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TITLE: Distribution of melt along the East Pacific Rise 9°50'N from amplitude variation with angle (AVA) of incidence technique

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ABSTRACT BODY: Multichannel seismic (MCS) data collected in 2008 along the crest of the East Pacific Rise (EPR) 8°20'-10°10'N offer an excellent opportunity for studying along-axis variations in seismic properties of the mid-crustal magma sill imaged at ~1.6 km below seafloor and inferring along-axis variations in the physical properties of this melt body. Locally, pre-stack data show a clear decrease in the amplitude of the P-wave reflection off the top of the magma sill as a function of angle of incidence, an observation reminiscent of the amplitude response of some hydrocarbon-saturated reservoirs, which may imply that within these regions the sill contains fully molten material. In oil and gas exploration, a technique known as amplitude variation with angle of incidence (AVA) analysis has been developed to derive reservoir properties from amplitude behavior. One such method, developed recently, uses intercept (derived from near-angle of incidence information, A) vs. slope (derived from mid-angle of incidence information, B) as seismic attributes to infer reservoir properties. Here, for the first time, we apply this approach to the mid-ocean ridge environment to infer variations in melt content of the axial magma sill. Using the presence of a converted P- to S-phase at the AMC as the first-order proxy for melt, we limit the application of AVA analysis to the region between ~9°30' and 10°00'N along the EPR axis. Prior to conducting the AVA analysis properly, data preparation steps are required (Kirchhoff pre-stack time migration, Radon filtering, velocity analysis of the AMC event for its accurate normal move-out correction, conversion of CMP gathers from offset domain to angle of incidence domain, and near and mid angle stacking were carried out here) and an interpretation scheme adequate for the mid-ocean ridge environment is established. The individual regions for conducting the A vs. B AVA analysis were based on previously-defined small-scale segmentation of the axial magma sill. The AVA behavior suggests the presence of melt within the four segments (each 5 to 10 km in length) spanning between ~9°42.3'N and 9°56.2'N. Drainage related to the 2005-06 eruption appears to be limited to a narrow area (~500 m in length) centered at 9°50.6'N. Furthermore, data from the 9°53'N area shows increased scatter of the seismic attributes A and B that can be explained by the anomalous density/velocity relationship for iron-enriched rocks; within this same region, seafloor lavas show a relatively higher concentration of Fe. The intercept vs. slope AVA method tested here thus seems a very promising tool for the study of mid-ocean ridge magma systems.

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