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Biogeochemical Cycling of Manganese in a Drinking Water Reservoir in Germany

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Cycling of Mn and Fe is determined by redox reactions. These are catalyzed by microorganisms as part of their energy metabolism, which makes them essential drivers for transformation between soluble and solid state. Redox cycling depends on O_2 availability, which in turn depends on temperature and stratification dynamics in standing waters. Surface temperature increase and shifts in stratification have been shown for drinking water reservoirs in Germany, including the Wahnbach Reservoir, a supplier for over 800,000 people [1]. Evaluation of long-term data of the Wahnbach Reservoir over the last three decades has revealed an increase in total and dissolved Mn concentrations in waters above the sediment during late summer to autumn. The putative Mn oxidizer "*Metallogenium*" is regularly detected with microscopic counts reaching >100,000 organisms ml^{-1} in these deep water layers [2].

In this study, we aimed to elucidate internal Mn loading. In addition to monthly sampling of the water column, sediment cores were retrieved in summer and autumn of 2022. Three sites within the reservoir were examined.

Lowered oxygen contents were observed above the sediment concomitant with decreasing redox potentials in the sediment. The highest Mn concentrations (0.228 mmol g^{-1} dry weight) were detected at the site closest to the dam. Mn concentrations at the main inflow and in the middle of the reservoir were all much lower (<0.057 mmol g^{-1} dry weight). Batch incubations indicated Mn reduction occurring in the sediment. Dilution series in selective media revealed 10^3 Mn(IV) reducers ml^{-1} both in summer and autumn whereas higher numbers of Mn(II) oxidizers only in autumn. 16S amplicon sequencing of water and sediment samples as well as enrichment cultures will further help to characterize the microbial community involved in Mn transformation. Together with correlations of different water and sediment parameters, we aim to complete our knowledge of biogeochemical Mn cycling and its impact on drinking water quality.

[1] Willmitzer *et al*. (2015), Energie/Wasser-Praxis 12/2015, 84-88.

[2] Hahn *et al.* (2023), DGL conference, Konstanz, 19. - 23. September 2022.