Li-O-Pb-Nd-Hf isotope and trace element systematics and S in residual peridotites: Evidences for ancient hydrothermal fluid-rock interactions at mid-ocean ridges

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Massive plagioclase lherzolite (MSPL) from the Horoman orogenic massif, Japan, which formed at ~ 1 Ga at a mid-ocean ridge (MOR), represents the most unradiogenic Pb reservoir ever found in the mantle [1]. New data for O and Li isotopes of these MSPL combined with previously published trace element, S contents, and Pb, Nd and Hf isotope data reveal evidences for ancient hydrothermal fluid-rock interaction (HFRI) at mid-ocean ridges.

The trace element patterns of MSPL show element enrichment and depletion in variably melt extracted residues. They show 2-43 times lower U/Pb and 3-11 times lower Ce/Pb than those of the depleted MORB mantle or DMM indicating Pb enrichment. Several MSPLs show bulk rock S elemental abundance (146-273 ppm) higher than those of the DMM (116 ppm) and primitive mantle (250 ppm) also suggesting S enrichment. In addition, S positively correlates with Pb. $\delta^{18}O$ (5.11-5.49 ‰) and $\delta^{7}Li$ (-0.83-3.96 ‰) compositions of MSPL suggest a mixing between DMM and a light Li and O isotope source. These oxygen isotope values negatively and positively correlate with age corrected Pb and Nd and Hf, respectively at ~ 1 Ga.

The correlation in O-Li isotope system indicates hydrothermal fluid and MSPL interaction. Hydrothermal fluids can react with residual peridotites at MORs giving rise to sulfide which can sequester Pb and increase S. The correlation of O with Pb, Nd and Hf indicates that HFRI of MSPLs occurring around 1 Ga. Thus, our data reveal evidences for hydrothermal fluid alteration of peridotites occurred at ancient time at MORs and account for origin of highly unradiogenic Pb reservoirs in the mantle.

[1] Malaviarachchi *et al*. (2008) *Nature Geosci*. **1**, 859–863.

Variation in contribution of Bay of Bengal moisture source derived from stable isotopic composition of cave carbonates in Meghalaya, India

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Stable isotope (SI) ratio of calcites in stalagmite samples collected from 3 different caves in the Jaintia (Krem Syndai and Rupasor; N25°09′ and E92°00′) and Khasi Hills (Krem Mawmluh; N25°20′ and E42°45′) of Meghalaya in northeast Himalayas reveals change in rainfall intensity during the last 21 ka BP. Analysis of stalagmite collected from Mawmluh Cave (6.95 – 21.6 ± 0.5 ka) revealed signature of the glacial maxima registered as an abrupt drop in $\delta^{18}O$ values by ~7‰. This is the first observation documenting large variability in isotopic ratio. The Syndai stalagmite (1.8 ± 0.05 ka – 4.69 ± 0.15 ka) captures climatic amelioration across 2.5 to 5 ka. The actively growing Rupasor stalagmite covers the period 0.42 ± 0.14 ka – 2.5 ± 0.03 ka. The late Holocene events, like the Medieval Warm Period (MWP) and Little Ice Age (LIA) have also been captured. Comparing the seasonal variability of present day average rainwater SI record from the Shillong region and wind speed observation from the nearest meteorological observatory allows defining an empirical relationship for predicting the contribution of BoB moisture. The estimates suggests more than 60% drop in the Wind speed (WS) vector corresponding to the ~7‰ difference observed between glacial and non-glacial times.