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TITLE: Pacific plate seaward of the western Alaska trench: A view into the structure of a fossil triple junction

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Tectonophysics (T)

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ABSTRACT BODY: In July-August 2011, the Alaska Langseth Experiment to Understand the megaThrust (ALEUT) program acquired deep penetration multichannel seismic (MCS) reflection and ocean bottom seismometer (OBS) data along a part of the western Alaska subduction zone, from the freely slipping Shumagin gap to the locked regions in the Semidi segment and the western Kodiak asperity. More than 3500 km of MCS data were collected along a series of strike and dip profiles that span the entire locked zone on the megathrust (as indicated by GPS data and estimated rupture zones of past earthquakes), the updip and downdip transitions to stable sliding, bending of the downgoing plate, and preexisting structures in the oceanic crust. These data were acquired using the Langseth's 6600 cu. in. air gun array and two 8-km-long streamers. The source and one of the streamers were towed at a depth of 12 m to maximize low frequencies (and deep imaging) while the second streamer was towed at 9 m for better imaging of the sediments and upper crust. Refraction data were acquired using the same source and short period OBS spaced at ~15 km along two ~400 km-long profiles coincident with MCS data across the Shumagin Gap and Semidi segment. Eight seismometers were deployed onshore from mid June to mid August, which recorded the entire offshore experiment plus local and regional seismicity. Supporting underway multibeam, sub-bottom profiler, gravity and magnetic data were also collected along all MCS/OBS profiles.
Here we present preliminary results from MCS and OBS data analysis regarding the structure of the Pacific plate seaward of the western Alaska trench. The initial images reveal marked variations in the structure of the downgoing plate, including changes in the Moho transition zone and oceanic crustal thickness, bending related faulting and hydration, and sediment input into the subduction zone, some of which occur at oceanic plate suture zones. Abundant normal faulting, thin sediments and lower mantle velocities are observed on the plate approaching the weakly coupled Shumagin Gap, while less bending-related deformation appears to be

associated with the oceanic plate approaching the Semidi segment. Much of the focus of this presentation is on the extraordinary view that the collected data provide into the structure of a fossil triple junction that once separated the Pacific, Kula and Farallon plates. Reflections are captured from depths as great as some 15 km into the lithosphere surrounding this fossil triple junction. These reflections could possibly be caused by gabbroic melts that were once percolating upward but had become frozen when the triple junction was abandoned during a plate reorganization in Early Tertiary. These preliminary observations may provide key new insight into the deep structure of triple junctions, how they operate, and what happens when they fail.

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INDEX TERMS: [3000] MARINE GEOLOGY AND GEOPHYSICS, [3025] MARINE GEOLOGY AND GEOPHYSICS / Marine seismics, [3040] MARINE GEOLOGY AND GEOPHYSICS / Plate tectonics, [3035] MARINE GEOLOGY AND GEOPHYSICS / Midocean ridge processes.