Rare Earth Element cycling associated with acid sulfate soils from their source and sink

NIAN XU[1*], ANDREW RATE[1] AND BREE MORGAN[2]

[1]School of Earth and Environment, University of Western Australia, M087, Crawley WA 6009 Australia (*correspondence:nian.xu@research.uwa.edu.au)

[2]School of Earth, Atmosphere & Environment, Monash University, Clayton VIC, 3800, Australia

Rare Earth Elements (REEs) and acid sulfate soils

We investigated REE cycling asscociated with acid sulfate soils both from their source and sink by collecting samples from a disposed dredge spoil area and the adjacent stormwater basin in South Yunderup, Western Australia. Oxidation of acid sulfate soils during the land disposal of sulfidic dredge tailings releases acidity and REEs into associated receiving waterways [1] [2]. Consequently sulfidic sediment accumulates in the waterways receiving acidic drainage from dredge spoil. Understanding the geochemical cycling of REEs in acid sulfate soil landscapes and associated drainage system is important for tracing the origins of contaminants. While sedimentary iron sulfides are well known to sorb trace element contaminants in undistrubed conditions, relatively little is understood about their influence on REE cycling, particularly in systems fed by acidic drainage from anthropogenic dredge spoils [3] [4].

Results and discussion

Acid volatile sulfide (AVS) concentrations, a proxy for FeS, were high in sediments (0~277.80, median: 79.15, μmol/g) from stormwater basin than in dredge spoils (0~7.89, median: 0.28, μmol/g). Additionally, sediment AVS was highly correlated (R^2=0.70) with sediment ∑REEs (*aqua regia* extract). Total Fe (*aqua regia* extract) was also found to be correlated with ∑REEs both in sediments (R^2=0.46) and dredge spoils (R^2=0.79).

At all studied sites, the REE patterns show apparent LREE (La – Nd) enrichment, distinct positive Ce anomalies and a "MREE (Eu – Dy) bulge". When comparing sediment sites and dredge spoil sites, ∑REEs were significantly ($P=1.322\times10^{-12}$) enriched in sediment group compared with the dredge spoil group; individual REEs behaved similarly. It was also found that several trace elements including Mn, Fe, Ba, Co, Cr, Pb, and As, are enriched in drain sediments relative to dredge spoil.

[1]Åström (2001), *Chem. Geol* **175**, 249-258. [2] Hirano & Suzuki (1996) *Environ. Health. Persp* **104**, 85. [3]Morgan et al. (2012), *Chem. Geol* **308**, 60-73. [4]Welch et al. (2009), *Geochim. Cosmochim. Acta* **73**, 44-64.