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Changes in lake stratification and oxygen distribution inferred from two contrasting records of Magnetotactic Bacteria and Diatoms

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Magnetotactic Bacteria (MTB) and diatoms produce hard parts on seasonal timescales that continuously becomes embedded in various soft sediment archives (SSA). Consequently, they can, and are, frequently used to reconstruct past environmental conditions in oceans, fjords and freshwater basins. In this study, we observe how these two cosmopolitan creatures can be used to track vertical shifts in the distribution of oxygen in a small mountain lake situated in Western Norway. Several short and long sediment cores have been retrieved from the lake, allowing for a detailed reconstruction that spans the last 2500-years. During periods of enhanced run-off from the catchment the Oxic-Anoxic Transition Zone (OATZ) is lowered down to the lake-sediment interface, due to increased convection. We posit that this condition reduces the concentration of microaerophilic magnetite-producing MTB, an interpretation partly supported by rock magnetic analyzes. Preservation of diatom frustules is, however, improved whenever this oxygen-rich scenario prevails. Similarly, when run-off is low, and the OATZ is lifted above the lake-sediment interface, MTB concentration seems to increase, whereas dissolution of diatoms is more common. This consistent anti-phase relationship between MTB concentration and diatom preservation, occurring on a multi-decadal timescale during lowest reconstructed lake-water pH in the lake's history, suggest a coupled response to subtle changes in external environmental variables that affect catchment and lake hydrology.