Heterogeneity of the lithospheric mantle beneath the western part of the Pannonian Basin

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Alkali basaltic volcanism occurred across the Carpathian-Pannonian Region (CPR) during Plio-Pleistocene times, resulting in five distinct volcanic fields, where upper mantle xenoliths can be found. Although several lava and pyroclastic deposits contain xenoliths in the westernmost Styrian Basin Volcanic Field (SBVF; Eastern Austria and Slovenia) too, so far only a few volcanic centres have been studied in details from here. This has led to the conclusion that the upper mantle beneath the region is composed of dominantly high temperature and texturally homogeneous spinel lherzolite. In this study we present petrographic, crystal preferred orientation (CPO) and mineral chemistry data from 14 less-known localities across the SBVF.

The studied xenoliths are predominantly lherzolite, but harzburgite and pyroxene-rich websterite lithologies also appear. Amphibole is a common constituent phase that replaces pyroxenes and attests for modal metasomatism. Phlogopite is also present in one sample. Besides, spinel often occurs with clino- and orthopyroxenes in rounded clusters that resemble former garnets. The texture of the peridotites is usually coarse-grained and annealed with very low abundance of subgrain boundaries in both olivine and pyroxenes. In a few xenoliths, however, spinels are elongated and mark the plane of the foliation. Olivine mostly displays orthogonal CPO with [010]-axes in the pole of the foliation and [100]-axes subparallel to the lineation. The CPO of pyroxenes is usually coherent with coeval deformation with olivine, but in the modal metasomatised peridotites the CPO of clinopyroxene and that of amphibole is postkinematic.

Supported by geothermobarometric calculations, we conclude that the lithospheric mantle beneath the SBVF is not as homogeneous as it was thought previously. The shallower part contains peridotites, where localized melt percolation postdates pervasive deformation and subsequent recovery of the mantle domain.