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Melt inclusions in olivine phenocrysts (Fo 91-93) from Tertiary picrites from Padloping Island, Baffin Island: the earliest melts generated by the Iceland Plume?

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Tertiary picrites from Baffin Island are thought to be the result of the earliest activity of the Iceland Plume. Olivine phenocrysts in these lavas are primitive (Fo 87.5 to 92.8).The composition of the melt inclusions in these olivines provides insight into the possible composition of primary mantle melts. This is particularly important since the melt inclusions in the Baffin Island picrites appear to record the most primordial He isotope signal recorded on Earth.

We have determined the composition of melt inclusions in olivine phenocrysts from a high MgO (23 wt%) picrite with $^{3}He/^{4}He$ = 43 R_a. Primary inclusions are randomly distributed and range from 10 to 80 μm in diameter. They contain glass, included spinel minerals, Al-rich clinopyroxene daughter minerals and gas/shrinkage bubbles, suggesting relatively slow cooling after entrapment.

In order to analyse the original melt, homogenisation experiments were carried out at ambient pressure using a heating stage under controlled fO_2 conditions. These experiments indicate liquidus temperatures as high as 1350ºC. However, the inability to obtain complete homogenisation by letting the gas phase disappear suggests that the melts were either over saturated in CO_2-rich volatiles or that the inclusions were trapped at higher pressures than could be obtained by our experiments.

Major element compositions for the homogenised inclusions suggest that the early melts in equilibrium with Fo 91-93 olivine are low in total alkalis ($<$2.5wt%) and

range in SiO_2 from 50 to 56 wt%. The melt compositions range from sub-alkalic olivine-normative basalt to quartz-normative basaltic andesite. The norm changes with silica content, with quartz normative compositions for inclusions with higher silica content and olivine normative compositions for inclusions that have a lower silica content. As the latter are found predominantly in the more evolved olivines, this variation cannot be explained by crystal fractionation of olivine and is thought to reflect source characteristics. The melt inclusion compositions could represent melts generated by either very shallow level melting of a depleted peridotite or progressive melting of an eclogite-type mantle at higher pressures. Additional trace element data will give more insight in the early stage melting processes, while Pb isotope data will be used to further constrain the origin of the mantle source.