Do manganese oxides dominate transport of Mo across the chemocline of redox-stratified lakes?

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Redox-stratified basins are often invoked as a common feature of ancient oceans, and yet our conceptual models of the geochemistry in these past oceans contain only limited recognition of the intense biogeochemical cycling that likely occurrs at the chemocline of such basins. To better understand the cycling of Mo in such systems, we explored Mo cycling and isotopic fractionation in the water column, sinking particles and sediments in Fayetteville Green Lake (FGL), a well-studied modern meromictic lake located near Syracuse, New York [1].

The concentration profile of dissolved Mo in FGL exhibits a sharp decline across the chemocline from 16 to ~1 nM, which is coincident with a more than 10-fold increase in the sinking flux of particulate Mo collected in sediment traps. Surprisingly, the water column δ^{98}Mo profile shows a parallel pattern with Mo concentration decreasing from 2.4 ‰ at the surface to 1 ‰ in the deep portion of the lake—a pattern which, at first glance, seems to contradict our usual assumption that only isotopically light Mo is removed to sediments [2].

We propose that this discrepancy could be reconciled if delivery of Mo to the euxinic water column were dominated by the shuttling of isotopically light Mo across the chemocline by Fe-Mn-oxides, leading to a significant negative shift in δ^{98}Mo in the deeper water column. Sediments in the deep lake basin do not record these Mn-oxides however, suggesting a parallel role for Fe-Mo-S particles in the final delivery of Mo to sediments [3,4]. We will discuss the possible implications of these results for understanding Mo and its isotopic cycling and records from ancient, redox-stratified oceans.

[1] Havig et al. (2015) *GCA*, **165**, 389-406. [2] Dahl et al. (2010) *GCA*, **74**, 144-163. [3] Helz et al. (2011) *CG*, **284**, 323-332. [4] Vorlicek et al. (2018) *ACSESC*, *accepted*.