Modeling phase equilibria for mineral assemblages of multiphase solid inclusions enclosed in peridotite garnet

Jakub Haifler [1], Jana Kotková [2], Renata Čopjaková [1], Radek Škoda [1]

[1] Department of Geological Sciences, Masaryk University, 61137 BRNO, Czech Republic; haifler.j@sci.muni.cz
[2] Czech Geological Survey, Klárov 3, 11821 PRAGUE, Czech Republic

Garnet peridotites of the Saxothuringian basement in the NW Bohemian Massif underwent UHP metamorphism (~4 GPa/1000°C) due to a deep subduction (Medaris *et al.*, 2015). The multiphase solid inclusions (MSI) concentrated in the outer rim of garnet from peridotites document a widespread cryptic metasomatism by a residual carbonate-silicate liquid after UHP crystallization of garnet pyroxenite (Kotková *et al.*, 2021). Forward thermodynamic models indicate that the phases comprising the MSI represent equilibrium. Among all the studied samples (harzburgites and lherzolites from different depths of a deep T7 borehole), the MSI in harzburgite 322 provide the most specific constraints (Fig. 1): the assemblage Dol+Cpx+Opx+Mgs+Grt+Spl+Phl is stable at relatively narrow pressure range of c. 1.8–2.1 GPa, and at high $X(CO_2)\geq0.7$ only (calculated at a representative sectioning T=1000 °C, which is close to values obtained from conventional thermometry applied on Grt – Cpx/Opx pairs). The modeled modes of the involved phases agree well with the observed amounts. Amphibole-bearing assemblages provide less specific pressure estimates due to a strong interdependence with $X(CO_2)$ of the liquid phase. Comparable pressure estimates to those above are obtained for $X(CO_2)$ values close to 1. Obviously, the equilibration – (re)crystallization took place during exhumation of the hosts.

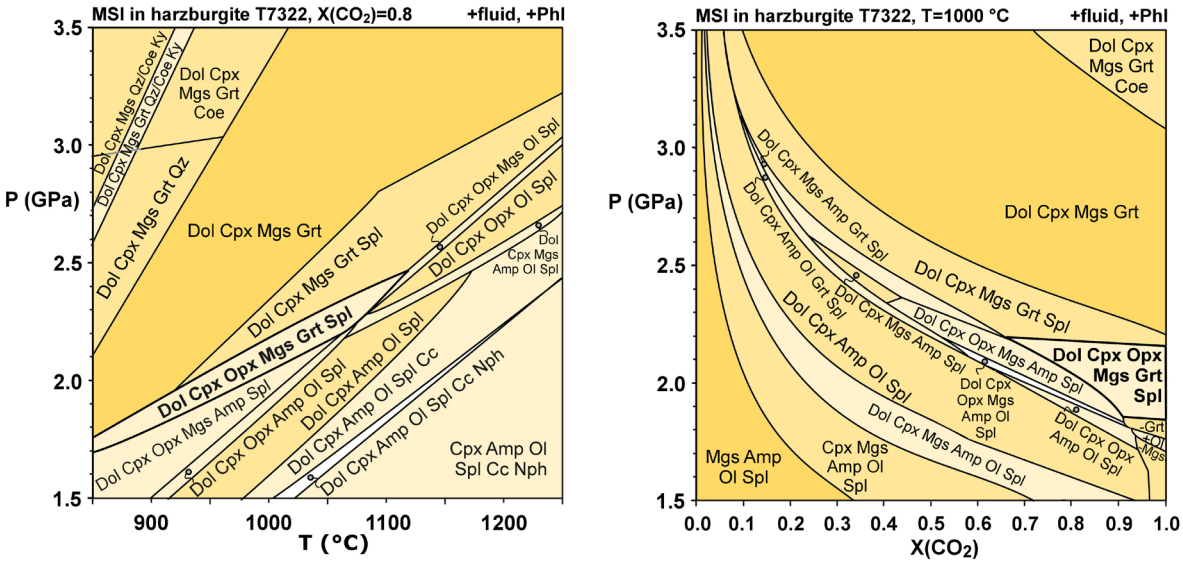

Figure 1 - Forward thermodynamic model for the MSI in harzburgite T7 322.

Kotková, J., Čopjaková, R., Škoda, R., 2021. Multiphase solid inclusions reveal the origin and fate of carbonate-silicate melts in metasomatised peridotite. *Lithos* 398, 106309.

Medaris, G., Ackerman, L, Jelínek E, Michels Z.D., Erban, V., Kotková, J., 2015. Depletion, cryptic metasomatism, and modal metasomatism (refertilization) of Variscan lithospheric mantle: evidence from major elements, trace elements and Sr-Nd-Os isotopes in a Saxothuringian garnet peridotite. *Lithos* 226, 81–97.