MANTLE PERIDOTITE XENOLITHS FROM HIRZSTEIN AND BAUNSBERG (HESSIAN DEPRESSION, GERMANY)

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Hirzstein and Baunsberg alkali-olivine Cenozoic basalt hills are located in Hessian Depression, 8 km SW from Kassel in Germany. Geologically those occurrences are situated in Rheno-Hercynian Zone of the European Variscan Orogen, close to its contact with the Mid-German Crystalline Rise. The basalts contain abundant peridotite xenoliths, which allow the insight into the lithology of lithospheric mantle underlying this part of the orogen

Xenoliths have 5–10 cm in diameter and have the composition of harzburgite or cpx-poor lherzolite. Contacts with host basanite are sharp. Their textures (sensu Mercier and Nicolas [1]) are protogranular to porphyroclastic. We classify the minerals forming those peridotites as I – primary grains, II – lamellae, and III – those occurring in the fine-grained intergranular aggregates.

Olivine I forms 1–6 mm subhedral crystals with deformation lamellae. Orthopyroxene I grains are subhedral, up to 4 mm long, and contain parallel lamellae of clinopyroxene II and spinel II in cores Clinopyroxene I is anhedral to subhedral and typically up to 3 mm long. Relatively large grains of spinel I occur only in the intergranular aggregates.

Major element chemical composition of minerals is similar in both sites. The content of forsterite in olivine, divides xenoliths into two groups: A (Fo=89.9–91.4%) and B (Fo=87.6–89.3%). Xenoliths from group A plot into OSMA field by Arai [2]. Group A xenoliths contain high-Mg orthoproxene and clinopyroxene (Mg#=0.90–0.92 in both phases) of similar Al content (0.09–0.22 atoms per formula unit, apfu) in opx and 0.13–0.25 apfu in cpx). Baunsberg orthopyroxene is depleted in Ca (0.01–0.02 apfu) compared with the Hirzstein one (0.02–0.05). Group B xenoliths are harzburgites (2–4 vol.% of Cpx) and lherzolites. Group B orthopyroxene has Mg# 0.88–0.89 and contains 0.11–0.22 atoms of Al pfu. Clinopyroxene has Mg# 0.87–0.89 and contains 0.17–0.31 atoms of Al pfu. Spinel in both groups exhibits significant variation in Cr# and is Mg-enriched (Mg#=0.66–0.76). An exception is spinel from xenolith (3637), rich in Cr (Cr#=0.49–0.52) and with low Mg# of 0.50.

Hirzstein and Baunsberg clino- and orthopyroxene differ in trace elements and REE patterns. Hirzstein clinopyroxene is LREE enriched (La/Lu_N=5.5–25.5), trace elements patterns show depletion in Nb, Pb, Ce, Zr-Hf and Ti. Orthopyroxene shows LREE depletion (La/Lu_N=0.12–0.38). Clinopyroxene from Baunsberg, shows constant PM normalizded REE contents from Sm to Lu and strong enrichment of La-Nd (La/Lu_N=1.6–18.2). Trace elements diagrams show positive Sr and negative anomalies Nb–Ta and Ti. Orthopyroxene is LREE depleted (La/Lu_N= 0.08–0.69).

Hirzstein and Baunsberg xenoliths are mostly lherzolites with low content of clinopyroxene. The forsterite content in olivine and Mg# of ortho- and clinopyroxene are similar to those of olivine and pyroxenes from the Lower Silesia (S Poland) xenoliths [3], but the pyroxenes are more aluminous (>0.10 atoms of Al pfu) compared to those from Lower Silesia (<0.10 atoms of Al pfu). The REE and trace elements compositions of pyroxenes from Hessian xenoloths suggest metasomatism by both silicate and carbonatitic agents. However, Baunsberg xenoliths show strong evidences only for carbonatitic metasomatism (La-Ce strong enrichment, Sr positive and Nb-Ta negative anomalies). The xenoliths form Hirzstein and Baunsberg show strong heterogeneity of upper mantle beneath Hessian Depresion.

Funding: This study was possible thanks to the project NCN UMO-2014/15/B/ST10/00095 of Polish National Centre for Science to JP. Electron microprobe work was possible thanks to the WTZ project PL/16 Austria-Poland.

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