AGU FALL MEETING
San Francisco | 14–18 December 2015

V12A-05: Seismic structure of the ~50 Myr fast and intermediate North Pacific oceanic crust off Alaska

ABSTRACT

Monday, 14 December 2015
11:20 - 11:35
Moscone South - 310

Multichannel seismic (MCS) reflection profiles across North Pacific oceanic Plate off Alaska Peninsula reveal the internal structure of a mature oceanic crust (48-56Ma) formed at fast to intermediate spreading rates. MCS data exhibit a prominent shallow subbasement events interpreted as being the base of the layer 2A. This is the first time that those events are imaged on MCS profiles from a >10Myr oceanic crust. This new result suggests that layer 2A might persist over time as a relatively low seismic velocity layer. MCS data across fast-spreading oceanic crust formed during plate reorganization contain abundant bright reflections, mostly confined to the lower crust above a highly reflective Moho transition zone. The lower crustal events dip predominantly toward the paleo-ridge axis at ~10–30°. Dipping events in the lower crust are absent on profiles acquired across the intermediate-spreading oceanic crust emplaced after plate re-organization, where a Moho reflection is weak or absent. Our preferred interpretation is that the dipping reflections arise from shear zones that form near the spreading center. The reflection amplitude strength of these events can be explained by a combination of solidified melt that was segregated within the shear structures, mylonitization of the shear zones, and crystal alignment. Formation of secondary shear zones with this geometry requires that the upper mantle moves away from the ridge faster than the crust in response to an active asthenospheric upwelling. The other possible interpretation is that dipping events are caused by magmatic layering associated with accretion from an axial magma chamber. Considering that the lower crustal dipping events have only been imaged in regions that have experienced plate re-organizations, we speculate that locally enhanced mantle flow associated with these settings may lead to differential motion between the crust and the uppermost mantle, and therefore to shearing in the ductile lower crust.

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Section/Focus Group: Volcanology, Geochemistry and Petrology

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