

Electronic appendix; Data sources

Figure 2; REE data for volcano suites;

An important element of our approach is to distinguish suites from individual volcanoes. We have collated data from a number of volcanoes in several different arcs where a common differentiation process is thought to relate the rocks to each other. When volcanoes from the same arc are compared (even volcanoes separated by <100 km), they typically show quite distinct trends, and mixing data from volcanoes in an arc (or arc segment or island) will obscure any trends that may be present.

Oceanic Arcs;

Tonga: Acland, S., 1996, Magma genesis in the northern Lau Basin, S.W. Pacific: PhD dissertation. Univ. of Durham.

Aleutians (Okmok): Finney, B.M., 2004, Magmatic differentiation at an island-arc caldera: a stratigraphically constrained multi-isotope study of Okmok Volcano, Aleutian Islands, Alaska: [PhD thesis]: University of Bristol, 296 p.

Aleutians: George, R., Turner, S., Hawkesworth, C., Nye, C., Bacon, C., Stelling, P., and Dreher, S., 2004, Chemical versus temporal controls on the evolution of tholeiitic and calc-alkaline magmas at two volcanoes in the Aleutian arc: *Journal of Petrology*, v. 45, p. 203-219.

Anatahan (Marianas): Wade, J.A., Plank, T., Stern, R.J., Tollstrup, D.L., Gill, J.B., O'Leary, J.C., Eiler, J.M., Moore, R.B., Woodhead, J.D., Tuskell, F., Fischer, T.P. and Hilton, D.R., 2005, The May 2003 eruption of Anatahan volcano, Mariana Islands: Geochemical evolution of a silicic island-arc volcano: *Journal of Volcanology and Geothermal Research*, v. 146, p. 139–170, doi: 10.1016/j.jvolgeores.2004.11.035.

Lesser Antilles: Davidson, J.P., 1986, Isotopic and trace element constraints on the petrogenesis of subduction-related lavas from Martinique, Lesser Antilles: *Journal of Geophysical Research*, v. 91, p. 5943-5962.

Davidson, J.P., 1987, Crustal contamination versus subduction zone enrichment: Examples from the Lesser Antilles and implications for mantle source compositions of island arc volcanics: *Geochimica et Cosmochimica Acta*, v. 51, p. 2185-2198.

Transitional Arcs;

Indonesia: Handley, H., 2006, Geochemical and Sr-Nd-Hf-O isotopic constraints on volcanic petrogenesis at the Sunda Arc, Indonesia: [PhD thesis]: University of Durham.

Handley, H.K., Macpherson, C.G., Davidson, J.P., Berlo, K. and Lowry, D. (in press) Constraining Fluid and Sediment Contributions to Subduction-Related Magmatism in Indonesia: Ijen Volcanic Complex: *Journal of Petrology*. doi: 10.1093/petrology/egm013

Continental Arcs;

Cotopaxi (N, Andes): Garrison, J., 2004, Magmatic processes at Cotopaxi Volcano, Ecuador: Geochemical and petrological constraints, and inferences for continental arc volcanoes: [PhD thesis]: Los Angeles, University of California, 247 p.

All other data are unpublished (Davidson and Turner).

Figure 4 Ce, H₂O data for glasses

Dixon JE and Clague, DA, 2001, Volatiles in basaltic glasses from Loihi seamount, Hawaii: Evidence for a relatively dry plume component: *Journal of Petrology*, v. 42, p. 627-654.

Michael, P., 1995, Regionally distinctive sources of depleted MORB: Evidence from trace elements and H₂O: *Earth and Planetary Science Letters*, v. 131, p. 301-320.

Figure 4 Ce, H₂O data for amphibole

- Cortosego L, Gaggero L and Zanetti A, 2000, Rare earth and trace elements in igneous and high-temperature metamorphic minerals of oceanic gabbros (MARK area, Mid-Atlantic Ridge): *Contributions to Mineralogy and Petrology*, v. 139, p. 373-393.
- Downes H, Beard A and Hinton R, 2004, Natural experimental charges: an ion-microprobe study of trace element distribution coefficients in glass-rich hornblendite and clinopyroxene xenoliths: *Chemical Geology*, v. 75, p. 1-17.
- Halter WE, Heinrich CA and Pertke T, 2004, Laser-ablation ICP-MS analysis of silicate and sulphide melt inclusions in an andesitic complex II: evidence for magma mixing and magma chamber evolution: *Contributions to Mineralogy and Petrology*, v. 147, p. 397-412.
- Moine, B.N., Grégoire, M., O'Reilly, S.Y., Sheppard, S.M.F. and Cottin, J.Y., 2001, High field strength element fractionation in the upper mantle: evidence from amphibole-rich composite mantle xenoliths from the Kerguelen Islands (Indian Ocean): *Journal of Petrology*, v. 42, p. 2145-2167.
- Witt-Eickschen, G. and O'Neill H.StC., 2005, The effect of temperature on the equilibrium distribution of trace elements between clinopyroxene, orthopyroxene, olivine and spinel in upper mantle peridotite: *Chemical Geology*, v. 221, p. 65-101.