Alkaline melt and fluid metasomatism in the lithospheric mantle below the Styrian Basin

L. E. ARADI[1*], E. BALI[2], M. BERKESI[1], A. ZANETTI[3] AND CS. SZABÓ[1]

[1] Lithosphere Fluid Research Lab, Eötvös University, Hungary (*correspondance: aradi.laszloelod@ttk.elte.hu; marta.berkesi@gmail.com; cszabo@elte.hu)

[2] Faculty and Institute of Earth Sciences, University of Iceland (eniko@hi.is)

[3] Istituto di Geoscienze e Georisorse, CNR, U.O.S. of Pavia, Italy (zanetti@crystal.unipv.it)

The Styrian Basin Volcanic Field (SBVF) is located at the western edge of the Carpathian-Pannonian Region. Beneath the area a subducted slab is suspected [1] and subduction related volcanic rocks are also present. In this study we present new mineral chemistry and fluid-inclusion data from amphibole enriched peridotite xenoliths [2] from the SBVF hosted in Plio-Pleistocene alkaline mafic rocks.

Ancient melt removal and metasomatic events were overprinted by infiltration of an alkaline mafic melt, which caused the crystallization of extensive amount of pargasite, minor phlogopite and apatite. The melt in equilibrium with the pargasites is similar to the Plio-Pleistocene alkaline mafic magma of the SBVF. This melt reacted with the ambient mantle peridotite mainly via reactive porous flow causing the transformation of spinels, orthopyroxenes and clinopyroxenes into Cr-rich spinels, phlogopite and pargasite. During this reaction the melt fractionated along the lithospheric column, causing further enrichment in H_2O, CO_2 and fluid mobile elements. This fractionation led to formation of the phlogopite and apatite bearing xenolith group, in which CO_2-rich fluid inclusion were studied.

These residual fluids contain dominantly CO_2 (>98 mol. %), smaller amount of H_2O (<1.2 mol. %), N_2 (<0.1 mol. %) and SO_4^{2-}, dissolved in the H_2O-rich phase. The solid phases of the fluid inclusions consist of different carbonates (magnesite, dawsonite, nahcolite and natrite) and sulfates (anhydrite and thenardite-burkeite). During the formation of amphiboles, the coexisting fluid phase might have become enriched in volatiles (C-O-N-S), Na^+, HCO_3^- and SO_4^{2-}, and then trapped in the amphiboles. Thus, this fluid represents the residual portion of the fractionated hydrous alkaline mafic melt, which most recently metasomatized subcontinental lithospheric mantle under the the SBVF.

[1] Qorbani *et al.* (2015) *EPSL* 409, 96-108.

[2] Aradi *et al.* (2017) *Tectonics* 36, 2987–3011.