

Hydrological constraints for biogeochemical processes in acidic mining lakes

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Recovery or remediation of acidic mining lakes (AML) is severely impeded through the occurrence of schwertmannite, its transformation and an associated acidity-driven iron cycle that prevents generation of alkalinity [1]

This concept was derived based on evaluation of sediment pore water data using a diffusion-controlled reactive-transport approach. It has, however, been demonstrated that ground water dynamics may have severe effects on the biogeochemical processes in sediments [2]. In this presentation I will therefore discuss some general aspects as to how hydrological processes interfere with biogeochemical process. Examples that will be discussed are

- The inflow of sulfate load on acidity formation from percolated sedimentary schwertmannite.

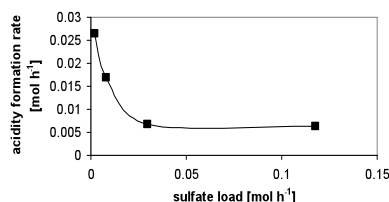


Figure 1: Acidity formation rate as a function of sulfate load measured in column experiments with schwertmannite (data from [3]).

- The effect of flow rate on competition between chemical (through sulfide leading to fixation of iron sulfides) and microbial (amplifying the acidity driven iron cycle) reductive dissolution of iron oxides.

- The spatial decoupling between oxidation of ground-water borne Fe(II) in lake water and the precipitation of schwertmannite through lake-water travel-path controlled reaction kinetics.

Implications of ground-water flow on biogeochemical processes in an AML will be discussed in a companion paper [4].

[1] Peine, Küsel, Tritschler, Peiffer (2000) *Limnol Oceanogr* **45**, 1077–1087. [2] Blodau (2005) *Acta Hydrochim. Hydrobiol.* **33**, 104–117. [3] Blodau & Knorr (2006) *J. Geophysic. Res.* **111**, G0202610.1029/2006JG000165. [4] Beer *et al. this session.*

High resolution sulfur isotope analyses across sulphate-methane transition zone

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We report here for the first time high resolution pyrite sulfur isotope ratios from Bay of Bengal. Pyrite from the sediment samples was extracted following chromium reduction method. Prior to CRS extraction, elemental sulfur and acid volatile sulphide were extracted using acetone and 6N HCl respectively. Two 30m long sediment cores, MD161-13 and MD161-8 were recovered at water depths of 647m and 1033 m respectively on-board *Marion Dufresne*. The cores were collected as part of our on going methane hydrate exploration program in the Krishna-Godavari basin. The CRS content at MD161-13 increases from 0.005 to 0.26 wt% down depth. CRS content varies from 0.04 to 0.41 wt% in the top 7.3 m at MD161-8. Below this depth CRS content shows marked fluctuations. Figure-1 shows the sulfur isotope ratios observed at the two locations. In both the cores $\delta^{34}\text{S}_{\text{CRS}}$ values increases with depth below seafloor. Highly depleted sulfur isotope ratios (-36 to -44‰ VCDT) at MD161-8 are attributed to sulfide oxidation and disproportionation of intermediate sulfur compounds. Sulfate limitation due to burial diagenesis resulted in enrichment in sulfur isotope ratios above SMTZ. Across SMTZ, $\delta^{34}\text{S}_{\text{CRS}}$ increases sharply due to sulfate reduction by anaerobic methane oxidation. AMO cause rapid sulfate limitation.

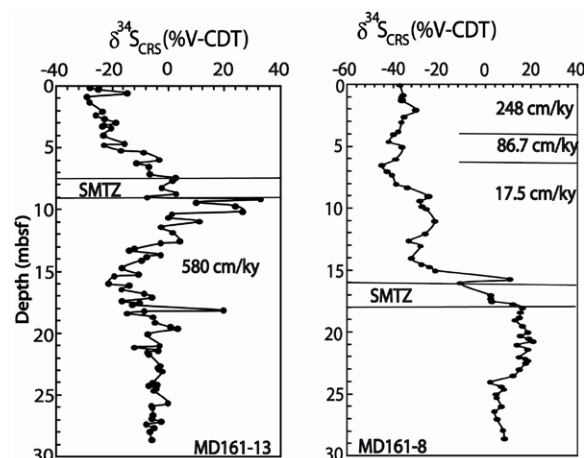


Figure 1: $\delta^{34}\text{S}$ of CRS in MD161-8 and MD161-13.