Fluid-mobile element characterization of early subduction zone magmatism

JEFFREY G. RYAN[1]

[1]School of Geosciences, University of South Florida, 4202 East Fowler Ave., Tampa, FL 33620, USA; ryan@mail.usf.edu

An examination of global published datasets of the products of early subduction zone magmatism indicate key differences in the comparative behaviors of large-ion lithophile (LIL) and "fluid mobile" elements (FME: [1][2]), pointing to differences in material sources, and in the magmatic processes active during the earliest stages of subduction relative to those in mature volcanic arcs.

In arcs, comparative LIL–FME systematics point to the involvement of several chemically distinguishable slab-derived components, and melting processes that are in most cases dominated by fluid-fluxing: only in back-arc and intra-arc rift settings is decompression-controlled melting strongly evident in trace element signatures. FME enrichments tend to correlate inversely with those of LIL elements, indicating abundances that are controlled primarily by the added flux.

Early subduction zone magmatism, as typified in the Izu-Bonin subduction system, involves the initial eruption of "fore-arc basalt" (FAB) [3] followed by boninite magmatism [4], in an intially extensional magmatic setting. LIL-FME systematics for published FAB data show MORB-like patterns of variation and little evidence for FME enrichment, pointing to decompression melting of a mantle source largely unmodified by slab-derived materials. Boninite systematics, by contrast, indicate a dominant role for fluid-fluxed melting processes, and point to additional elements exhibiting "fluid-mobile" systematics (i.e., Ba and K, but not Sr). While most volcanic arcs (including the IBM arc system) exhibit consistently elevated Ba/La, probably indicative of a slab sediment-derived input, boninites show substantial variation in Ba/La and other FME indicators, pointing to varying degrees of addition of fluid-mobile species independent of any specific slab component.

[1] Leeman, *AGU Monograph* **96**, 1996. [2] Ryan and Chauvel, *Treatise on Geochemistry* V. **3**, 479-508. [3]Reagan et al, *GCubed*, **11**(**3**):Q03X12. [4] Stern and Bloomer, *GSA Bulletin*, 1992, 1621-1636.