Seasonal dynamics of molybdenum in a permanently anoxic lake

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Mo is an essential enzyme cofactor in nitrogenase and nitrate reductase, necessary to nitrogen assimilation by phytoplankton (cyanobacteria and microalgae respectively). Mo is also considered in sediment records as a proxy of anoxic paleo-environments where sulphide builds up and precipitate molybdenum. In order to understand dissolved Mo removal mechanisms in freshwater bodies we investigated the lake Pavin water column (Puy-de-Dome, France).

Lake Pavin is meromictic and at the bottom, about 30 meters out of 91 meters remain permanently anoxic and constitutes a natural “test tube”. The anoxic bottom layer overlaps a large density gradient layer (mesolimnion) where maximum reduced sulphur species concentrations are observed, and a more homogeneous layer where reduced compounds accumulate (monimolimnion).

The Mo size fraction was studied in the meso- and monimolimnion and compared to dissolved organic carbon (DOC) behaviour. Previous studies showed clearly Mo removal within the monimolimnion and chemical association of dissolved Mo with DOC. In this work, we demonstrate that this association is effective with large reactive organic polymers (> 1kD).

Monthly sampling of rivers input, water column solutions and solid samples (sediment traps) allowed to quantify Mo and nitrogen lake annual budget. Seasonal evolution of vertical profiles for dissolved Mo, nitrate, ammonium, sulphate and sulfide are compared and related to nitrate assimilation in the epilimnion and iron sulphide formation in the mesolimnion.

Li isotopic signature of the Reunion plume inferred from Li-Pb isotope systematic of Piton de la Fournaise historic lavas

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We have investigated short-term variations of ^{7}Li/^{6}Li at Piton de la Fournaise volcano in order to better constrain the signature of the Reunion plume source and contribution of shallow-level processes. ζ^{7}Li (with reference to the IRMM-016 standard) determined in 30 lava samples erupted between 1927 and 2006 (including basalts and oceanites) ranges from +3.4‰ to +4.9‰. $\zeta\,^{7}$Li does not correlate with the abundance of olivine xenocrysts (whose mass fraction reaches 50% in oceanites) ruling out diffusive fractionation of Li isotopes between olivine and melt as the main cause of ^{7}Li/^{6}Li variability. However, the heaviest compositions (ζ^{7}Li > +4.2‰) are found in oceanites. Contrasting with global scale systematics, $\zeta\,^{7}$Li correlates negatively with ^{206}Pb/^{204}Pb. More precisely, three distinct arrays converge toward a unique composition, suggesting mixing between a single plume component (with $\zeta\,^{7}$Li = +3.4‰ and ^{206}Pb/^{204}Pb = 18.90) and distinct contaminants. The dominant array may reflect interaction of plume melts with altered oceanic crust having unradiogenic Pb and heavy Li signature.

The Li isotopic signature of Reunion plume, as inferred from Li-Pb isotope relationships, is lighter than that of the Hawaiian plume and plumes sampling EM2 and HIMU mantle components, and is similar to that of DM and EM1 mantle components, as sampled by depleted MORB and Pitcairn lavas, respectively (Chan *et al*., 2006).

In agreement with previous inferences (Vlastelic *et al*., 2006) Li isotopes require little, or not at all, recycling of isotopically light continental sediments or isotopically heavy altered oceanic crust into the Reunion plume source.

References

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