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Evolution of carbonatite and silicate melts stable at the same pressure and temperature conditions in the lithospheric mantle

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The origin of carbonatites and kimberlites in the mantle is highly investigated and still not well understood. However, it is widely known that both melts might have a genetic relation. Carbonatite melts can be generated at the asthenosphere and migrate upward into the lithosphere causing metasomatism (1). Due to the high carbon concentration, these melts are extremely reactive with the mantle wall rock and may evolve in composition to carbonate-silicate melts (2). Experimental studies suggest that proto-kimberlite melts are formed by primary carbonatites in the deep mantle that react and evolve to carbonate-silicate melts (3). Another study has shown that the evolution of carbonate-silicate melts when reacting with the lithosphere may form liquid immiscibility (4). This experimental study focuses on the relation and evolution of carbonatite and silicate melts present in the deep mantle in a H_2O-rich system with low alkali contents. Two mixtures of different proportions of carbonatite and kimberlite components were prepared (C-K 10% carbonatite/90% kimberlite; and C-K 30% carbonatite/70% kimberlite). These mixtures were loaded in Au-Pd capsules, and our 8 experiments were processed in 100TonF hydraulic press with toroidal shape, varying the conditions from 4 to 6 GPa, and 1200 to 1300°C. Results were first observed using SEM-EDS, and EMPA for quantitative analyses of the silicate and oxides phases and melts. Our preliminary results show different carbonate-silicate melt compositions in terms of Si, Ca, Mg and CO_2 proportions dissolved in the melt. In most carbonate-silicate melts, olivine, orthopyroxene and clinopyroxene were stable with no important difference considering composition and P and T conditions. It was observed a melt evolution with melt inclusions trapped in olivine and the rest of melt formed in the experiments. The study is still under data interpretation to understand the evolution of these melts.

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