Molybdenum and uranium isotopes in a euxinic lake

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The isotope geochemistry of redox-sensitive trace metals has a prominent place in studies of oceanic redox history [1]. It is generally accepted that the analysis of sediments may reveal information on biogeochemical evolution of the oceans over time, but we still need to improve our fundamental understanding of the specific water column processes that control the trace metal and isotope geochemistry recorded in sediments. Modern analogs of ancient oceanic anoxia are rare. The objective of this study is to use the euxinic Rogoznica Lake, Croatia, in an attempt to bridge this gap [2].

In order to elucidate the dependence of $\delta^{98/95}$Mo and δ^{238}U signatures on redox conditions, Mo and U isotopes were analyzed in Rogoznica Lake, both in the particulate and in the dissolved phase, from the oxic surface through to the euxinic deep lake. The $\delta^{98/95}$Mo signature recorded in the dissolved phase clearly shows a redox-dependent behaviour, with a seawater value recorded in the upper (oxic) region, changing at depth. Deep lake sediments exhibit a moderate enrichment in Mo, while the authigenic $\delta^{98/95}$Mo ratio is lower (~0.35 ‰) than the seawater value in the euxinic part of the lake. This indicates incomplete removal of Mo from the water column, suggesting that both pH and HS^- plays a role in Mo isotope fractionation in euxinic waters.

On the other hand, the dissolved U profiles are consistent with incorporation of reduced U into the sediment, depleting the overlying water column in U. The sedimentary δ^{238}U ratios are only moderately heavier than open-ocean seawater (~0.15). The dissolved pool in bottom-water is depleted in U and has δ^{38}U signficantly lighter (~0.5 ‰) than the seawater ratio, consistent with U isotope fractionation during U uptake in reducing sediments [3].

These findings from Rogoznica Lake provide important geochemical observations to improve the understanding of the influence of redox conditions on molybdenum and uranium isotopes, and ultimately their use for plaeoceanographic reconstructions.

[1] Lyons et al. (2014) *Nature*, **506**, 307-315. [2] Bura-Nakic et al. (2009) *GCA*, 13, 3738-3751. [3] Andersen et al. (2014) *EPSL*, **400**, 184-194