Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19502

# Seasonal variations in rate of bacterial sulfate reduction and sulfur isotopic fractionation in coastal salt marshes

**BIZHOU ZHU**[1], THOMAS IDRIS MARQUAND[2], CAROLINE M. DAUNT[1], JOSEPHINE A CLEGG[1], BETH WILLIAMS[3], JONATHAN D. TODD[3] AND ALEXANDRA (SASHA) V. TURCHYN[1]

[1]University of Cambridge

[2]Department of Earth Sciences, University of Cambridge

[3]University of East Anglia

Presenting Author: bz280@cam.ac.uk

Microbial sulfate reduction and bacterial iron reduction are important anaerobic respiration pathways involved in the oxidation of organic matter in anoxic sediments. Sedimentary porewaters beneath ponds in the salt marshes near the coast of Blakeney, Norfolk, United Kingdom exhibit bimodal redox conditions where dissolved sulfide and dissolved iron are found in high concentrations as a consequence of microbial sulfate reduction and bacterial iron reduction, respectively. Organic matter in the ponds is supplied by high primary productivity while dissolved sulfate is fed by supply of seawater during high tides or storms and iron minerals are transported by wind. Understanding seasonal variability in microbial sulfate reduction and bacterial iron reduction may help us understand what controls which pond sediment are sulfidic and which are ferruginous. In this study, we employed an *in situ* apparatus to collect porewaters montly over the course of sixteen months and monitored major ion concentrations ($Na^+$, $K^+$, $Ca^{2+}$, $Mg^{2+}$, $SO_4^{2-}$, and $Cl^-$), dissolved $Fe^{2+}$, and $\delta^{34}S_{SO4}$ of dissolved sulfate up to 36 cm below the sediment-water interface in both a sulfidic and a ferruginous pond. In the ferruginous pond, porewater profiles of $Fe^{2+}$ and sulfate show that iron reduction dominates the shallow depths while its magnitude varies over the season, while $\delta^{34}S_{SO4}$ suggests that a small amount of sulfate reduction occurs at depth. We use a reactive transport model for the data from the sulfidic pond sediment, which suggests that the rate of sulfate reduction and the magnitude of sulfur isotopic fractionation varies seasonally. Our results suggest a seasonal adjustment of microbial activity in response to changes in the surface condition likely through changes in the overlying water which are transmitted into the sedimentary pore fluids.