Tracing slab volatiles during subduction through the noble gas isotope and halogen systematics of ophiolites

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The subduction of volatiles into the deep Earth represents a first order coupling of the exosphere (atmosphere, ocean, crust) and mantle. Halogens and noble gases are key tracers of these processes, with high abundances and large variations in relative abundances in surface materials. Establishing a subducted flux for these elements requires accurate determination of their concentrations in the oceanic lithosphere and in fluids released during progressive dehydration with depth. The latter is complicated by processes of magma differentiation, mixing and assimilation in the arc crust. A potentially clearer view of volatile outfluxes is provided by supra-subduction zone ophiolites.

The mantle section of the ~497Ma Leka Ophiolite Complex, Norway, is cross-cut by numerous subduction-related dunites, podiform chromitites and pyroxenites. These are interpreted to have formed above a subduction zone by focussed reactive flow at high melt/rock ratios [1, 2]. Mineral separates from these channels and surrounding mantle harzburgites have been analysed for their noble gas isotopes and abundances by crushing *in vacuo*. Arrays in $^{40}Ar/^{36}Ar$–$^{84}Kr/^{36}Ar$ and $^{40}Ar/^{36}Ar$–$^{132}Xe/^{36}Ar$ space to show apparent mixing between a radiogenic Ar component and a Kr and Xe enriched component in the podiform chromitites. Both components appear to be derived from altered oceanic crust and/or sediments. The implications of these signatures for volatile recycling are discussed, together with the application of forthcoming halogen analyses to resolve outstanding uncertainties surrounding volatile fluxes in subduction zones.

[1] Maaløe (2005), *Mineralogy and Petrology* 85: 163–204.
[2] O'Driscoll et al. (2015), *Journal of Petrology* 56 (9): 1797–1828.