Investigation of coastal neotectonics and paleoseismicity of the southern Cascadia margin as recorded in coastal marsh systems

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Wetlands in four northern Oregon estuaries (Neawanna Creek (46°), Nestucca Bay (45.2°), Siletz Bay (44.9°) and Yaquina Bay (44.6°)) were investigated for evidence of coseismically buried peats, both in cores and cutbanks and the results were combined with and compared to completed studies in Netarts Bay (45.4°) and Alsea Bay (44.4°) (Darienzo and Peterson, 1990; Peterson and Darienzo, 1990).

The focus of this report will be on the record of buried peats in the upper 2.5 m in four out of the six bays (Neawanna, Netarts, Siletz and Alsea Bay), because similarities were noted in the upper 2.5 m of marsh stratigraphy between those bays. Evidence for rapid coseismic burial for the last five events based on criteria from Atwater (1987), Darienzo and Peterson (1990), and Peterson and Darienzo (1991), includes but is not limited to the following:

1) Buried peats are widespread and correlatable within each bay.

2) Buried peats have abrupt contacts with overlying lower organic layers in all cases and gradual contacts with underlying lower organic layers in most cases.

3) There is usually an anomalous and distinct sandy layer immediately above the buried peat. This layer also has a greater % sand content than the underlying peat as well as the overlying deposit. Mechanisms of placement (river flood, storm, or tsunami) of the anomalous sand layers from Neawanna and Siletz and additional layers from Netarts and Alsea are pending.

4) *Triglochin* rhizomes (usually a low marsh species and tidal flat colonizer) overly a few well-developed peats (indicative of high marsh settings).

Similarities between the bays are:

1) The number of buried peats in the top 2.5 m are the same (five).

2) The depth to the top of each buried peat is consistent between bays. 1st peat depth ranges from 0.40-0.56 m, 2nd peat 0.70-0.96 m, 3rd peat 1.00-1.23 m, 4th peat 1.58-1.76 m, and 5th peat 1.90-2.19 m.

2) Distinct sandy capping layers are present over four out of five of the peats and absent over the third buried peat from the surface in all bays except Neawanna.

3) The third buried peat is not usually well developed and/or easily recognized in all the bays.

4) The radiocarbon ages of the five peats are all within the last 1850 RCYBP.

If burial is indeed coseismic for the five events in all four bays then the similarities between bays suggests synchroneity of events. Given a rupture width of approximately 100 km as has been suggested for the Juan de Fuca (Savage and Lisowski, 1991; Rogers, 1988) and the distance between Alsea and Neawanna of 175 km, then the rupture area is 17,500 sq km. Using Wyss' (1979) equation for earthquake magnitude, M_{max}=logA + 4.15, where A is the rupture width, the paleomagnitude for an earthquake along the northern Oregon coast would have been at least 8.4.

References

Atwater, B.F., 1987. Evidence for great Holocene earthquakes along the outer coast of Washington state. Science, 236, 942-944.

Darienzo, M.E. and C.D. Peterson, 1990. Episodic tectonic subsidence of late Holocene salt marshes, northern Oregon, central Cascadia margin. Tectonics, 9: 1-22.

Peterson, C.D. and M.E. Darienzo, 1990. Discrimination of climatic, oceanic and tectonic forcing of marsh burial events from Alsea Bay, Oregon, U.S.A. (U.S. Geological Survey Professional Paper, submitted).

Rogers, G.C., 1988. An assessment of the megathrust earthquake potential of the Cascadia subduction zone. Canadian Journal of Earth Science, 25, 844-852.

Savage, J. C. and M. Lisowski, 1991. Strain measurements and the potential for a great subduction earthquake off the coast of Washington. Science, 252, 101-103.

Wyss, M., 1979. Estimating maximum expectable magnitude of earthquakes from fault dimensions. Geology, 7, 336-340.