Character and evolution of fluids metasomatizing mantle wedge: insight from minerals in multiphase solid inclusions

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Multiphase solid inclusions (MSI) were discovered in garnet in lherzolites, harzburgites and pyroxenites in ultrahigh-pressure Saxothuringian basement of the northern Bohemian Massif. The MSI in harzburgites and lherzolites are dominated by amphibole, barium mica and carbonates (magnesite, dolomite), and contain acessory LREE and/or Th+U-bearing phosphates and oxides. High abundances of LILE (Ba, K), LREE, P, Th, U as well as CO_2, H_2O and Cl in MSI point to mantle metasomatism by crustal-derived fluids/melts.

The MSI in the subordinate garnet pyroxenite vein are enriched in LREE±Th, U-bearing phases as well as Ti-bearing oxides. On the other hand, contents of Cr, CO_2, and Cl/F ratios are relatively low compared to the ultrabasic rocks. In addition, the MSI occur througout garnet, in contrast with a narrow MSI-bearing annulus at garnet rim in lherzolites and harzburgites.

Supercritical fluids/melts produced in deep parts of subduction zones represent efficient carriers of the chemical elements transported from the crustal slab into the overlying mantle wedge. Character and composition of the MSI in garnet pyroxenite, its discordant character, and bulk chemical and isotope composition suggest that it might represent a residuum after the subduction-related melt infiltrating into the mantle, and source of metasomatizing fluids. These fluids became progressively more enriched in Cr, Ba, CO_2 and Cl vs. F, and depleted in Si, Al and Ti during interaction with mantle wedge lherzolite and harzburgite.