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## Lherzolite - carbonatite melt interaction in the presence of additive CO<sub>2</sub> and H<sub>2</sub>O: Experimental data at 5.5 GPa and 1200-1450°C

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We study the reaction of garnet lherzolite with carbonatitic melt rich in molecular CO<sub>2</sub> and/or H<sub>2</sub>O in experiments at 5.5 GPa and 1200-1450°C. The experimental results show that carbonation of olivine with formation of orthopyroxene and magnesite can buffer the CO<sub>2</sub> contents in the melt, which impedes immediate separation of CO<sub>2</sub> fluid from melt equilibrated with the peridotite source. The solubility of molecular CO<sub>2</sub> in melt decreases from 20-25 wt.% at 4.5-6.8 wt.% SiO<sub>2</sub> typical of carbonatite to 7-12 wt.% in more silicic kimberlite-like melts with 26-32 wt.% SiO<sub>2</sub>. Interaction of garnet lherzolite with carbonatitic melt (2:1) in the presence of 2-3 wt.% H<sub>2</sub>O and 9-13 wt.% molecular CO<sub>2</sub> at 1200-1450°C yields low SiO<sub>2</sub> (<10 wt.%) alkali-carbonatite melts, which shows multiphase saturation with magnesite-bearing garnet harzburgite. Thus, carbonatitic melts rich in volatiles can originate in a harzburgite source at moderate temperatures common to continental lithospheric mantle (CLM).

Having separated from the source, carbonatitic magma enriched in molecular CO<sub>2</sub> and H<sub>2</sub>O can rapidly acquire a kimberlitic composition with >25 wt.% SiO<sub>2</sub> by dissolution and carbonation of entrapped peridotite. Furthermore, interaction of garnet lherzolite with carbonatitic melt rich in K, CO<sub>2</sub>, and H<sub>2</sub>O at 1350°C produces immiscible kimberlite-like carbonate-silicate and K-rich silicate melts. Quenched silicate melt develops lamelli of foam-like vesicular glass. Differentiation of immiscible melts early during ascent may equalize the compositions of kimberlite magmas generated in different CLM sources. The fluid phase can release explosively from ascending magma at lower pressures as a result of SiO<sub>2</sub> increase which reduces the solubility of CO<sub>2</sub> due to decarbonation reaction of magnesite and orthopyroxene.

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