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Complex structure of upper mantle beneath SW Poland - the Krzeniów xenoliths case.

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The SW Poland experienced intensive alkaline volcanism during Cenozoic. The volcanic activity occurred in three phases: 30-26Ma, 23-18Ma and 5.46-3.83Ma (Badura, et al. 2006). The K-Ar age of Krzeniów basanite (Łysanka Hill, northern margin of the North Sudetic Depression) varies from 19.41 $\pm$ 0.88 to 18.72 $\pm$ 0.81 My (Birkenmajer, et al. 2007) and thus belongs to the second phase of volcanic activity.
The Krzeniów basanite carries scarce, usually 3–7 cm in diameter xenoliths of depleted spinel peridotites (harzburgites and dunites). The forsterite content in olivine allow to divide the xenoliths into two groups: the typically mantle, high-Fo ones (88.5-91.6) and a low-Fo ones (82.6-88.5) of probably cumulative origin. The Krzeniów xenoliths with Fo 88.5 – 89.4 are characterized by unusually high FeO contents and elevated alkalies suggesting interaction with melt enriched in these elements. Melt exists in some of xenoliths as melt pockets verifying that the metasomatic agent, which was a silica undersaturated melt, caused the "Fe-metasomatism". The Fe-metasomatism affected olivine, orthopyroxene and, to lesser extend spinel, but not clinopyroxene. Moreover, the clinopyroxene major and trace element (enrichment in light rare earth elements – LREE with La-Pr bump) composition suggest a late metasomatic event, which may be related to alkaline melt(s).
Xenoliths with Fo content in olivine ranging from 90.4 to 91.6 are subdivided into five groups based on clinopyroxene major and trace element composition. The group 1 is characterized by the highest #mg (0.93 – 0.94) and REE patterns showing strong depletion in heavy REE (HREE), while the LREE elements concentration is up to 10 times higher than in primitive mantle. The group 2 is similar to the first one, but concentration of all the major(#mg 0.93-0.94) and trace elements is higher. Groups 3 and 4 are characterized by lower #mg's (0.92-0.93 and 0.92, respectively). The REE patterns of both the groups are LREE enriched, with characteristic bump at La-Nd in group 4. Group 5 lacks clinopyroxene.
Diversity in chemical composition of peridotites from Krzeniów suggests complex structure of the mantle beneath this area. Each group was affected by different metasomatic medium, starting from hydrous fluid in groups 1 and 3, through intermediate between melt and fluid in group 3 to alkaline melt in group 4. Interaction with similar alkaline melt is recorded also in clinopyroxene from the Fe-metasomatized group. Fe-metasomatism, has been also reported in spinel peridotites from Księginki and appears that this kind of metasomatism is widespread in SW Poland.