^{39}Ar measurements on hydrothermal fluids from Yellowstone National Park

R. PURTSCHERT[1], R. YOKOCHI, N.C. STURCHIO[2], Y. KHARAKA[3] AND J. THORDSEN[3]

[1]Physics Institute, University of Bern, Switzerland (purtschert@climate.unibe.ch)
[2]University of Illinois at Chicago, USA (yokochi@uic.edu, sturchio@uic.edu),
[3]U. S. Geological Survey (ykharaka@usgs.gov, jthordsen@usgs.gov)

^{39}Ar ($T_{1/2}$: 269 years) is a useful tracer for groundwater dating for timescales on the order of 50-1000 years [1-3]. Underground production by the ^{39}K(n,p)^{39}Ar reaction may, if not quantifiable, affect the dating results but can also act as a formation sensitive marker of the origin of noble gases in the water [4]. In this study, ^{39}Ar was measured for the first time in hydrothermal fluids from several basins at Yellowstone National Park (USA) to investigate their underground residence times. New sampling techniques were developed in order to extract sufficient amounts of noble gases for the determination of ^{39}Ar and radio-Kr isotopes from steam discharges. Our ^{39}Ar results indicate that underground production exceeds the atmospheric signal by a factor of 3.7-6.2. A comparison with CO_2/^{4}He/^{40}Ar and other chemical and isotopic data indicates that the ^{39}Ar enrichment correlates with the proportion of radiogenic noble gas isotopes released by fluid-rock interaction.

[1] Corcho J. A., Purtschert R., Barbecot F., Chabault C., Rüedi J., Schneider V., Aeschbach Hertig W., Kipfer R., and Loosli H. H. (2007) *Water Resources Research* **43**(W03427). [2] Loosli H. H. and Oeschger H. (1980) *Radiocarbon* **22**, 863-870. [3] Purtschert R. (2008) Timescales and Tracers. In *The natural Baseline Quality of Groundwater* (ed. W. M. Edmunds and P. Shand), pp. 91-108. Blackwell Publishing. [4] Purtschert R., Lehmann B. E., and Loosli H. H. (2001) *Proc. 10th Intl. Symp. Water-Rock Interaction, WRI-10*, 1569-1573.

Geochemical mirages in isotope systematics of the mantle material

YU. D. PUSHKAREV AND L.P.NIKITINA

IPGG, emb. Makarova 2, St. Petersburg 199034, Russia (ydcanon@rambler.ru, lpn@LN10839.spb.edu)

Isotope systematics of the mantle material is based on the isotope composition of its magmatic derivatives and for 30 years has been used to improve our understanding of the Earth's interiors. But the constraints of such approach have never been discussed while often it produces geochemical illusions. Indeed, there are xenoliths of the mantle material depleted both in the main and in rare earth elements but with such REE distribution that this material can generate the melts having $E_{Nd}<<0$ and be identified as the EM or even crust material. Moreover, ~ 40% of tholeiites have such a high Sm/Nd ratio that they can produce the melts with $E_{Nd}>>0$. According to this isotope characteristic they have to be classified as derivatives of DM while in reality they are the melts of ocean crust or lower continental crust material. At last, xenoliths of geochemically closed primitive mantle (PM) give the evidence that composition of protoplanetary material did not correspond to the chondrite one and that the modern Nd isotope composition of PM and of MORB source are identical. It means that deficiency of Nd relative to Sm in real PM in comparison with their concentrations in chondrites is not caused by crust formation and has appeared at the earliest stage of planet evolution. The same conclusion was obtained on the basis of data generalization for Sm-Nd systematics of modern volcanic rocks [1] and as a result of study of coupled ^{146,147}Sm–^{142,143}Nd isotope systematics of the Earth, Moon and Mars [2]. Thus, according to the above mentioned classification of the mantle material as primitive, enriched and depleted one without specifying the classification attribute is meaningless.

The study was supported by RFBR 07-05-00527; 08-05-00861

[1] Caro *et al.*, (2008) *Nature* **452**, 20. [2] Kostitsyn (2004) *Petrology* **12**, 5, 451-466 (in Russian).