2009 Portland GSA Annual Meeting (18-21 October 2009)

Paper No. 273-6

Presentation Time: 2:55 PM-3:10 PM

FAULT DEFORMATION MODELS FOR GENERATION OF TSUNAMIS FROM THE CASCADIA SUBDUCTION ZONE: IMPLICATIONS FOR SEISMIC AND TSUNAMI HAZARDS ON THE WASHINGTON AND NORTHERN OREGON COAST

PRIEST, George R.1, WANG, Kelin2, GOLDFINGER, Chris3, ZHANG, Yinglong4, WITTER, Rob5, and BAPTISTA, António M.4, (1) Oregon Department of Geology and Mineral Industries, Newport Coastal Field Office, PO Box 1033, Newport, OR 97365, george.priest@dogami.state.or.us, (2) Geological Survey of Canada, Pacific Geoscience Centre, 9860 West Saanich Road, Sidney, BC V8L 4B2, Canada, (3) COAS, Oregon State University, Corvallis, OR 97331, (4) OGI School of Science and Engineering, Oregon Health & Science University, Portland, OR 97291 1000, (5) Coastal Field Office, Oregon Department of Geology, P.O. Box 1033, Newport, OR 97365

Coseismic deformation is generally not a mirror image of interseismic deformation, and therefore coseismic slip for a future Cascadia megathrust earthquake cannot be readily inferred from models of present interseismic locking. New regional fault rupture models developed for tsunami hazard analysis of the northern Oregon coast are instead based on the premise that most coseismic slip on the Cascadia megathrust is likely to be concentrated landward of the Pleistocene accretionary wedge and seaward of a “stress boundary” defined by landward change from contraction to extension of the North American Plate. Coseismic slip in these models is consistent with the assumption that ruptures will encounter velocity strengthening conditions as they propagate up the megathrust where it underlies sediments of the Pleistocene accretionary wedge (the outer wedge). Slip in the Pleistocene wedge is likely in the form of slow afterslip, similar to what was geodetically observed after the 2005 Sumatra earthquake. Coseismic slip also decreases landward as temperature increases down dip on the megathrust. Most of the coseismic slip occurs under the Washington and northern Oregon continental shelf (the inner wedge) in a zone ~ 40-100 km-wide, narrowing in Oregon. This narrowing causes much of the coseismic slip and resulting seismic energy to be further from the open coast in northern Oregon than in Washington. Peak coseismic subsidence for Cascadia earthquakes lies10-30 km landward of the Washington coast but 0-10 km seaward of the northern Oregon coast. Since the sea surface deforms with the seafloor, the resulting tsunami will therefore form a leading elevation wave at the Washington coast but a leading depression wave in much of northern Oregon. A leading depression wave will cause initial withdrawal of water and amplify tsunami runup relative to a leading elevation wave. The leading elevation wave on the Washington coast will cause water at the open coast to begin to rise immediately after a Cascadia earthquake.

2009 Portland GSA Annual Meeting (18-21 October 2009)

General Information for this Meeting

Session No. 273

Living on the Edge: Deformation along the Cascadia Margin

Oregon Convention Center: B110/111/112

1:30 PM-5:30 PM, Wednesday, 21 October 2009

Geological Society of America Abstracts with Programs, Vol. 41, No. 7, p. 702