From MARID to lamproite: Melting phase relations of MARID-like xenoliths from Kimberley, South Africa

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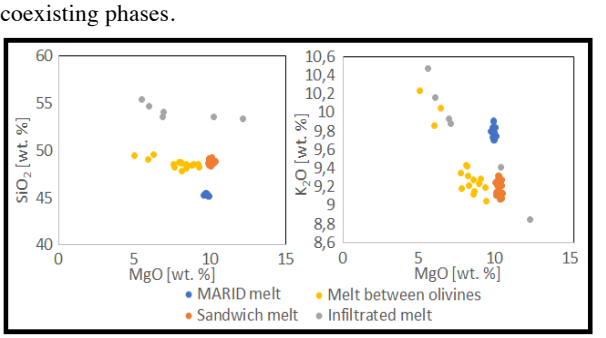
Mica- amphibole- rutile- ilmenite- diopside (MARID) xenoliths are alkali-rich, coarse-grained ultramafic rocks, typical for lamproite-derived metasomatism of the subcontinental lithospheric mantle. We conducted phase equilibria and trace element partitioning experiments on a (MARID)-like xenolith from the Boshof Road Dump of the Bultfontein mine in Kimberley, South Africa. Major and trace elements were measured on two mica-rich (>90% phlogopite) MARID xenoliths. Phlogopites are perpotassic, comprising K/Al >1 and Mg#-values of 84.5-86.5. Diopsides are very low in Al_2O_3, with values of <0.8%. Both compositions are typical for lamproites.

High-pressure experiments were performed on fine milled material of one MARID sample and on 50/50 sandwiches with a synthetic harzburgite, at conditions appropriate to the non-cratonic lithospheric mantle: 1–3 GPa, 1100°–1300°C using a rapid-quench piston cylinder. We determined the solidus, phase stabilities and major and trace element compositions of coexisting phases.



In all our experiments, the solidus was controlled by incongruent melting of phlogopite. The solidus is located at 1225 ± 25°C at 1 GPa, 1300 ± 25°C at 2 GPa, and 1350 ± 25°C at 3 GPa. First results at 1 GPa and 1225°C exhibit strong infiltration metasomatism of the MARID-melt into the harzburgite. The infiltrating melt is high in SiO_2, K_2O and low in MgO due to crystallization of olivine on the expense of orthopyroxene (figure).