Role of dust deposition and seasonal floods in cycling of redox-sensitive elements in the sediments of the Gulf of Aqaba

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The Gulf of Aqaba is situated in hyperarid region with scarce rainfall, rare seasonal floods and intense aeolian dry deposition from adjacent deserts. The goal of this study was to constrain biogeochemical cycling of redox-sensitive elements in the sediments of the Gulf of Aqaba and to identify potential sources of these elements. Redox zonation was studied in the upper 50 cm of the sediments under shallow water depth (≤ 420 m), as well as in the upper 90 cm of the sediments under deep waters (694 m). Iron speciation was measured in dust and material from dry creek beds, which were suggested as potential sources of redox-sensitive elements in the sediments of the Gulf of Aqaba[1].

The oxic zone was located in the upper 1 cm, the manganous zone in the upper 1-10 cm, and the ferruginous zone in the upper 50 cm of sediments. The highest concentration of H_2S (≤ 0.31 μM) in pore-waters was detected only at depths greater than 50 cm bsf due to the presence of dissolved iron (≤ 14.9 μM). Mo content decreased with depth after a maximum concentration of 4 ppm in the surface sediments. Relatively high Mo/TOC values (up to 10 ppm/wt%) were predominantly caused by strong nutrient limitation and low organic carbon content.

The composition of highly reactive iron (Fe_{HR}) present as carbonate-bounded Fe(II) and Fe(III) associated with amorphous oxyhydroxides was similar in both the sediment and dust samples, whereas the composition was lower in seasonal stream beds. Fe_{HR} present as Fe(III) oxyhydroxide (e.g. hematite, goethite) comprised similar concentrations in dry creek beds and deep-waters sediments (65-66% of Fe_{HR}), whereas near-shore sedimentary iron content in this pool was lower (29% of Fe_{HR}). The increase in pyrite content and the presence of H_2S in pore-waters at shallow depths may reflect enhanced consumption of reactive iron due to its reaction with H_2S. The similarities between iron speciation in dust (average Fe_{HR} of 56%) and sediments (51% of Fe_{HR} at deep sites; 44% of Fe_{HR} at shallow sites) implies strong impact of dust input on the iron cycling in the Gulf of Aqaba, as the mean Fe_{HR} content in desert flood material is 31%.

[1] Katz *et al*. (2015), *EPSL* **417**, 87-98.