HELIOUM ISOTOPIC COMPOSITION OF MANTLE XENOLITHS FROM THE WESTERN EGER RIFT, CZECH REPUBLIC

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We have determined noble gas abundances and isotopic compositions in six mineral separates of mantle xenoliths, megacrysts and phenocrysts from Quaternary volcanic rocks in the western part of the Eger (Ohře) rift, which belongs to the European Cenozoic Rift System (ECRS). Geothermobarometric estimations for the investigated samples from the Železná Hůrka volcano and the tephra-tuff deposit of Mýtina indicate a depth of origin of about 25-40 km. One phlogopite megacryst, one clinopyroxene (cpx) megacryst and an apatite-bearing clinopyroxenite (ACP) were degassed by stepwise heating, while two olivine separates (phenocrysts from olivine nepheline/megacryst) and one cpx megacryst were crushed in vacuo.

The two olivine separates and the stepwise heated cpx yield consistent $^{3}$He/$^{4}$He ratios with a mean of 6.42 ± 0.27 R$_a$. The value obtained by crushing the cpx megacryst is only slightly lower (6.01 ± 0.41 R$_a$), agreeing within error limits. Therefore, we interpret these data to represent the He isotopic composition in the source magma. The $^{3}$He/$^{4}$He ratios obtained by stepwise heating of the phlogopite and ACP separates are 5.19 ± 0.35 and 3.67 ± 0.27 R$_a$, respectively, most likely reflecting the presence of radiogenic He produced by U/Th decay in these 0.3-0.5 Ma old rocks. The radiogenic He is degassed at lower temperatures than the magmatic component, below 700°C for the phlogopite, which shows a He composition indistinguishable from that of the olivines (6.42 ± 0.40 R$_a$) in the 1000°C step. $^{40}$Ar/$^{36}$Ar ratios are ≤ 390 except for some contribution of in situ-produced Ar in the stepwise heating extractions. Ne, Kr and Xe do not show any isotopic signatures typical for the mantle.

The $^{3}$He/$^{4}$He ratios presented here are the first ones reported for mantle rocks from the Eger rift. They are within the range typical for xenoliths from the European sub-continental mantle (6-7 R$_a$; e.g. Gautheron et al., Chem. Geol. 217, 97-112, 2005), supporting a common source of the ECRS in the lithospheric mantle which is enriched in U and Th as compared to the MORB mantle. Recent observations of $^{3}$He/$^{4}$He ratios up to 6.2 R$_a$ in CO$_2$-rich mofette gases from the western Eger rift (Bräuer et al., GRL 32, doi: 10.1029/2004GL022205, 2005) indicate that magma/fluid reservoirs with the same He isotopic signature as shown by the xenoliths still exist in the subcontinental mantle or even in the lower crust beneath that area today.