

## Experimental evidence of fast REE re-distribution in mantle clinopyroxene via reactive melt infiltration

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Reactive porous flow is the main mechanism of melts transport in the deep mantle. Mineral-melt interaction may significantly modify the mineralogy and chemistry of the upper mantle, as a function of temperature, pressure and melt amount and composition. However, the efficiency of melt-rock reaction in re-distributing trace element (e.g. REEs) in mantle clinopyroxene is still poorly constrained. We carried out reaction experiments at 1150-1350°C, and 1-2 GPa on mixture of natural MORB-like mantle clinopyroxene and San Carlos olivine (Fo<sub>90</sub>), used to model the peridotite matrix, and an Enriched-MORB glass (La<sub>N</sub>/Yb<sub>N</sub> = 5.49). Textural evidence of dissolution and reprecipitation suggest the reaction: glass<sub>1</sub> + cpx<sub>1</sub> + ol<sub>1</sub> = glass<sub>2</sub> + cpx<sub>2</sub> + ol<sub>2</sub>. Olivine after reaction is chemically homogeneous and shows decreasing X<sub>Mg</sub> and increasing Ca content. Relict clinopyroxenes mainly preserve the initial major element composition. New clinopyroxene grows around relics and as new crystals showing lower X<sub>Mg</sub>, Cr, Ca and higher Al, Na contents relative to the initial clinopyroxene. Both temperature and run durations promote its textural replacement. New clinopyroxenes have higher LREE/MREE and lower HREE abundances with respect to the initial one. The interaction with EMORB causes a systematic lowering of Sm<sub>N</sub>/Nd<sub>N</sub> and Lu<sub>N</sub>/Hf<sub>N</sub> ratios in clinopyroxene, as observed in some metasomatized mantle samples. The most incompatible element content increases in clinopyroxene as a function of initial melt amount and through high crystallization rate in melt-consuming reaction experiment. Notably, few relict clinopyroxenes preserve initial trace element composition whereas most of them record higher LREE and lower MREE-HREE suggesting that diffusion also plays a role during the melt-clinopyroxene reaction. Reacted glasses have high X<sub>Mg</sub> and low CaO, Al<sub>2</sub>O<sub>3</sub>, Na<sub>2</sub>O and REE contents, mostly reflecting olivine dissolution. Their LREE-HREE fractionation (La<sub>N</sub>/Yb<sub>N</sub> = 1.74-3.66) is moderated by the reaction with mantle clinopyroxene. D<sub>REE</sub><sup>cpx/liq</sup> measured in the longest runs approach those derived from literature, suggesting that local chemical equilibrium between clinopyroxene and melt can be approached even at the time scale of the experiments. New experimental data demonstrate that infiltration of REE-enriched melt within a mantle peridotite is potentially able to completely reset the pristine trace element budget of mantle clinopyroxene.