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Upper Crustal Structure above Off-axis Magma Lenses at RIDGE-2000 East Pacific Rise Integrated Study Site from 3D Multichannel Seismic Reflection Data

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The 2008 multi-streamer 3D seismic reflection experiment conducted aboard the R/V Marcus Langseth at the RIDGE-2000 East Pacific Rise Integrated Study Site reveals prominent near-axis crustal reflectors on both the east and west flanks of the ridge crest which are interpreted as off-axis melt lenses (OAML) injected at mid-crustal levels. These OAML are probable sites of off-axis volcanism and provide potential heat sources for localized hydrothermal circulation on the ridge flanks, which we speculate may affect off-axis upper crustal structure. To investigate the effect of OAML on the upper crustal structure, we choose two across-axis lines above a prominent OAML on the east flank of the ridge that is present in the southernmost part of our study area: Line 1428P across the middle part of the OAML near 9° 38'N and Line 1476P across the northern end of this OAML near 9° 39'N. Initial analysis includes 2D processing to produce seismic reflection images for each line and 1D travel time modeling on CMP super gathers to characterize Layer 2A and upper Layer 2B velocity structure. Comparison of seismic reflection images and upper crustal velocity structure for the two lines shows a decrease in Layer 2A thickness by 150m and a decrease in the uppermost 2B velocity by 10-20% above the central portion of OAML. We attribute these local anomalies to alteration associated with off-axis hydrothermal circulation driven by the OAML where enhanced precipitation of alteration minerals may seal porosity within lowermost Layer 2A, converting it

to lower velocity uppermost Layer 2B. To further constrain the velocity structure of Layer 2A and Layer 2B, we conduct 2D P-wave tomography with downward continued shot gathers along the studied lines (Harding et al, 2007). The downward continued shot gathers simulate seismic sources and receivers located near the seafloor, and therefore provide travel time information from near-offset refractions that are normally obscured by the seafloor reflection. Layer 2A and 2B arrivals from the downward continued shot gathers are picked and a regularized non-linear inversion is conducted with FAST software (Zelt & Barton, 1998). We present the tomography results as well as associated 3D seismic reflection images that encompass the OAML. With this analysis we aim to better constrain the spatial extent of altered upper crust associated with the OAML. The results have implications for the processes of the crustal formation and off-axis hydrothermal activity on fast-spreading mid-ocean ridges.

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