Measuring annual variation of soil air composition focusing on the effect of oxygen depletion on noble gas partial pressures

F. FREUNDT, T. SCHNEIDER AND
W. AESCHBACH-HERTIG*

Institute of Environmental Physics, Heidelberg University,
69120 Heidelberg, Germany
(*correspondence: aeschbach@iup.uni-heidelberg.de)

While it is known that the partial pressures of soil air components like oxygen, carbon dioxide and nitrous oxides show fluctuations on both temporal and spatial scales [1] primarily caused by microbiologic activities in the soil, the use of dissolved noble gases as a climate proxy utilizes the basic assumption that the ground air equilibrating with water during recharge is of atmospheric composition with regard to noble gases [2].

This assumption has been questioned to account for lower than expected noble gas temperatures, suggesting an enrichment of noble gas partial pressures in ground air caused by removal of CO_2 (produced by oxygen depletion) due to its high solubility [3].

To test this proposition, two permanent sampling sites were built in clay dominated soil, allowing for sampling of ground air in regular intervals and depths up to 6 meters. The locations were chosen based on preliminary data by T. Schneider [4] indicating the possibility of high oxygen depletion. O_2 and CO_2 concentrations were measured on site while the noble gases helium, argon, neon, krypton and xenon were measured using mass spectrometry.

Preliminary noble gas data from the first four months of sampling indicate no deviation of noble gas partial pressures from atmospheric values, suggesting that the proposed oxygen depletion model cannot be supported by actual data from the sampled clay soils. Further data extending the record to ten months (August to May) will be presented.

[1] Amundson & Davidson (1990) *J Geochem Explor* **38**, 13-41. [2] Aeschbach-Hertig *et al.* (1999) *Water Resour. Res.*. **35**, 2779-2792. [3] Castro *et al.* (2007) *Earth Planet. Sci. Lett.* **257**, 170-187. [4] Schneider (2010) *University of Heidelberg, master thesis.*

Molybdenum isotopes as a novel tracer for subduction components in the Mariana arc

HEYE FREYMUTH*, TIM ELLIOTT AND
MATTHIAS WILLBOLD

Bristol Isotope Group, University of Bristol, Wills Memorial Building, Queen's Road, Bristol BS8 1RJ
(*correspondence: glxhf@bristol.ac.uk)

At least two different slab-derived components have been proposed to be present in arc volcanoes: a sediment component and a component derived from altered mafic oceanic crust. Despite a widely held belief of the involvement of these components in the genesis of arc volcanoes [1,2] the unambiguous identification of these components and discrimination of their chemical signatures from residual phase mineralogy remains difficult. We propose stable molybdenum isotopes as a novel tracer for subduction components in arc magmas.

Molybdenum has seven stable isotopes, which have been shown to fractionate during the incorporation of dissolved Mo into oceanic sediments. Under oxic conditions, Mo slowly adsorbs to particles in the sediment, a process that is particularly efficient when Fe-Mn oxides are present. The adsorption of Mo is associated with isotopic fractionations from $\delta^{97/95}Mo_{seawater} \approx 1.8$ ‰ to $\delta^{97/95}Mo_{oxic\text{-}sediments} < 0$ ‰. Under anoxic conditions, Mo is quantitatively removed from the water column and sediments with a heavy isotopic composition are produced [3,4].

We measured Mo isotopes on basalts from the Mariana arc as well as representative samples of subducting sediments from ODP sites 800, 801 and 802 using a double-spike technique [5]. The sediments are light in their isotopic composition with $\delta^{97/95}Mo_{sediments} < 0$ ‰, consistent with the incorporation of Mo into the sediment under oxic conditions. The arc basalts are enriched in Mo relative to Pr, an element with similar degree of incompatibility during mantle melting. The Mo isotopes in the arc basalts correlate well with Mo/Pr, Ba/La and Ce/Pb ratios, with samples containing a larger sediment component [6] also having the lowest $\delta^{97/95}$Mo. Less incompatible element enriched samples are isotopically heavy and their $\delta^{97/95}$Mo exceeds the range of ocean island basalts and continental material. They presumably trace a fluid derived from deeper parts of the subducted lithosphere.

[1] Plank & Langmuir (1998) *Chem. Geol.* **145,** 325–394. [2] Plank (2004) *J.Petrology,* **5**, 921–944. [3] Anbar & Rouxel (2007), *Ann. Rev. Earth Planet. Sci.*, **35**, 717–746. [4] Siebert *et al.* (2003) *EPSL* **211**, 159–171. [5] Archer *et al.* (2008) *Nature Geosc.*, **1**, 597-600. [6] Elliott *et al.* (1997) *JGR*, **102**, 14,991-15,019.