Juan de Fuca Plate Ridge-to-Trench Experiment: initial results from active source seismic imaging of the Juan de Fuca plate and Cascadia fore-arc *(Invited)*

Details

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Section	Seismology
Session	Understanding the Cascadia Subduction Zone: Contributions From the Cascadia Initiative and Multidisciplinary Studies II
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Abstract

Active source seismic data were acquired during the Juan de Fuca Ridge-to-Trench experiment (June-July 2012) to characterize the evolution and structure of the Juan de Fuca plate from formation at the ridge, through evolution in the plate interior, to subduction at the Cascadia trench. The survey provides plate-scale images of the sediments, crust, and shallowest mantle along two ridge-perpendicular transects, one extending from Axial seamount to the Oregon margin near Hydrate Ridge and the other from near Endeavour segment to Grays Harbor offshore Washington. In addition, a 450

km long trench-parallel line ~10 km seaward of the Cascadia deformation front was acquired to characterize variations in plate structure along the margin. Coincident long-streamer (8 km) multi-channel seismic (MCS) and wide-angle ocean bottom seismometer (OBS) data were collected along each transect. Using these data, our current investigations focus on the properties of the thick sediment blanket covering the Juan de Fuca plate and evidence for fluid flow at the deformation front, crustal structure within the plate interior and near the deformation front, and tracking the downgoing plate beneath the margin. Highlights include the discovery of numerous pockmarks on the seafloor providing evidence of active fluid flow up to 60 km west of the deformation front. Along the Oregon transect, a bright decollement horizon is imaged at ~1sec twtt above basement whereas at the Washington margin, protothrusts of the deformation front reach to the top of the oceanic crust. Variations in sediment properties are documented within the margin-parallel transect with changes in the stratigraphic level of decollement. While crustal thickness is quite uniform along the margin (~ 6 km), variations in crustal reflectivity and in shallowest mantle velocities are observed over ~30-50 km length scales that could be related to structural variations in the Cascadia subduction zone. Further landward, the top of the downgoing plate is imaged intermittently beneath the Oregon margin to within ~30 km of the coast. Patches of shallower bright reflectivity possibly related to the seaward edge of the Siletzia terrane are also imaged. A piggyback 3D onshore/offshore tomography experiment indicates considerable along-strike structural variation along this segment of the subduction zone. West of the deformation front, crustal-scale faults transect the downgoing plate along the Oregon transect. Seismic layer 2A is well imaged for most of this transect but disappears within 15 km of the deformation front, possibly linked to enhanced alteration or deformation associated with plate bending. An overview of these results will be presented here with details provided in companion presentations of the co-authors at this meeting.

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