Geophysical Research Abstracts
Vol. 15, EGU2013-9009, 2013
EGU General Assembly 2013
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Lithospheric mantle beneath Central Europe: two dominant lithologies?

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The lithospheric mantle beneath Central Europe (SW Poland, SE Germany, N and NW Czech Republic) was sampled by numerous Cenozoic alkaline volcanoes. The Ohře (Eger) Rift in western Czech Republic was the centre of volcanic activity, but individual eruptions are dispersed within more than 150 km from its margins. Many of lava occurrences contain mantle peridotite xenoliths, which allows the comparison of lithospheric mantle beneath the Rift and that located outside. The lithospheric mantle beneath the Ohře Rift was rejuvenated – chemically and thermally – by the alkaline melt moving to the surface. In the places where the flow was channelized, the olivine clinopyroxenites were formed, and in the zones of pervasive flow the depleted harzburgites was subjected to intense cryptic metasomatism, which changed trace element contents in clinopyroxene, and locally induced "Fe-metasomatism", lowering slightly (by few %) forsterite content in olivine and mg# of coexisting pyroxenes (Puziewicz et al. 2011). The lithospheric mantle located outside the rift appears to be dominated by two basic harzburgitic lithologies. The first one is characterized by highly magnesian mineral compositions (olivine Fo90.5 -92.0, orthopyroxene of corresponding mg#), contains no clinopyroxene or clinopyroxene which is younger than the harzburgitic mineral assemblage and in places highly magnesian (mg# 0.94). This clinopyroxene exhibits "spoon-shaped" REE patterns. Preliminary analysis (only 1 sample because of very low clinopyroxene content in the peridotites, Krzeniów site) show 87Sr/86Sr 0.703117±0.000009 and 143Nd/144Nd 0.512907± 0.000006 in clinopyroxene. The second lithology contains less magnesian olivine (Fo87.5-90.0), ortho- and clinopyroxene. The clinopyroxene is characterized by REE pattern suggesting its equilibration with silicate melt and (one analysis only, Krzeniów site) 87Sr/86Sr 0.703213± 0.000009, 143Nd/144Nd 0.512500 ± 0.000005). The second lithology originated due to "Fe-metasomatism" of more magnesian peridotites by silicate melts moving pervasively through lithospheric mantle; the metasomatism was coeval with Cenozoic volcanism (Puziewicz et al. 2011). The first lithology might have been the protolith of the second one. The xenoliths belonging to both the lithologies occur together in some in lavas (eg. Krzeniów in Lower Silesia, SW Poland or Steinberg in Upper Lusatia, SE Germany). These lithologies probably make significant part of the lithospheric mantle in the region outside the area of the Ohře rift.

Puziewicz J., Koepke J., Grégoire M., Ntaflos T. & Matusiak-Małek M. (2011): Cenozoic rifting in Central Europe: Evidence from the Księginki nephelinite (SW Poland) xenolith suite. Journal of Petrology 52: 2107-2145