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Variations on the Lower Silesian (SW Poland) lithospheric mantle – the Grodziec xenoliths case study

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The lithospheric mantle underlying the northern margin of Bohemian Massif (Lower Silesia, SW Poland) is in general characterized by presence of two ultramafic lithologies, both of mostly harzburgitic composition. The group A harzburgites are strongly depleted and record variable metasomatic events, which are however always related to reactions with mixed alkaline-carbonatite melts. The group B harzburgites also record reaction with mafic melts, but in this case the reaction resulted in enrichment of the peridotites in Fe ("Fe-metasomatism"). The xenoliths suites from Grodziec (this study), Krzeniów (Matusiak-Małek et al., 2014, JoP) and Wilcza Góra (Matusiak-Małek et al., submitted), all in the Złotoryja volcanic complex, follow the "A" and "B" lithological characteristics. The Grodziec suite contains, however, numerous lherzolitic xenoliths.

The group A xenoliths from Grodziec are anhydrous lherzolites, scarcely harzburgites. The Fo content in olivine varies from 90.7 to 91.8%, Mg# in ortho-and clinopyroxene is 0.91-0.92. Al content in orthopyroxene is 0.05-0.14 a pfu (0.70 to 3.44 wt.%), which makes them one of the highest in region. Few lherzolites are characterized by slightly lower Fo content in olivine (89.16-90.10%) and are therefore classified as A- group. The Mg# of pyroxenes in this group varies from 0.89 to 0.90, but orthopyroxene is generally characterized by low Al content (< 0.08 a pfu, corresponding to <2 wt.% in majority of xenoliths). Group B xenoliths are orthopyroxene – free dunites, and wehrlite. Olivine contains from 85.14 to 86.14 % of Fo, the Mg# of clinopyroxene varies from 0.84 to 0.88. Clinopyroxene in all the groups is LREE enriched and has negative Sr, Zf-Hf and Ti anomalies, but the enrichment decreases from group A to B and so are the depths of negative anomalies.

Temperatures of major element equilibration of group A and A- pyroxenes are from approximately 1010 to 1100°C with no specific differences between the groups. So high temperatures of pyroxene equilibration in the xenoliths from Lower Silesia have been recorded only in the Księginki peridotite suite, which has been affected by percolative reaction with young (synvolcanic) nepehelinitic melts.
Our study shows that evidence for restitic origin of clinopyroxene and spinel in Grodziec xenolith are not clear. Clinopyroxene shows enrichment in LREE suggesting its metasomatic reaction with mixed alkaline-carbonatite melts. Similar metasomatic agent was proposed for all the Lower Silesian xenolith peridotites, and those from the Złotoryja volcanic complex contain clinopyroxene of almost identical trace element composition. Despite those similarities, the Grodziec xenoliths contain significantly more clinopyroxene, orthopyroxene is missing in group B xenoliths and show relatively high temperatures of pyroxene equilibration. This suggest, that Grodziec xenoliths represent another "variation" on the basic types of Lower Silesian lithospheric mantle.

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