New insight to the evolution of backarc basins: Leg 135 drilling transect

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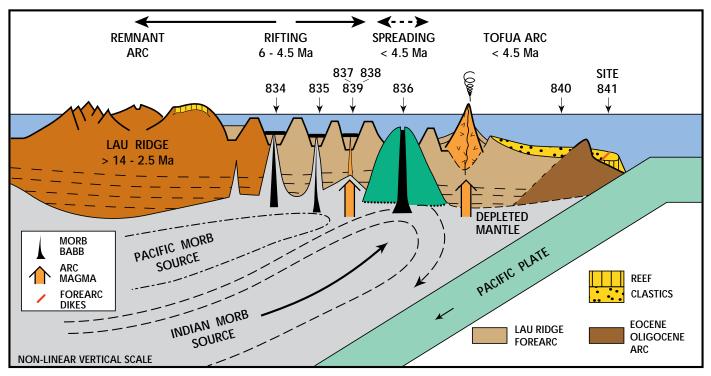
Backarc basins are small extensional basins formed at oceanic plate convergent margins. Upwelling and partial melting of the mantle forms magmas similar in most respects to mid-ocean ridge basalt (MORB) but also includes arc-like and transitional (backarc basin) basalt (BABB) while adjacent mantle sources form arc magmas. Heterogeneous sources, temporal changes, and complex mantle dynamics are implicit. [*Hawkins*, 1994; *Parson and Hawkins*, 1994].

Leg 135 drilling data support a two stage rifting model. Crustal extension and rifting of the Lau Ridge volcanic arc and its forearc began at about 6 Ma. Small rift basins (basin-range structure) were filled with arc-derived clastics and basalt flows mainly having MORB chemistry with Pacific MORB isotopic composition. Basin rifting and BABB/MORB magmatism were synchronous with Lau Ridge rifting and arc magmatism. At about 4.5 Ma a southward propagating spreading center began to form MORB crust. Small, ephemeral, intra-basin seamounts with arc-like chemistry formed adjacent to the MORB-like spreading ridge. MORB-source and island arc-source mantle were juxtaposed under the Lau Basin. A second propagator began at 1.5 Ma and forms MORB crust with Indian Ocean mantle isotope chemistry. The active Tofua (Tonga) arc postdates initial backarc seafloor spreading; it is imprinted on older "backarc," or remnant forearc, crust. The ages and variations of magma types suggest that the mantle wedge retained isolated, small domains of multiply depleted mantle, variably re-enriched in a subduction component, whereas the major source for the BABB crust is relatively more fertile MORB-source mantle. Temporal change from a Pacific source to an Indian MORB-source mantle suggests eastward mantle counterflow above the subducted Pacific plate. Lau Basin geology resembles that of the Mariana Trough; it may offer a general model for western Pacific convergent margin systems.

References:

Hawkins, J.W., Petrologic synthesis: Lau Basin transect (Leg 135), Proc. ODP, Sci. Res., 135, 879-905, 1994.

Parson, L.M. and J.W. Hawkins, Two stage ridge propagation and the geological history of the Lau backarc basin, *Proc. ODP, Sci. Res.*, *135*, 819-828, 1994.



SCHEMATIC CROSS - SECTION LAU BASIN