

Trace element partitioning between orthopyroxene and anhydrous silicate melt on the lherzolite solidus from 1.1 to 3.2 GPa and 1230 °C to 1535 °C in the model system Na₂O-CaO-MgO-Al₂O₃-SiO₂

Frei, Dirk¹ Liebscher, Axel² Franz, Gerhard¹ Wunder, Bernd² Klemme, Stephan³ Blundy, Jonathan⁴

¹Technische Universität Berlin, Ackerstr. 73-75, D-13355 Berlin, Germany ²GeoForschungsZentrum Potsdam, Telegrafenberg, D-14473 Potsdam, Germany ³Universität Münster, Corrensstrasse 24, D-48149 Münster, Germany

⁴Department of Earth Sciences, University of Bristol, Bristol BS8 1RJ, United Kingdom

For any numerical modelling of magma genesis, especially to check for crustal contribution to a mantle-derived magma, a thorough knowledge of mineral-melt partition coefficients for different P - T conditions is essential. We determined experimentally the Nernst distribution coefficient between orthopyroxene and anhydrous silicate melt for trace elements i in the system Na₂O-CaO-MgO-Al₂O₃-SiO₂ (NCMAS) along the dry model lherzolite solidus from 1.1 GPa/1230°C up to 3.2 GPa/1535°C in a piston cylinder apparatus by analyzing melt and orthopyroxene with a combination of electron microprobe and ion probe analyses. We provide partitioning data for trace 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. The melts are boninitic at 1.1 and 2.0 GPa, picritic at 2.3 GPa and komatiitic at 2.7 and 3.2 GPa. Orthopyroxene is tschermakitic with 8 mol% Mg-Tschermaks MgAl[AlSiO₆] at 1.1 GPa while at higher pressure it has 18-20 mol%. We also determined the intracrystalline distribution on the two different M-sites M1 and M2 in orthopyroxene, and the values for D_0 , E_0 , and r_0 according to the lattice strain model.

The rare earth elements show a continuous, significant increase in compatibility with decreasing ionic radius from La to Lu. For the high-field-strength elements compatibility increases from La through Ce, Pr, Nd, and to Sm. From graphical fits we determined best-fit values for La, Ce, Pr, Nd, and Sm. Our data indicate extreme intracrystalline fractionation for most elements in orthopyroxene; for the divalent cations the partition coefficient varies by three orders of magnitude between from 0.044 to 0.0009 and from 11 to 3.6. Trivalent cations Al and Cr almost exclusively substitute on M1 while the other trivalent cations substitute on M2; U reaches extreme values between $3.4 \cdot 10^{14}$ and $9.4 \cdot 10^8$. Tetravalent cations Ti, Hf, and Zr almost exclusively substitute on M1 while U and Th exclusively substitute on M2.

→

Abs. No. **591**
Meeting: **DMG 2008**
submitted by: **Franz, Gerhard**
email: **gerhard.franz@tu-berlin.de**
date: **0000-00-00**
Req. presentation: **Poster**
Req. session: **S05**