Sr, Nd, and Pb isotopes of basalts along hotspot-influenced Central Indian Ridge

S. MACHIDA[1], Y. ORIHASHI[2], N. NEO[3], M. TANIMIZU[4], S.C. UNSWORTH[5] AND K. TAMAKI[6]

[1]School of Creative Science and Engineering, Waseda University, 3-4-1 Okubo, Shinjuku, Tokyo 169-8555, Japan (m-shikit@aoni.waseda.jp)
[2]Earthquake Research Institute, the University of Tokyo
[3]Faculty of Sciences, Niigata University
[4]Kochi Core Center, JAMSTEC
[5]National Oceanography Centre, University of Southampton
[6]Graduate School of Engineering, the University of Tokyo

A type of distal ridge-hotspot interaction is observed between the Central Indian Ridge (CIR) and the Réunion hotspot. The Rodrigues, Three Magi, and Gasitao Ridges clearly indicate topographic connection of CIR at 20°S and the Réunion hotspot track. However, northward geochemical enrichment of MORB along a segment of CIR at 18-20°S still remains a contentious issue, and is explained by an inflow of plume materials from the Réunion hotspot [1, 2] or ancient recycling process [3]. In order to define what factor regulates melt production along hotspot-influenced CIR, it is important to clarify extensive distribution of the plume-related or -unrelated MORB. We thus report Sr, Nd, and Pb isotopic compositions, with geochemical data set [4] and H_2O content, of fresh quenched glasses and basalts along CIR at 15-20°S.

Variation of isotopic compositions, Ba/Nb (Ba/La, Nb/Zr), and H_2O content are interpreted by mixing of three mantle endmembers: depleted MORB mantle (DMM); enriched source mantle for the Rodrigues Ridge [5] and intermediate series of the Mauritius Island [e.g. 6]; and enriched source mantle for the Gasitao Ridge [3]. These two enriched components are geochemically distinct from the Réunion plume. In fact, geochemical variation of MORB doesn't relate to the pollution of the upper mantle by the Réunion plume. Melting of the ancient recycled plate materials with a low melting point by the heat brought from the Réunion hotspot regulates voluminous magma production along CIR around 19°S. These results strongly support that small-scale plume-unrelated heterogeneity widespread in upper mantle [7].

[1] J.J. Mahoney *et al.* (1989) *JGR*, **94**, 4033–4052. [2] B.J. Murton *et al.* (2005) *G3*, **6**, 2004GC000798. [3] F. Nauret *et al.* (2006) *EPSL*, **245**, 137–152. [4] Y. Orihashi *et al.* (2009) *GCA*, **73** (13) Sup. **1**, A975. [5] A.N. Baxter *et al.* (1985) *CMP*, **89**, 90–101. [6] S. Nohda *et al.* (2005) *J. Petrol.* **46** (3) 505–522. [7] S. Machida *et al.* (2009) *GCA*, **73**, 3028–3037.

A field method for the *in situ* determination of excess air and oxygen consumption in groundwater

L. MÄCHLER[1*,2], M.S. BRENNWALD[1] AND R. KIPFER[1,3]

[1]Eawag, Swiss Federal Institute of Aquatic Science and Technology, Duebendorf, Switzerland. (*correspondence lars.maechler@eawag.ch)
[2]Institute of Geochemistry and Petrology, ETH Zürich, Switzerland
[3]Institute of Biogeochemistry and Pollutant Dynamics, ETH Zürich, Switzerland

Measurements of dissolved gases play a crucial role in studying aquatic systems in the environment. An important example is the study of oxygen consumption in groundwater. For its determination, the input of oxygen into the water body must be estimated. This input not only depends on the temperature at recharge, but also on a common phenomenon called "excess air", i.e. the entrapment and dissolution of air bubbles into the water, caused by water-table fluctuations, that lead to an excess of dissolved gases in water relative to solubility equilibration.

Noble gases are chemically inert and therefore ideal tracers to study gas transport in groundwater and gas-exchange mechanism at the air-water boundary. The light noble gases (He, Ne) are sensitive indicators for excess air formation, while the heavy noble gases (Kr, Xe) are good proxies to reconstruct the physical conditions (i.e. temperature and salinity) of the water body during the last gas exchange with atmosphere. Furthermore, Ar has similar physical properties as O_2 and can be used to estimate the O_2-input into groundwater.

Common methods to measure noble-gas concentrations are all based on sampling the water in the field and transporting the sample to the laboratory, where the analysis is performed. However, changes in dissolved-gas concentration, in river-groundwater interactions, can occur within minutes/hours and cannot be studied using the conventional approaches for noble-gas analysis.

Therefore, we developed a membrane-inlet mass-spectrometric system to analyse *in situ* O_2, He, Ar, Kr, and CO_2 concentrations in groundwater in the field. The system is based on a commercially available quadrupole mass-spectrometer connected to a membrane-contactor module. We optimized the system to a measurement cycle of about 15 minutes in order to measure gas-concentration changes in groundwater occurring in response to river table fluctuations.