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Evidence From Three-Dimensional Seismic Reflection Images for Crustal Magma Bodies off the East Pacific Rise

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In Summer 2008 we conducted a three-dimensional, multi-streamer seismic reflection experiment over the RIDGE-2000 East Pacific Rise Integrated Study Site (cruise MGL0812). Here we present 3D post-stack time-migrated reflectivity images of a subset of the MGL0812 main seismic volume covering a ~16x13 km ^{2} area over the ridge crest between 9°50'-57'N and its eastern flank. In addition to reflectivity originating from the axial melt lens, the data show evidence for discrete reflectors interpreted as off-axis crustal melt lenses (OAML). A small, elongated (525x170 m ^{2}) lower-crustal OAML is located 7.5 km east of the axis at a depth of 4.2 km below the seafloor. Two prominent irregular (but roughly equi-dimensional, 1x1 km ^{2}) mid-crustal OAMLs are found 5.5 km and 7 km east of the rise axis at depths of 2.1 and 2.3 km below the seafloor, respectively. These two melt bodies are 2.5 km apart from each other, but are inter-connected by a thin channel of melt pockets. The large melt sill that is deeper and farther from the ridge axis appears to be formed by two distinct smaller sills offset just by ~100 m. These two large OAMLs sit outside of the 6km-wide axial low P-wave velocity zone (LVZ, as tomographycally imaged along a 2D OBS

seismic refraction profile across the southern end of the study area). However a weak but coherent channel of reflectivity connects the larger, slightly shallower melt sill closer to the ridge axis with the axial LVZ. This suggests that these off-axis melt bodies may feed melts to, or are being fed from, the LVZ or mush volume from which the axial crust is constructed. Although we cannot discriminate between these models yet, our results show that the magmatic system of the EPR is more complex than anticipated. The interconnected system of off-axis melt bodies and axial magma system may result in complex lava compositional and age variation patterns in seafloor samples.

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