



Composition of komatiite melts from Abitibi and Belingwe inferred from melt inclusions in olivine phenocrysts.

Evgeny Asafov (1), Alexander Sobolev (1,2), Nicholas Arndt (2), Valentina Batanova (1,2)

(1) Academy of Sciences, Vernadsky Institute of Geochemistry and Analytical Chemistry, Moscow, Russian Federation, (2) ISTerre, University J. Fourier, Grenoble, France

Komatiites are the products of extreme amounts of partial melting and hence are best indicators of the composition of their mantle sources. However, the most known komatiites are highly altered, and this prevents the use of their compositions to estimate the volatile and mobile element contents of the mantle. To estimate the concentrations of these elements, we analyzed melt inclusions in high-Mg olivine phenocrysts from two 2.7 Ga sample suites, one from Abitibi greenstone belt, Canada and the other from the Belingwe greenstone belt, Zimbabwe.

Fresh olivine grains 0.2-0.5 mm across were heated for 5 minutes and quenched at 1350°C in a C-O-H atmosphere with oxygen fugacity corresponding to quartz-fayalite-magnetite buffer. Homogenized melt inclusions were exposed at the surface of grains and analyzed by electron probe micro-analyzer for concentrations of Mg, Si, Ti, Al, Fe, Mn, Ca, Na, Cr, P, K, Cl and S. The size of melt inclusions ranges from 20 to 80 μm . The measured compositions were adjusted to equilibrium with host olivine with iron loss correction using Petrolog3 software (Danyushevsky & Plechov, G-cubed 12, 2011). Cracked inclusions were filtered out using their low S contents. Data on the volatile components Cl and S were thus obtained for the first time for the melt inclusions in Abitibi komatiites.

Calculated melt compositions range from 19.5 to 27.1 wt.% MgO in Abitibi samples and from 18.9 to 22 wt.% in Belingwe samples. Other elements, except Cl and K, show strong negative correlation with MgO and follow an olivine fractionation trend. Concentrations of Si, Ti, Al, and Ca are consistent with the corresponding compositions of whole rocks. Variations of Cl and K cannot be explained by fractionation of olivine and are attributed to the variations in parental melt.

The melt inclusion compositions from Abitibi and Belingwe komatiites have similar Ca, Na, K and S concentrations at the same concentration of Mg but Al and Ti are lower in Belingwe samples, and Si and Cl are higher. In Abitibi samples, Cl correlates strongly with K₂O with a constant ratio (Cl/K₂O= 0.7); in Belingwe samples the correlation is weak with Cl/K₂O=1.4. In general, Cl/K₂O ratios are a factor of 10-20 higher than in estimated Phanerozoic mantle reservoirs. Possible explanations of obtained data including crustal contamination of parental melt; presence of recycled components in the mantle sources or specific composition of Archean mantle sources will be discussed.

This study has been funded by Russian Science Foundation grant 14-17-00491.