



## **The role of volatiles in subduction zone metasomatism and melting: An experimental perspective**

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Fluid-mediated metasomatism and melting in subduction zones play a key role in the geochemical evolution of the Earth's mantle and crust. Dehydration of the subducting hydrated and altered oceanic lithosphere release H<sub>2</sub>O-CO<sub>2</sub>-rich fluids into the overlying mantle wedge. Melting of the metasomatized mantle wedge is the source of Island arc lavas. Despite the obvious role of volatiles in subduction zones, relatively little is known about the high-pressure dehydration and melting relations of mantle rocks in the presence of H<sub>2</sub>O±CO<sub>2</sub>.

Experiments on both basaltic and peridotitic compositions were performed on a rocking multi-anvil apparatus using the diamond trap setup. The compositions of the volatile-bearing fluid and melt phases were measured using the cryogenic LA-ICP-MS (for the cation content) and QTS (for the H<sub>2</sub>O and CO<sub>2</sub> content) techniques. The minerals compositions were determined by EMPA.

The solidus of eclogite+H<sub>2</sub>O system is located between 850 and 900oC at 4 GPa and between 1000 and 1050oC at 5 GPa. The solidus of the eclogite-H<sub>2</sub>O-CO<sub>2</sub> system at 4 GPa is ~150°C higher. The difference in the solidus temperature of the two systems narrows as pressure increases, eventually resulting in a similar location of the second critical endpoint between 5 and 6 GPa and 1050oC. Differences in solidus location are most probably due to differences in alkali and H<sub>2</sub>O content.

The H<sub>2</sub>O-bearing alkali-rich peridotite solidus is located between 900 and 1000oC at 4 GPa and between 1000 and 1100oC at 5-6 GPa. Addition of 1 wt% CO<sub>2</sub> does not affect the solidus location. Increasing the amount of CO<sub>2</sub> to 5 wt% in the bulk peridotite lowers the solidus by about 100oC.

The near solidus H<sub>2</sub>O±CO<sub>2</sub>-bearing fluids and melts interacting with both eclogite and peridotite rocks studied here are similar to intermediate compositions along the array spanned between low-Mg carbonatitic high-density fluids and hydrous-silicic ones that are found in microinclusions in diamonds. Changes in the H<sub>2</sub>O/CO<sub>2</sub> ratios in the bulk rock results in different location along the array. With increasing temperature, the H<sub>2</sub>O-CO<sub>2</sub>-bearing melts approach type II kimberlites.