Spatial distribution of halogens (Cl, Br, I) in back-arc basin basalts

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The extent to which the subduction process preserves the volatile elements signature of the downgoing slab and the mechanisms by which these elements are transferred into the mantle wedge are not well understood. Halogens (Cl, Br, I) are good candidates to trace these processes, due to their incompatibility and their relatively high concentrations in seawater and marine sediments. A technique developed at the University of Manchester [1] allows the high precision measurements of these elements on neutron-irradiated samples using noble gas mass spectrometry.

To better constrain the cycle of halogens in subduction zones, we analyzed the halogens in 21 volcanic glasses (BABB) from three back-arc basins which are known to contain slab-derived components *viz* Manus basin, Lau basin and Mariana trough. The extents of La/Sm from 0.6 to 2.1 and Ba/Nb from 5.0 to 33.3, indicate respectively different degrees of mantle enrichment and slab-derived fluid components compared to the MORB mantle source.

The BABB glasses have relatively constant Br/Cl ratios ($3.4\pm0.5\times10^{-3}$) which are 30% higher than MORB values. The I/Cl ratios (0.9 to 7.4×10^{-5}) range from values close to seawater to MORB values. The I/Nb ratios positively correlate with Ba/Nb ratios, suggesting that I is slab-derived. The positive correlations between I/Cl and Ba/Cl suggest a mixing between brines assimilation and slab related fluids. However, the I/Ba ratio is distinct for Manus samples ($16.7\pm3\times10^{-4}$) whereas Mariana and Lau samples show a similar ratio ($2.6\pm0.7\times10^{-4}$). The difference could reflect different types of fluids affecting the mantle wedge source of Manus samples, compared to those of Lau and Mariana samples. The Manus samples are explained either by a higher proportion of sediments or serpentines contributing to the slab fluid component in the Manus basin mantle source, or by a more efficient dehydration of the I from the slab.

[1] Johnson *et al* (2000), *GCA* **64**, 717-732