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Geochemical evolution of lithospheric mantle underlying Intrasudetic Fault (SW Poland).

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The Pilchowice basanite (SW Poland) forms volcanic plug located exactly on Intrasudetic Fault, which is one of the major tectonic lines in northern part of the Bohemian Massif. It originated during the formation of Variscan Orogen and marks the contact between two different crustal domains. The basanite is rhönite-bearing (Ladenberger et al., 2005. Min.Pol-Spec. Pap.) and contains small (<3 cm) xenoliths of clinopyroxene-bearing spinel harzburgites and spinel dunites. Numerous, fine-grained aggregates formed of olivine, clinopyroxene, spinel and glass occur interstitially. A "glassy patch" enclosing subhedral clinopyroxene occurs in one of the xenoliths.
The Fo content in olivine forming xenoliths varies from 91.4 down to 83.2%, but the NiO content is always high (0.31-0.45 % wt.). Orthopyroxene has the composition of Al-Cr-Fe enstatite (mg# 0.86- 0.92). It is either LREE-depleted or shows U-shaped REE patterns. Clinopyroxene is Al-Ti-Cr diopside (mg# = 0.80-0.95). Spinel is mainly chromite with wide variation of cr# (0.40-0.80). Clinopyroxene is usually LREE-enriched with convex upward REE pattern. Two other types of REE patterns in clinopyroxene are also present: convex downward (U-shaped) and with constant enrichment in LREE. All the clinopyroxenes show distinct Ti and Zr-Hf negative anomalies.
Low $Al2O_3$ content in orthopyroxene suggests that Pilchowice peridotites are restites after extensive (16-35%) partial melting (Faccini et al., 2013, JoP), which is in an opposition to modal content of clinopyroxene (0-4.1 vol.%). This suggests, that clinopyroxene is a "stealth" metasomatic phase (O'Reillly and Griffin, 2013, Springer). As trace element composition of clinopyroxene shows features typical for reaction with alkaline silicate melt (negative inflection at the most incompatible trace elements) and carbonatite (Ti, Zr, Hf anomalies), we suggest that majority of xenoliths were metasomatized by the an agent being a carbonatite-silicate melt or by CO_2-bearing alkaline silicate melt. Xenolith where clinopyroxene shows constant enrichment in LREE may represent a part of mantle affected by pure carbonatitic metasomatism. Xenoliths with the lowest Fo content in olivine are probably cumulates of mafic silicate melt.
Intergranular aggregates originated during reaction between primary phases and infiltrating, possibly mafic melt. The "glassy patch" might be a product of complete breakdown of amphibole in upper mantle conditions (Shaw, 2009, Lithos). However, presence of rhönite in host basanite suggests that some amphibole might have been broken also in lower pressures.
Chemical composition of peridotites from Pilchowice resembles that recorded by group A mantle xenoliths from Krzeniów (Matusiak-Małek et al., 2014, JoP). In Pilchowice we have described the first xenolith affected by purely carbonatitic metasomatism. We also suggest that hydrous phases might have been present in upper mantle beneath this Pilchowice, which is believed to be nominally anhydrous (Puziewicz et al., 2015, IJES, DOI 10.1007/s00531-014-1134-2).

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