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The origin of melilitites: preliminary results on melting of a carbonated wehrlite

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Melilitites are ultramafic magmas characterized by normative Ca_2SiO_4 , larnite, high FeO^* and TiO_2 . Liquids compositionally close to melilitites were experimentally reproduced from carbonated lherzolites in alkali, Fe and Ti-free model systems at 3.2-3.3 GPa, approx. 1500 °C (Gudfinnsson & Presnall, 2005), at relatively high melt proportions. In complex compositions, MORB-eclogite derived, carbonated, partial melts reacted with a fertile peridotite were proposed at the origin of melilitites (Mallik & Dasgupta, 2013, 2014). The experimental reconstruction of phase relationships along a join olivine melilitite - carbonate revealed that at 3 GPa, clinopyroxene and olivine or garnet are stable on the liquidus (Brey & Ryabchikov, 1994), suggesting that carbonated wehrlites are potential sources for the genesis of melilitites.

Here, we explore phase relationships on the high pressure melting of a model wehrlite, initially composed of a mechanical mixture of San Carlos olivine, diopside, aegirine, dolomite, rutile and kyanite. Starting materials were loaded in graphite capsules, inserted in sealed platinum capsules. Vitreous carbon spheres and synthetic diamond grains were adopted for liquid traps.

Preliminary experimental results show that at 3 GPa the solidus is located at temperatures lower than 1200 °C. A thick, orthopyroxene-rich layer, with polygonal microstructure, forms at contact with aggregates resulting from quenched liquids, both at 1200 °C and 1400 °C. Estimates of liquid composition are melilititic, with TiO_2 approx. 2.5 wt.% on a volatile free basis.

Currently available experiments suggest that the solidus is controlled by the reaction dolomite + olivine + clinopyroxene = orthopyroxene + liquid, as suggested in Eggler (1976). This is feasible only if the liquid composition is located on the CaO-rich side of the plane diopside-forsterite-dolomite in the model system $\text{CaO-MgO-SiO}_2\text{-CO}_2$, i.e. on the normative larnite (akermanite) portion of the tetrahedron.

Brey G.P. & Ryabchikov I.D. (1994). Carbon-dioxide in strongly silica undersaturated melts and origin of kimberlite magmas. *Neues Jahrbuch Fur Mineralogie-Monatshefte*, (10), 449-463.

Eggler D.H. (1976). Does CO_2 cause partial melting in the low-velocity layer of the mantle?. *Geology*, 4(2), 69-72

Gudfinnsson G.H. & Presnall D.C. (2005). Continuous gradations among primary carbonatitic, kimberlitic, melilititic, basaltic, picritic, and komatiitic melts in equilibrium with garnet lherzolite at 3–8 GPa. *Journal of Petrology*, 46(8), 1645-1659.

Mallik A. & Dasgupta R. (2013). Reactive infiltration of MORB-eclogite-derived carbonated silicate melt into fertile peridotite at 3 GPa and genesis of alkalic magmas. *Journal of Petrology*, 54(11), 2267-2300