



The redox couplings between carbon, sulfur and iron in Lake Kinneret (Israel)

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This research uses a geochemical approach to identify and quantify the redox microbial couplings between C, S and Fe in Lake Kinneret (Israel) using high-resolution profiles of a variety of ions and isotopes. For this purpose, lake water and sediment cores (30 cm long) were collected from the deepest part of the lake (40 m depth). The water and the extracted porewater were characterized using measurements of Ca^{2+} , Mg^{2+} , SO_4^{2-} , S^{2-} , alkalinity, total dissolved inorganic carbon (DIC), methane (CH_4), Fe(II), Fe(III) and $\delta^{13}\text{C}_{\text{DIC}}$. The results show that sulfate reduction rates in the water column are low compared to the sediments, as expected due to the low concentrations of organic carbon. In the sediments, SO_4^{2-} is depleted below 10 cm with a concave-up profile, indicating a continuous bacterial sulfate reduction along the core. CH_4 and $\delta^{13}\text{C}_{\text{DIC}}$ profiles suggest that methanogenesis has maximum rates between 5 to 10 cm in the sediments, and it ends in greater depth. The obvious methanotrophy occurs in the water column through aerobic oxidation at the thermocline. Anaerobic methane oxidation by SO_4^{2-} or Fe(III) might occur in the deep water column. Fe (II) and Fe(tot) in the porewater show a significant increase below the sulfate reduction zone. The low concentrations at the sulfate zone seems to be associated to S^{2-} , whereas as long as there is S^{2-} , Fe(II) precipitates as Fe-pyrite. The clear difference between the DIC and the alkalinity at the sediments can be explained by the methanogenesis process. Calcium and magnesium porewater profiles indicate on net dissolution of Ca-Mg carbonate minerals along the sediments. The results imply to other terrestrial environments, and also shed insight into suggested processes in marine sediments that are difficult to

track due to analytical challenges in measuring in such high pressures.