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On the cover: The castle of Veszprém (photo by: M. Pósfai)

Constraints on mantle metasomatism beneath the Nógrád-Gömör volcanic field with combined geochemical and geophysical approaches

Patkó, L.[1], Klébesz, R.[2], Novák, A.[2], Liptai, N.[1], Szabó, Cs.[1]

[1] Lithosphere Fluid Research Lab, Department of Petrology and Geochemistry, Eötvös Loránd University, Pázmány Péter sétány 1/C, Budapest 1117, Hungary (patkolev@gmail.com)

[2]MTA Research Centre for Astronomy and Earth Sciences, Geodetic and Geophysical Institute, Csatkai Endre u. 6-8., Sopron 9400, Hungary

In the Carpathian-Pannonian region (CPR) there are five occurrences where Plio-Pleistocene alkali basalts brought upper mantle xenoliths to the surface, providing the opportunity to obtain direct information from greater depths. The northernmost xenolith bearing locality in the CPR is the Nógrád-Gömör Volcanic Field (NGVF) from where new geochemical and geophysical data has been acquired with the aim of proposing a mantle evolution model.

After thorough sampling, a xenolith suit was distinguished from the dominant lherzolites, exhibiting anomalous modal composition. These orthopyroxene-poor and clinopyroxene-rich wehrlite xenoliths, which are only present in the central part of NGVF, show particular petrographic features with small (100-200 μm), rounded olivines and vermicular spinel inclusions sitting in irregularly shaped, elongated, relatively large (up to 3 mm) clinopyroxenes. Orthopyroxene remnants can be present in the core of clinopyroxenes, suggesting that clinopyroxene formed at the expense of orthopyroxene.

Besides petrography, major element composition of minerals also reveals differences between lherzolites and wehrlites. Wehrlites shows Fe and Mn enrichment in olivines, Ti, Al and Fe enrichment in clinopyroxenes, and Fe and Ti enrichment in spinels compared to lherzolite xenoliths from the same localities.

Trace element geochemistry of clinopyroxenes in wehrlite xenoliths was determined by LA-ICP-MS analyses, and show similar results for each locality: slight enrichment in incompatible elements, including LREE compared to lherzolitic clinopyroxenes.

In order to obtain geophysical information of the upper mantle of the NGVF, long period magnetotelluric (MT) measurements were carried out at 14 locations along a ~ 60 km long NNW-SSE profile. As a result, a body with low electric resistivity (high conductivity) was recognized beneath the Moho of the central part of the NGVF.

We propose that the wehrlite was formed by interaction of alkali mafic melt with peridotitic wallrock at top of the subcontinental lithospheric mantle beneath the central part of the NGVF. During this event the original lherzolitic upper mantle went through pervasive metasomatism, where orthopyroxene was transformed into clinopyroxene. At 35-50 km depth a low resistivity body was mapped by MT measurements which suggests that the metasomatic agent as small melt pockets connected by glass veinlets might still be present beneath the central part of the NGVF, possibly causing detectable low resistivity.