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TITLE: The ups and downs of magma in the crust beneath the East Pacific Rise axis 8°20-10°10'N

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

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CURRENT SESSION: OS10. Integrated Study of Oceanic Spreading Centers: From Mid-Ocean Ridges to Back-Arc Basins

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ABSTRACT BODY: The East Pacific Rise (EPR) between the Siqueiros and Clipperton Transform Faults is a unique site on the global mid-ocean ridge where two documented eruptions have occurred and abundant hydrothermal venting has been extensively monitored over the past two-decades. Multi-channel seismic (MCS) data acquired during cruise MGL0812 to the region permit detailed characterization of the present-day mid-crust magma lens, that feeds modern volcanic eruptions and drives hydrothermal flow in the crust above, for the first-order EPR segment from 8°20' to 10°10'N. From a series of axially centered MCS lines collected during the survey, a composite profile that coincides with the inner axis is constructed. The lines were processed to stack and post-stack time migration assuming a 2D geometry, and reflection events from the axial magma lens and the base of seismic layer 2A were identified. The seismic data reveal that, after accounting for variations in layer 2A thickness, the magma lens detected beneath the innermost axial zone undulates in depth over short spatial scales. Abrupt steps in depth of up to 800 m are observed as well as smaller depth undulations of 50-100 m over along-axis distances of a few kilometers. In addition, numerous lateral discontinuities in the magma lens reflection occur, most of which coincide with local depth maxima in the undulating depth profile, defining a magma lens that is segmented on 5-10 km length scales along the ridge axis.

Seismic data previously collected within our survey area in 1985 reveal that the discontinuities in the magma lens reflection observed in 2008 were also present in the older data, collected prior to the last two documented eruptions. Furthermore, along-axis variations in the cross-axis morphology of the axial high are observed which indicate that this fine-scale segmentation must persist for even longer periods. Pinches and swells in the plan view shape of the axial high are observed over short length scales which are quantified by measuring the area enclosed within bathymetric contours encompassing the inner 2-3 km of the axial high. Low points in the along-axis ridge area profile coincide with magma lens discontinuities or local depth maxima indicating that the longer-term morphological segmentation is linked to segmentation of the present-day magma lens. The

age of the seafloor surface associated with the ridge area measurements provides a minimum duration of the morphologic segmentation of 1-2 ka, which is one-to-two orders of magnitude longer than the expected life span of a magma lens. Hence, many generations of magma lenses must exist to build the morphological segmentation, and focusing mechanisms to maintain magma lens segmentation through multiple periods of lens replenishment are required. Focusing of melt via thermal erosion and melt migration along permeability barriers, both at the base of the crust and within the mid-crust magma lens may occur. The fine-scale ups and downs of the magma lens will also give rise to spatial gradients in thermal structure of the upper crust that must contribute to the patterns of high-temperature hydrothermal flow along the ridge.

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