



P-T-aH₂O conditions for the phlogopite-pargasite coexistence in spinel peridotite xenoliths of Mount Leura in southeast Australia

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Two spinel peridotite xenoliths hosted in Cenozoic basanites from Mount Leura in southeast Australia show coexisting amphibole and phlogopite apparently texturally equilibrated with the peridotite matrix.

This study was aimed to understand the chemico-physical conditions of circulating fluid(s) that stabilized these hydrous phases with the mantle ambient. To explore the hydrous phase-forming process, we model two fundamental reactions that account for our findings to determine i) the P-T conditions of formation of the related assemblages, and ii) H₂O-activity; for this latter to be used to infer the further geochemical and petrological information.

The first reaction (R1) accounts for the occurrence of pargasite and phlogopite in the peridotite assemblage is written as ideal terms:



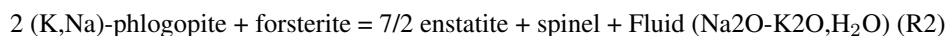
By means of R1, we estimated P-T equilibrium for the assemblages at the right-hand and left-hand side of R1, using the key-equation governing the classic equilibrium relationships between co-existing phases that participate in a reaction, changing into each other:

$$\sum_j v_j u_j(P,T) = \sum_k v_k u_k(P,T)$$

Calculations were carried out using the path integrations discussed by Curetti et al. (2018) of the output of tests performed using supercells to model cation order-disorder by means of semi-empirical potentials and lattice dynamics via the GULP code (Gale, 2005) The obtained results confirm that actual assemblage bearing both Na-rich phlogopite and

pargasite to be reasonably approximated by R1 in terms of static and vibrational energy contributions. We complemented our modelling introducing configuration contributions stemming from the occurrence of complex solid mixings, using crystal-chemical data determined by chemical analyses, Mössbauer spectroscopy and single crystal diffraction for phlogopite and pargasite, along with bare chemical composition of olivine, clinopyroxene and spinel.

The P-T locus obtained (1.5-3.0 GPa – 1412-956 K) were used to constrain the pressure-temperature range on which the second assemblage bearing Na-rich phlogopite, stabilized, according to the following simplified reaction:



The preliminary, encouraging results, obtained using the theoretical model, suggest that water (OH) is firmly incorporated in phlogopite (coexisting with amphibole) up to 2.2 GPa - 1160 K. At higher pressure this mantle assemblage tends to “stabilize” the fluid phase, promoting the circulations of volatiles in deeper mantle segments.

Curetti et al. (2018) Phengite megacryst quasi-exsolving phlogopite, from Sulu ultra-high pressure metamorphic terrane, Qinglongshan, Donghai County (eastern China): New data for P-T-X conditions during exhumation, *Lithos*, 314-315, 156-164

Gale J.D. (2005) GULP: Capabilities and prospects, *Z. Krist.*, 220, 552-554

