouver Island would take the brunt of the tsunami, however, with wave heights of 20 feet or more expected. Waves would arrive within 30 minutes so warning time would be short. Some coastal communities are now aware of tsunami dangers and warning signs have been posted. The coastline may likely be down dropped due to drag along the offshore fault, which would expand inundation zones and flood coastal properties.

Most tsunami energy from large subduction zone earthquakes moves perpendicular to the trend of coastline or the trench, or in this case, directly on shore or out into the Pacific towards Japan. The shoreline of central and southern California would therefore be somewhat sheltered from large waves generated by a major Cascadia earthquake. While there is no historic record of what happened here during the huge 1700 earthquake, models or simulations of such an event indicate maximum wave heights of about 6 feet along the central coast.

Tsunamis generated by large earthquakes in the Aleutian trench in 1946 and 1964 raised water levels along the Santa Cruz coastline higher that those predicted from a large Cascadia event. Although we are farther away from the Aleutian trench, we are more directly in the path of Alaskan tsunamis. On November 15, 2006 a tsunami from an 8.3 magnitude earthquake in the Kuril trench north of Japan raised water levels over 6 feet in the Crescent City harbor and left $700,000 in damage. The Santa Cruz harbor experienced three-foot surges of muddy water. A local tsunami generated by a large slump in the head of Monterey Submarine Canyon would provide the least warning time, ten minutes, and could produce significant run up. Evidence of large slumps exists in the canyon, but there is no record over at least the past 150 years of any tsunami generated just offshore. So far, so good.