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New constraints on the textural and geochemical evolution of the upper mantle beneath the Styrian basin

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Plio-Pleistocene alkali basaltic volcanism sampled sporadically the upper mantle beneath the Carpathian-Pannonian Region (CPR, e.g. [1]). Lavas and pyroclasts often contain mantle derived xenoliths, and the majority of them have been extensively studied [1], except the westernmost Styrian Basin Volcanic Field (SBVF, Eastern Austria and Slovenia). In the SBVF only a few volcanic centers have been studied in details (e.g. Kapfenstein & Tobaj). Based on these studies, the upper mantle beneath the SBVF is consists of dominantly high temperature, texturally and geochemically homogeneous protogranular spinel lherzolite. New major and trace element data from rock-forming minerals of ultramafic xenoliths, coupled with texture and deformation analysis from 12 volcanic outcrops across the SBVF, suggest that the lithospheric roots of the region are more heterogeneous than described previously.

The studied xenoliths are predominantly lherzolite, amphibole is a common phase that replaces pyroxenes and spinels and proves modal metasomatism. Phlogopite coupled with apatite is also present in amphibole-rich samples. The texture of the xenoliths is usually coarse-grained and annealed with low abundance of subgrain boundaries in both olivine and pyroxenes. Olivine crystal preferred orientation (CPO) varies between the three most abundant one: [010]-fiber, orthogonal and [100]-fiber symmetry [2]. The CPO of pyroxenes is usually coherent with coeval deformation with olivine, however the CPO of amphibole is suggesting postkinematic epitaxial overgrowth on the precursor pyroxenes.

According to equilibrium temperatures, the studied xenolith suite samples a broader temperature range (850-1100 °C) than the literature data, corresponding to mantle depths between 30 and 60 km, which indicates that the xenolith suite only represents the shallower part of the recent 100 km thick lithospheric mantle beneath the SBVF. The equilibrium temperatures show correlation with the varying CPO symmetries, with [100]-fiber and orthorhombic symmetry appear in the high temperature (>1000 °C) xenoliths, which are thought to have an asthenospheric origin [3].

Based on our study, the subcontinental lithospheric mantle beneath the western part of the CPR is not as homogeneous as it was reported before. The shallower part of the mantle lithosphere contains peridotites, where the pervasive deformation and subsequent thermal recovery of the upper mantle was followed by melt percolation events causing extensive metasomatism.

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