

# Phase relation and melting of pyroxenite in the presence of CO<sub>2</sub> and H<sub>2</sub>O at 3 GPa

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COH fluids are the major agents of mass transfer and mantle metasomatism at high-pressure-temperature environments and control the geochemistry of rocks in the crust and mantle. Most experimental studies focused on the effect of COH volatiles on the melt composition of mantle peridotites and eclogites. Geochemical variation of basalts suggests that lithologies like pyroxenites produced from the reaction between subducting crustal melt and mantle peridotites contribute significantly due to their lower melting point at a given pressure. Similarly, experiments on pyroxenites constraining the H concentration in the nominally anhydrous minerals (NAMs) and the effect of variable X<sub>CO<sub>2</sub></sub> on it, remain sparse. To understand the partitioning of H between NAMs coexisting with hydrous carbonated melt and the contribution of pyroxenites in the genesis of the primary arc melts, here we have performed piston-cylinder experiments at pressures similar to mantle wedge melting on a pyroxenite at variable X<sub>CO<sub>2</sub></sub> condition.

Partial melting experiments are conducted on three synthetic pyroxenite+H<sub>2</sub>O+CO<sub>2</sub> starting compositions with X<sub>CO<sub>2</sub></sub> [=molar CO<sub>2</sub> / (H<sub>2</sub>O+CO<sub>2</sub>)] varying between 0.08 to 0.29 at 3 GPa and 1350-1525°C. Mineral chemistry and melt compositions are measured using electron microprobe (EMP) analysis, and H content in NAMs is estimated using Fourier Transform infrared spectroscopy (FTIR). All experiments have clinopyroxene + orthopyroxene ± garnet in equilibrium with high-degree partial melts (>30 wt.%). Garnet and orthopyroxene are progressively consumed by melting reactions with an increase in melt fraction. Increasing X<sub>H<sub>2</sub>O</sub> at constant pressure on major oxides of partial melt is to decrease the concentration of CaO and SiO<sub>2</sub> systematically. Compared with global primitive arc melt compositions, melt from our experiments shows similarity to arc melts with high CaO, Al<sub>2</sub>O<sub>3</sub>, MgO and low Na<sub>2</sub>O and SiO<sub>2</sub> found in Japanese, Sunda and Lesser Antilles arc settings. The Liquidus phase in all three starting materials is clinopyroxene, and the low Na<sub>2</sub>O content of melts suggests a high partition coefficient of Na between clinopyroxene and melt. The H content in NAMs from our study shows a concentration similar to that of NAMs from subduction settings. With respect to starting materials, the H concentration in pyroxenes increases with the Al content in their structure.