# Mercury isotope fractionation due to permeation of a PVC polymer

PAUL G. KOSTER VAN GROOS[1]*, BRADLEY K. ESSER[2], ROSS WILLIAMS[2] AND JAMES R. HUNT[1]

[1]Department of Civil and Environmental Engineering, University of California, Berkeley, CA, USA (*correspondence: pkostervangroos@berkeley.edu)
[2]Chemical Sciences Division, Physical Life Sciences Directorate, Lawrence Livermore National Laboratory, Livermore, CA, USA

The stable mercury isotope system is being investigated as a powerful tool for examining mercury sources and transformation processes in the environment. Accurate interpretation of environmental variations in mercury isotope composition requires knowledge of isotope fractionating processes. A representative fractionation factor, $\alpha=[^{202}Hg/^{198}Hg]_r/[^{202}Hg/^{198}Hg]_o$, where the subscripts *r* and *o* refer to a reservoir and outflow respectively, can be used to describe the magnitude of an isotope fractionating process. In studies published to date, fractionation factors range from $\alpha=1.0005$ to $\alpha=1.0020$ [1,2]. In this work, we experimentally characterize mercury fractionation resulting from a previously unexplored process, permeation through a polymeric material. Similar permeation processes are utilized for generating experimental $Hg^0$ gases and in passive mercury samplers. This work also provides insight into potential fractionation resulting from $Hg^0$ diffusion through other solid and polymer-like materials, such as the cell periplasm and membranes.

For this work, $Hg^0$ was allowed to permeate through the walls of PVC tubing, and subsequently trapped for isotope measurements. The relative isotope ratios of the samples were measured using a liquid sample introduction method with an IsoProbe MC-ICP-MS, and fractionation factors were estimated assuming Rayleigh fractionation. These experiments have yielded an average fractionation factor of $\alpha=1.003$, significantly greater than those previously published. The large magnitude of this effect suggests that diffusion processes through polymer-like materials can result in large isotope variations and its relevance to environmental systems needs to be carefully considered.

Part of this work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

[1] Zheng *et al*. (2007) *J. Anal. At. Spectrom.* **22**, 1097-1104.
[2] Bergquist & Blum (2007) *Science* **318**, 417-420.

# U-PB dating and HF isotope analysis of zircon from young magmatic rocks of the Mid-Atlantic ridge

YU. KOSTITSYN[1], E. BELOUSOVA[2], N. BORTNIKOV[3], S. SILANTIEV[1] AND E. SHARKOV[3]

[1]GEOKHI RAS, Moscow, Russia (kostitsyn@geokhi.ru)
[2]GEMOC, Sydney, Australia (ebelouso@els.mq.edu.au)
[3]IGEM RAS, Moscow, Russia (bns@igem.ru)

We present results of *in situ* U-Pb dating and Lu-Hf isotopic analyses of 140 zircon grains recovered from 13 samples of gabbroic rocks and trondhjemites dredged at 6°N (Markov Deep) and 13°N (Ashadze field) of the Mid-Atlantic Ridge. Dating and geochemical studies of the youngest magmatic rocks from axial mid-ocean rift valleys provide important information about the formation of oceanic crust and its geodynamic evolution. U-Pb and Lu-Hf isotopic analyses were done at GEMOC, Macquarie University, Sydney using a New Wave/Merchantek 213nm laser-ablation microprobe coupled to an Agilent-7500 ICP-MS and NU-Plasma MC-ICP-MS respectively [1].

The Markov Deep is represented by gabbro-norite (I1028, L1097 and L1153 sites) and troctolite (I1069 site) samples. Two metagabbro and three trondhjemite samples were recovered from the Ashadze field (SE-DR-01 site). 17 zircon grains from three samples of the I1028 site yield an age of 1.95±0.05 Ma (MSWD=1.6); 11 grains from the gabbro-norite sample L1153/49 gave 0.98±0.10 Ma (0.2) and 9 zircon grains from two samples from the L1097 site were recorded 0.82±0.02 Ma (1.0). 77 zircon from 5 samples from the SE-DR-01 site gave 0.96±0.03 Ma (1.3). About half of the data-points are concordant within analytical uncertainties, while the remainder show a common-Pb component, which most likely resides in grain cracks or comes from Pb-bearing mineral inclusions.

There is a negative correlation between gabbro-norite ages and dredge depth at the Markov Deep that might reflect a basement age distribution at the mid-ocean rift area.

Hf isotopic data for these zircons show radiogenic compositions; the weighted average $\varepsilon_{Hf}$ for 58 zircon grains from the Markov Deep rocks is +18.8±0.3 (95% conf.), whereas this value for 48 grains from the Ashdze field is slightly lower, +17.7±0.3. These data indicate a long-term depleted mantle source for the parental magmas.

[1] Jackson S.E., Pearson N.J., Griffin W.L. Belousova E.A. (2004). *Chemical Geology* **211**, 47-69.