AGU Abstract Browser Beta

- About
- Meetings
- Sections
- Index Terms

Quick Search | Submit Query

Architecture of Off-Axis Magma Bodies at EPR 9º37-40'N and Implications for Oceanic Crustal Accretion *(Invited)*

Details

Meeting	2013 Fall Meeting
Section	Ocean Sciences
Session	On and Off-Axis Accretionary Processes at Mid-Ocean Ridges II
Identifier	OS42A-04
Authors	Han, S*, Marine Geology and Geophysics, Lamont Doherty Earth Observatory, Palisades, NY, USA Carbotte, S M, Marine Geology and Geophysics, Lamont Doherty Earth Observatory, Palisades, NY, USA Carton, H D, Marine Geology and Geophysics, Lamont Doherty Earth Observatory, Palisades, NY, USA Mutter, J C, Marine Geology and Geophysics, Lamont Doherty Earth Observatory, Palisades, NY, USA Aghaei, O, Dalhousie University, Halifax, NS, Canada Nedimovic, M R, Dalhousie University, Halifax, NS, Canada Canales, J, Woods Hole Oceanographic Institution, Woods Hole, MA, USA
Index Terms	Marine seismics [3025] Midocean ridge processes [3035] Mid-ocean ridges [7245]

Abstract

Oceanic crust is formed by decompression melting of upwelling mantle beneath mid-ocean ridges. At fast spreading ridges, although the mantle melting region is several hundred kilometers wide, crustal accretion is believed to be concentrated in a narrow zone a few kilometers wide centered beneath the ridge axis. However, mid-ocean ridge studies over the past two decades have provided increasing evidence that melt focusing may not occur entirely within this narrow zone. Here, we present 3D multichannel seismic (MCS) images from the East Pacific Rise 9º37-40'N extending to 11 km on the ridge flanks. In the axial region, we observe two axial magma bodies underlying the seafloor discontinuity at ~9°37'N at a depth of 1.5-1.6 km, with an overlapping geometry similar to that of the seafloor structures. On the ridge flanks, a series of off-axis melt lenses (OAML) are imaged, located from 2 -10 km from ridge axis, at 700 to 1520 ms twtt below seafloor (bsf) (~1.6 to 4.5 km), and with various sizes from 0.46 km^2 to 5.15 km^2. The largest body is centered 3.9 km east of the ridge axis and is composed of a series of small discontinuous upward dipping bodies at the western edge of a larger, continuous flat-topped lens. The flat-topped crest of the OAML lies at approximately the same depth beneath layer 2A as the axial magma lens, from which we infer that this OAML has formed by aggregation of smaller melt bodies ascending along the western edge of the main body that accumulate at the base of the sheeted dike section. A cluster of reflectors underlies the OAML at 1260-1510 ms bsf that may be deeper lenses feeding melts to the upper lens. Moho traveltime anomalies associated with this OAML suggest a lower crust that is partially molten with velocities reduced by 8-18% and/or thicker than normal by up to 1 km. The data indicate that melt delivery pathways to the OAML are independent of the axial system. Local volcanic edifices are found above two of the three OAMLs in our study area that we infer to be the eruptive products of the OAML. From the volume of these edifices and the Moho traveltime anomalies associated with the OAML we estimate the potential contribution of off-axis magmatism to the total volume of the crust of a few percent. Off-axis volcanism associated with OAMLs could account for the greater variation in layer 2A thickness observed on the ridge flanks (~30 m) compared with the axial zone (~10 m). The OAMLs imaged in our study area are present over roughly the same distance range as the formation zone for near-axis seamounts and we speculate that volcanic edifices above the OAMLs are small-scale manifestations of near-axis seamount formation.

Cite as: Author(s) (2013), Title, Abstract OS42A-04 presented at 2013 Fall Meeting, AGU, San Francisco, Calif., 9-13 Dec.