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Title: THE CHEMICAL COMPONENTS OF BACK-ARC BASIN MAGMAS

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Abstract: The compositions of back-arc basin basalts (BABB) can usefully be viewed as the products of four processes: 1) the nature of the mantle asthenosphere entering the back-arc system and the preconditioning of that mantle during its flow to the site of melting; 2) the influx of a subduction component into the arc basin system; 3) the nature of the interaction between the mantle and subduction components; and 4) melting of water-rich mantle and the crystallization of the resulting hydrous magma. In terms of chemical components, the inflowing mantle asthenosphere can be treated to a first order as a "mantle component", the influx from the subduction zone as the "subduction component" and the contribution of the lithosphere as the "lithospheric component". At a more detailed level, the mantle component may contain the depleted and enriched components that characterize much of the asthenosphere away from subduction zones, the subduction component may contain deep (high-temperature) and shallow (low-temperature) components, and the lithosphere may contain subduction-related and non-subduction vein components and assimilated crustal components. By isolating (finding proxies for) and mapping these components, it is possible to make inferences about the geodynamics and tectonic evolution of arc-basin systems. For the mantle component, Nb/Yb provides a useful proxy for mantle flow, as asthenosphere flow towards the arc front leads to mantle depletion (reduced Nb/Yb) by melt extraction. Geochemical maps using Nb/Yb as a tracer of mantle flow indicate that mantle flow in arc-basin systems is highly variable and depends not only on subduction-driven corner flow, but also on the availability of mantle flow pathways around the edges of the systems and the presence of barriers to flow within the systems. For the subduction component, Ba/Nb provides a useful proxy for the shallow flux and Th/Ba a proxy for the deep flux. Geochemical mapping using Ba/Nb to indicates that the magnitude of the subduction input is a function primarily of basin evolution, mantle flow patterns and arc proximity. Geochemical mapping using Th/Ba highlights the fact that most back-arc basins are characterized by deep subduction components while arc fronts are characterized by the shallow components. The lithospheric mantle component is difficult to isolate, ideally requiring

U-series to distinguish it from recent subduction additions. However, because lithospheric enrichment typically involves small melt fractions, Nb/Ta provides a potentially effective proxy for such a component. Geochemical mapping using Nb/Ta highlights areas of possible lithospheric contribution to back-arc basins, the most obvious being near the rifting margins of the Mariana Trough and parts of the Manus Basin containing extreme trace element enrichments (the XBABB of Sinton and co-workers). Crustal components may be identified using water/K as a proxy, as demonstrated by Kent and co-workers.