Effect of CdS precipitation on the partitioning of Cd isotopes

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Cadmium displays nutrient-like behaviour similar to that of phosphate in the oceans [1, 2]. This is thought to be due to consumption by phytoplankton in surface waters with remineralization taking place deeper in the water column. Two recent studies have suggested an additional Cd scavenging mechanism via CdS precipitation in organic-rich microenvironments in Oxygen-deficient Zones (ODZ) [3, 4]; this is based on an observed depletion of Cd relative to phosphate along with a Cd isotope shift between the dissolved pool and sinking particles. Up until now, however, there is only indirect evidence for enrichment in light Cd isotopes under hydrothermal reducing conditions [5, 6]. But, partitioning of light Cd isotopes into sulphides in aqueous solution is supported by *ab initio* calculations [7].

In this study, we report CdS precipitation experiments performed under controlled atmosphere (anaerobic) conditions at low (MilliQ water) and high ionic strength (synthetic seawater) and at variable reaction time as well as cadmium/sulphide ratio. Both solution and precipitates will be chromatographically purified and the Cd isotope compositions determined using a double-spike TIMS technique. In such experiments, the Cd isotope fractionation is assumed to follow a Rayleigh distillation model, isolating the CdS product from the unreacted Cd in solution. A slight enrichment in light Cd isotopes in the solid phase, with $\varepsilon^{112/110}\mathrm{Cd}_{\mathrm{CdS\text{-}Solution}}$ of around -2 ± 1, would be expected from the previous natural observations and *ab initio* calculations. These results will provide a test of the postulated Cd removal and isotope fractionation by sulphides in oceanic regions with pronounced ODZ, anoxic basins as well as hydrothermal systems in general.

[1] Boyle et al. (1976) *Nature* **263**, 42-44; [2] Boye et al. (2012) *Biogeosci.* **9**, 3231-3246; [3] Janssen et al. (2014) *PNAS* **111**, 6888-6893; [4] Conway et al. (2015) *GCA* **148**, 269-283; [5] Schmidt et al. (2009) *EPSL* **277**, 262-272. [6] Abouchami et al. (2015) *Goldschm. Abstr.* 8; [7] Yang et al. (2015) *Chem. Geol.* **391**, 74-82.