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An experimental study on the role of volatiles on the solidus and melting relations of amphibole- and mica-bearing peridotites.

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Partial melting of peridotite lithologies is responsible for much of the chemical heterogeneity and compositional evolution of lithospheric mantle [1]. To that end the role of volatile elements are crucial in promoting melting and thus in metasomatizing the depleted mantle by melts and fluids (see [2] for a review). To assess the role of volatiles on the melting of metasomatised mantle sources we conducted melting experiments in two peridotitic compositions, a lherzolite and a K-enriched lherzolite (resembling a metasomatised source). Experiments were run under H_2O- and CO_2-undersaturated conditions with additional F. Experimental pressures ranged between 1 and 2 GPa and temperatures between 950°C and 1300°C.

Initially, we determined the H_2O- and CO_2-undersaturated solidus of the two peridotite bulk compositions. For the lherzolite composition the solidus is located at 1050°C at 1 GPa and 1175°C at 2 GPa. Amphibole remains stable for 50°C above the solidus at 1-1.5 GPa in contrast to 2 GPa where it is present only in subsolidus experiments. Phlogopite is not present on any of these runs. In the K-enriched lherzolite the solidus coincides with the lherzolite solidus up to 1.5 GPa, and it is slightly lower at 2 GPa at ~ 1140°C. Amphibole and phlogopite are both present in all the sub-solidus and super-solidus runs. Both amphibole and phlogopite persist 15-50°C above the solidus, becoming less stable with increasing pressure.

Our data will be used to calculate melting relations to develop a quantitative mantle melting model for amphibole- and phlogopite-bearing mantle sources. This model will place quantitative constrains on the amount of melt generated, hence improving our understanding about the role of volatiles during melting of metasomatised mantle rocks.

[1] Foley S. F. and Pintér Z. (2018) Primary Melt Compositions in the Earth's Mantle. In *Magmas Under Pressure* Elsevier. pp. 3–42.

[2] Foley S. F., Ezad I. S., van der Laan S. R. and Pertermann M. (2022) Melting of hydrous pyroxenites with alkali amphiboles in the continental mantle: 1. Melting relations and major element compositions of melts. *Geoscience Frontiers* 13, 101380.