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Partial melting of a fertile peridotite: application of the microcrack extraction technique

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The partial melting of peridotite at very low degrees is an important process for the generation of basaltic magma at mid-ocean ridges. We will present the results of anhydrous low-degree partial melting experiments on a fertile peridotite composition at pressures of 1.0 GPa and 1.5 GPa and temperatures ranging from near the solidus to about 100 $^{\circ}$ C above the solidus.

We used a fine-grained mix of minerals from a natural spinel lherzolite as starting material for the piston-cylinder experiments and we applied the recently developed microcrack extraction technique^[1]: the partial melt in equilibrium with the peridotite powder intrudes at run conditions into microcracks in the surrounding graphite container. In these cracks, the glasses remain unaffected by quench crystallization and can be analyzed by electron probe microanalysis.

The crystalline phase assemblage comprises olivine, orthopyroxene, clinopyroxene, and spinel; the runs at near-solidus temperatures at 1.0 GPa also contain plagioclase. Melt and solid phase fractions were calculated by mass balance. The melt fractions within the temperature interval studied range from 0.7 to 16 wt.% at 1.0 GPa and from 0.4 to 8 wt.% at 1.5 GPa. With decreasing temperature, i.e. lower melt fractions, the magnesium, calcium, and iron contents decrease continuously with a concomitant increase of the silica and alkali contents in the melt. Close to the solidus, at 1.0 and 1.5 GPa respectively, the silica content reaches 55 and 52 wt.%; the potassium content approaches 300 times that of the starting material. Aluminium behaves as an incompatible element at all P-T conditions studied, except in the near-solidus runs at 1.0

GPa because of the formation of plagioclase.

We will discuss compositional trends of the melt and the co-existing crystalline phase assemblages as a function of pressure and temperature and we will compare our data with those from literature obtained by applying different melt extraction techniques.

^[1] Laporte D., Toplis M., Seyler M., and Devidal J.L., (2004), *Contrib. Mineral. Petrol.* 146, 463-484. DOI: 10.1007/s00410-003-0509-3.