Geophysical Research Abstracts
Vol. 20, EGU2018-16703-4, 2018
EGU General Assembly 2018

‘Water’ poor rock forming constituents in upper mantle xenoliths and their possible implications from the Nógrád-Gömör Volcanic Field (Northern Pannonian Basin)

Nóra Liptai (1,2), Levente Patkó (1), István Kovács (3), László Aradi (1), William Griffin (2), Suzanne O’Reilly (2), Viktor Wesztergom (3), and Csaba Szabó (1)

(1) Lithosphere Fluid Research Lab (LRG), Eötvös University, Budapest, Hungary, (2) CCFS-GEMOC, Department of Earth and Planetary Sciences, Macquarie University, Sydney, Australia, (3) HAS RCAS Geodetic and Geophysical Institute, Sopron, Hungary

In the mantle, ’water’ can occur as molecular water in fluid inclusions and in bubbles of silicate melt inclusions or as structurally bound hydroxyl incorporated in mineral structures [1]. Little structurally bound hydroxyl content (tens to few hundred ppm) of nominally anhydrous minerals (NAMs) like olivine, orthopyroxene and clinopyroxene, which compose most of the upper mantle, can control the ’water’ concentration and distribution beneath the Moho.
It is always a question how representative are the determined ‘water’ results for the mantle.
In this research, we introduce a case study from the well-studied [2] Nógrád-Gömör Volcanic Field (NGVF) situated in the northern part of the Pannonian Basin, which is one of the five known Neogene upper mantle xenolith bearing alkaline basalt localities in the region.
NGVF NAMs are extremely ‘water’ poor based on the large number of Fourier-transform infrared (FTIR) spectra of olivines, orthopyroxenes and clinopyroxenes. Olivine dominantly has no detectable ‘water’ content. The hydroxyl content of the orthopyroxene (1 – 147 ppm with an average of 31 ppm) and the clinopyroxene (0.5 – 894 ppm with an average of 186 ppm) are both representing low values. This low ‘water’ content of NAMs is accompanied by unusual spectral properties and extraordinary Dcpx/opx ratios (>3). Furthermore, the structural hydroxyl content in NAMs was compared to different petrographic, geochemical and physical variables without getting consistent relationships. All these results suggest that the NGVF xenoliths were exposed to significant diffusion-driven ‘water’ loss linked to the pre-, syn- and posteruptive processes. The anomalous partition coefficient can be explained by the fact that the speed of H diffusion is different in different minerals [3]. In addition, the unusual spectral features in pyroxenes can be interpreted by the experimental observation that different substitution mechanisms of structural hydroxyl have different diffusion speed [4]. Therefore, slower diffusing substitution could become more prominent during water loss.
The novel application of our study are the diagnostic features which could indicate that ‘water’ loss occurred. This experience could help in selecting more suitable volcanic formations and tectonic setting for obtaining representative ‘water’ content of NAMs in the upper mantle.

This project has been implemented with the support provided to I. J. K. from the National Research, Development and Innovation Fund of Hungary, financed under the K119740 funding scheme.

References:
[1] Hidas, K. et al. 2010. Chemical Geology, 274(1), 1-18.
[2] Liptai, N. et al. 2017. Journal of Petrology, 58(6), 1107-1144.
[3] Tian, Z. Z. et al. 2017. Geology, 45(1), 87-90.
[4] Ferriss, E. et al. 2016. Contributions to Mineralogy and Petrology, 171(6), 55.