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Stable Isotope, Fe^{III}/Fe^{II}, and Trace Element Evidence for Subduction-Related Fluids in the Upper Mantle Beneath the Pannonian Basin

Attila Demeny (demeny@sparc.core.hu)[1], **Torsten Vennemann** (torven@uni-tuebingen.de)[2], **Zoltan Homonnay**[3], **Antal Embey-Isztin**[4] & **Gabor Dobosi**[1]

[1] Laboratory for Geochemical Research, Hungarian Academy of Sciences, Budapest, Budaorsi ut 45., H-1112, Hungary
[2] Institut fur Mineralogie, Petrologie und Geochemie, Eberhard-Karls-Universitat Tubingen, Wilhelmstrasse 56, Tubingen, D-72074, Germany
[3] Department of Nuclear Chemistry, Eotvos Lorand University, 1518 Budapest, P.O. Box 32, Hungary
[4] Dept. of Mineralogy and Petrology, Museum of Natural History, Budapest, Ludovika ter 2, H-1083, Hungary

Alkaline basalts of the Pannonian Basin are characterized by a ubiquitous occurrence of mantle-derived xenoliths. Geochemical investigations on these xenoliths can provide information on the physical and chemical properties of the mantle, as well as on processes responsible for these properties. One of the most important processes that has influenced the mantle region is subduction linked to uplift of the Carpathians. Degassing and partial melting of subducted material leads to migration of fluid-rich melts that can metasomatise adjacent mantle peridotite. Trace element and radiogenic isotope geochemistry of the peridotite xenoliths indicate that the xenoliths have been influenced by metasomatism. However, the origin of the metasomatic fluids is still questionable and is being investigated by analyses of the stable isotope compositions of amphibole megacrysts and hornblendite veins within the xenoliths. Samples have been analyzed from marginal as well as the central part of the Pannonian Basin. Major and trace element contents in these amphiboles suggest a genetic relationship with the host basaltic magma. The oxygen isotope compositions (5.1 to 5.8‰) are typical for unaltered mantle material (5.3-5.5‰). However, hydrogen isotope compositions show a large scatter between -75 and -19‰. The most negative values are regarded characteristic for average mantle-derived material, whereas the upper end of the range is clearly atypical for normal mantle melts. Furthermore, the low <d>δ values have been measured for samples from the marginal area, whereas the high <d>δ values are common for samples in the central part. This distribution is in compliance with the trace element and radiogenic isotope data that show a similar spatial distribution, interpreted as contamination by crustal components in the source of the peridotite xenoliths (Embey-Isztin and Dobosi, 1995). However, interpretations of the hydrogen isotope compositions must also consider effects of magmatic degassing, that, on the basis of a negative correlation between Fe^{III} contents obtained by Mössbauer spectroscopy and the <d>δ values, may have been important. High <d>δ values have been measured for crustal rocks influenced by sea water. Subduction, degassing and melting of such crustal material and reaction with surrounding mantle will result in ^{18}O- and D-enrichments in the mantle. The amphibole megacrysts with high <d>δ values also show a slight ^{18}O-enrichment (+0.2‰) compared to megacrysts with low <d>δ values. Large variations in <d>δ associated with small differences in <d>^{18}O values indicate that crustal melts were present in subordinate amount. Collectively the geochemical data suggests that the basaltic magmas have assimilated metasomatised mantle material prior to crystallization of amphiboles. The metasomatism was most intense in the central part of the Pannonian Basin. Some xenoliths show trace element characteristics suggesting metasomatism by carbonatitic melts. Direct evidence for the existence of such melt is found in rare peridotite xenoliths that contain carbonate and glass veins, some of which also contain amphibole. The trace element contents of these amphiboles significantly differ from the compositions of the megacrysts. Stable isotope investigations suggest that these veins are related to infiltration of fluid-rich, slab-derived melts.

Embey-Isztin, A. & Dobosi, G., *Acta Vulcanologica*, **7**, 155-166, (1995).