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Radiogenic isotope analyses in olivine-hosted melt inclusions: What can we learn from ocean island basalts

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Melt inclusions trapped in high forsterite olivine record significantly larger geochemical variability compared to bulk lavas as they represent primitive deep melts that are shielded from mixing in the lithosphere. The extreme variability in highly incompatible element and isotope ratios suggests that mantle sources are more heterogeneous than previously assumed. Where data for single isotope systems (i.e Pb or Sr) on ocean island basalts were reported since last century, analysis of combined isotopes such as Sr-Nd-Pb remained a challenge owing to the small melt inclusion size and low concentrations.

Over the last ten years, at VU Amsterdam, we developed techniques allowing combined analyses of major- and trace elements by EMPA and LA-ICPMS and subsequent analyses of Sr-Nd-Pb by wet chemistry and TIMS, making use of 10^{13} Ohm amplifier technology. These techniques were successfully applied to enriched post-collisional localities, but data on more depleted ocean island basalts (OIB) remain sparce.

Here we present new combined major-, trace element and Sr-Nd isotope data from melt inclusions from Iceland, Socorro and Reunion that confirm larger variability compared to bulk lavas. Major-and trace element data reveal extremely depleted signatures that survive mixing when trapped in high Fo olivine. Sr and Nd isotopes record both more depleted and enriched signatures compared to host lavas, confirming that lavas are homogenized. The combined major, trace element and isotope data are used in this presentation to evaluate the melting conditions, the extent of source heterogeneity and melt mixing during melt extraction for these different OIB localities.