European Mineralogical Conference
Vol. 1, EMC2012-715, 2012
European Mineralogical Conference 2012

Trace element partitioning between orthopyroxene and anhydrous silicate melt: an experimental and computational study

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Although orthopyroxene (Opx) is present during a wide range of magmatic differentiation processes in the terrestrial and lunar mantle, the effect on pressure (P), temperature (T), as well as crystal and melt composition on Opx-melt partitioning is not well understood. However, a thorough knowledge of the variation of Opx-melt partition coefficients as a function of these parameters is essential for any sophisticated numerical modelling of magma genesis. We will present the results of an experimental study that investigated the trace element partitioning between Opx and anhydrous silicate melt over a wide range of P-T conditions and chemical compositions.

Experiments were performed (A) in air at atmospheric pressure and temperatures ranging from 1326 to 1420˚C in the system CMAS and the subsystem CMS; and (B) in a piston cylinder apparatus along the dry model lherzolite solidus from 1.1 GPa and 230˚C up to 3.2 GPa and 1535˚C in the system NCMAS. Melt and Opx compositions have been analysed with a combination of electron microprobe and ion probe analyses and partitioning data for the elements Li, Be, B, K, Sc, Ti, V, Cr, Co, Ni, Rb, Sr, Y, Zr, Nb, Cs, Ba, La, Ce, Sm, Nd, Yb, Lu, Hf, Ta, Pb, U, and Th will be presented.

The results have been used to establish general equations (using the lattice strain model for mineral-melt trace element partitioning) that describe Opx-melt trace element partitioning as a function of P, T, and chemical composition. Additionally, we will compare the results with those obtained from atomistic computational modelling of Opx-melt partitioning.