Recycled halogen signature preserved in the Tristan hotspot

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The halogens (Cl, Br, I) are moderately volatile elements which exhibit incompatible behaviour during melting, and are fractionated by biological processes. Although the halgoens share similar geochemical properties to the noble gases in many systems, the heavy halogens have been underutilised as tracers because of the analytical difficulties related to determining their low abundances in geological materials.

Halogen compositions have been determined in a suite of ocean island basalts, including samples from the Tristan group of islands (Tristan and Inaccessible Is.). Analyses were completed on fluid and melt inclusions in olivine separates, using an extension of the Ar-Ar technique.

The Tristan and Inaccessible Island basalts exhibit a subducted halogen signature, showing a strong overlap in Br/Cl and I/Cl with marine pore fluids (fig. 1). Intergrated Br/Cl and I/Cl values extend up to 3.4 x 10^{-3} (molar ratio) and 4.1 x 10^{-3}, with mixing trend between MORB and marine pore fluid end-members observed. Higher ratios are obsevered in the Inaccessible Island samples, suggesting that the composition of the Tristan hotspot source has changed over time.

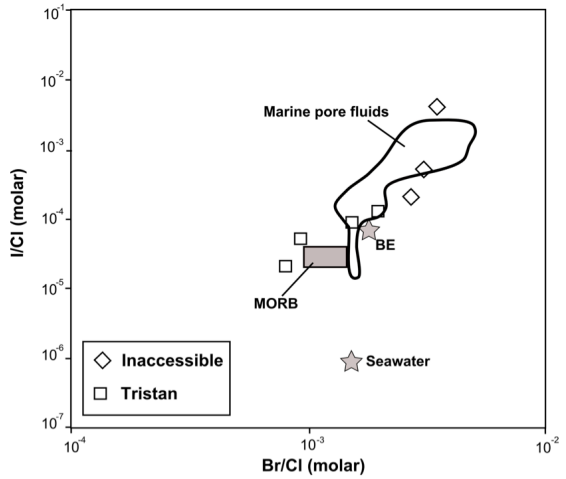

Figure 1: Observed overlap with marine pore fluids

(additional data from [1] Burgess *et al*. (2002), *EPSL* **197**, 193-203. [2] Mahn and Gieskes (2001), *Mar Geol* **174**, 323-339. [3] Martin *et al*. (1993), *GCA* **57**, 4377-4389.)

Calc-alkaline lamprophyre from Lusatia (Germany) derived from a multiply enriched mantle source

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Lusatia represents part of a 570-545 Ma old Cadomian magmatic arc that – in contrast to the adjacent areas of the Sudetes and the Erzgebirge – largely escaped metamorphism during the 350-340 Ma old Variscan orogeny. The post-Cadomian mantle beneath Lusatia was sampled by c. 400 Ma old tholeiitic gabbros and c. 230 Ma old calc-alkaline lamprophyre (spessartite), which allows to characterize the effect of the Variscan orogeny on the mantle beneath Lusatia and to compare it with the metasomatized mantle beneath the Erzgebirge and the Sudetes.

The tholeiitic gabbros originated from a mantle source that had been metasomatized during subduction beneath the Cadomian magmatic arc, which led to enrichment of LREE, Ba/Nb, and LILE relative to primitive mantle. The post-Variscan spessartites have the same trace-element pattern and Zr/Nb, Ce/Pb, and Y/Nb as the gabbros, indicating derivation from the same mantle source. The distinctly higher Rb, Ba, Pb, Sr, Th and Cs contents, higher La/Yb $^{87}Sr/^{86}Sr$, and $^{206}Pb/^{204}Pb$ ratios, and lower $^{143}Nd/^{144}Nd$ ratios in the spessartites, however, indicate a second, Variscan event of mantle enrichment. In addition, the spessartites have trace element ratios (i.e., Ba/Nb, Nb/U, Th/U, and Th/Nb) that resemble continental crust and the Sr, Nd and Pb isotope systematics demonstrate involvement of crustal material.

The trace-element signatures and Sr and Nd isotopic composition of Lusatian spessartites differ from post-Variscan calc-alkaline lamprophyres from the adjacent areas of the Sudetes and the Erzgebirge. This implies that the subduction during the Variscan orogeny resulted in geochemically and isotopically heterogenous mantle on the regional scale, possibly reflecting the contrasting nature of the subducted rocks.