Silicate melt inclusions in komatiites as potential indicators for crustal growth

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In order to understand the history of crust-mantle differentiation of the Earth, it is important to quantify any possible secular changes in key incompatible trace element ratios of the mantle (eg. Rb/Cs, Nb/Th, Nb/U). Volcanic rocks with a high degree of melting, such as komatiites, are thought to inherit the incompatible trace element ratios of their mantle sources but the distributions of Rb and Cs in komatiitic melts and hence the Archean mantle are largely unknown due to their mobility in alteration. Rb and Cs are also easily affected by contamination as they are highly enriched in crustal materials and have low abundances in most mantle sources.

Silicate melt inclusions in high temperature minerals from ultramafic and mafic volcanics are a potential vessel for preserving ancient trace element signatures of the mantle. Unfortunately, fresh primary minerals with melt inclusions are extremely rare in precambrian volcanic rocks.

We have assembled a range of komatiitic and basaltic samples and found melt inclusions in several samples in the 3.3-1.9 Ga period (See Figure). In general these inclusions show smooth depleted patterns for immobile incompatible trace elements when normalised to the primitive mantle.

Techniques have been developed for analysing both Rb and Cs from single inclusions using SHRIMP and LAICPMS. However, Rb-Cs and other mobile element data is not as straight forward to interpret as the immobile element patterns. Komatiites show a range from essentially pristine to compromised systematics due to contributions from hydrous alteration, crustal contamination or metasomatised sources.

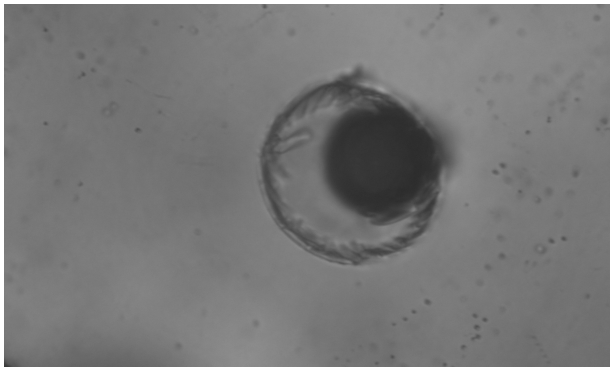

Figure of a 3.3 Ga glassy olivine-hosted silicate melt inclusion from the Barberton Greenstone Belt. The size of the inclusion is 50 microns.