Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.25076

# Quantitative constraints on hydrogen sulfide concentrations in the pore-waters of the reactive iron-rich organic carbon-poor sediments with cryptic sulfur cycling

**ALEXEY KAMYSHNY**[1] AND TOMAS ISRAEL GRIJALVA-RODRIGUEZ[2]

[1]Ben-Gurion University of the Negev
[2]Autonomous University of Baja California Sur

Sediments of the oligotrophic Gulf of Aqaba (Red Sea) contain relatively high amounts of reactive iron of aeolian origin [1]. Active but cryptic sulfur cycling with sub-micromolar concentrations of hydrogen sulfide in the pore-waters exists in the sediments of the Gulf of Aqaba at ≥300 m water depth [2]. The goal of this work was to provide quantitative constraints on concentrations of hydrogen sulfide in the porewaters of sediments with a cryptic sulfur cycling. Toward this goal we have measured rates of sulfate reduction and of hydrogen sulfide oxidation in the sediments. The concentration of hydrogen sulfide was calculated from the rates of its production and consumption and compared to its measured concentrations. We found that concentrations of hydrogen sulfide <100 nM in the porewaters of sediments at 400 m and 700 m water depths is a result of combination of low rates of sulfate reduction and fast rates of hydrogen sulfide oxidation. The possible reasons for low sulfate reduction rates are organic carbon limitation, microbial sulfate reduction suppression due to the presence of high amounts of reactive Fe(III) and Mn(IV) oxides or combination of these two factors. High contents of reactive Fe(III) and Mn(IV) are also a reason for high hydrogen sulfide oxidation rates.

A combination of the measured kinetic parameters should lead to $H_2S$ porewaters concentrations <1-4 nM. The concentrations of $H_2S$ measured at 400 m and 700 m water depths are in the range of 29 - 99 nM. We suggest that one of the possible reasons for this discrepancy is preparation and shaking of sediment slurry which was used for measurement of hydrogen sulfide oxidation rates. This treatment removes diffusion control of the sulfide oxidation rates and may form fresh surfaces of Fe(III) and Mn(IV) oxide available for oxidation of $H_2S$. The methodology developed in this work may be applied to studying the quantitative constraints on sulfur cycling in the other water bodies affected by high aeolian deposition fluxes, including north-eastern Atlantic Ocean.

[1] Boyko, V., Blonder, B. & Kamyshny Jr., A. (2019) Mar. Chem. 216:103691.

[2] Blonder, B., et al. (2017) Front. Microbiol. 8:1131.