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# Baffin Island plume development and evolution

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Studies of the trace-element, radiogenic-isotope, and noble gas isotope characteristics of mid-ocean ridge basalts (MORBs) and ocean-island basalts (OIBs) reveal the existence of domains within Earth's mantle that have experienced distinct evolutionary histories. Although alternative theories exist, most studies suggest that high $^{3}He/^{4}He$ ratios in some OIBs indicate the existence of relatively undegassed regions in the deep mantle compared to the upper mantle, which retain a greater proportion of their primordial He. Study of the chemistry of these deep mantle regions can thus provide information relating to the Earth's original composition, and the building blocks it formed from.

The Baffin Bay Volcanic Province erupted ~58 million years ago, during the rifting apart of Greenland and Baffin Island, which formed the Davis Strait. The resulting picrites are among the earliest manifestations of the ancestral Iceland mantle plume, and are thought to have a composition that reflects little fractionation from the mantle source. Based on the trace element compositions of chilled margins and glasses from the Baffin Bay picrites, Robillard et al. (1992) demonstrated that both slightly depleted lavas (similar to N-MORBS) and slightly enriched lavas (similar to E-MORBS) were erupted. Both N-type and E-type picrites from this location have been reported to contain the highest $^{3}He/^{4}He$ ratios of any terrestrial samples yet measured, at between 31 and 50 Ra. These high $^{3}He/^{4}He$ ratios highlight the undegassed nature of the Baffin Island mantle plume material, indicating it has been largely isolated from mantle mixing over geological time. The PhD candidate will analyse the mineralogy, petrology and chemistry of 5 unstudied Baffin Island picrites, originally collected from north-east Padloping Island in 2004. The aim of the project is to determine if the Baffin Island source region has been truly isolated from crustal recycling and mantle mixing throughout Earth history.

**Project objectives:**

1. Characterise sample mineralogy, via SEM analyses, and locate olivine-bound glassy melt inclusions
2. Use SEM EDX and WDX in combination to determine inclusion chemistry. This will allow for the differentiation of samples from the previously reported depleted and enriched plume sources. Melt inclusion chemistry will also indicate if crustal assimilation or sea-water contamination has affected any of the samples.
3. Use LA-ICP-MS to measure inclusion trace-element chemistry (including REE), to again look for crustal assimilation and contamination.
4. Crush olivine separates of each sample to gain $^{3}He/^{4}He$ isotopic data, in order to determine if these samples originate from an undegassed, deep mantle source, as suggested by previous Baffin Island picrite analyses.

Interested candidates should contact Dr Lydia Hallis (Lydia.hallis@glasgow.ac.uk) for further information.