

Reconstructing the geochemical cycle of Fe in Lake Towuti (Indonesia)

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Iron speciation and isotope ratios provide information on the redox state of water bodies and sediments through time. They can therefore aid in identifying and characterizing the magnitude of past climate-induced changes in limnological processes.

One of the main goals of the Towuti Drilling Project (TDP) is the reconstruction of environmental and climate dynamics of the western equatorial Pacific region. Redox processes in Lake Towuti (Indonesia) are primarily controlled by climate-induced changes in water column mixing. Today, Lake Towuti is anomalously rich in iron, ultra-oligotrophic, S-depleted, and has anoxic bottom waters. However, previous studies focusing on the last 60kyr reveal water column mixing during dry periods, leading to the deposition of higher amounts of Fe(III)-phases and further diagenetic formation of siderite. Iron speciation and isotopes are thus ideally suited for the reconstruction of past limnological conditions in Lake Towuti and by inference, climate in the equatorial Pacific.

We analysed elemental, mineralogical and isotopic proxies in a 100m Quaternary sequence to track dynamics in paleoredox conditions of the water column. The speciation of sequentially extracted-Fe along with $\delta^{56}\text{Fe}$ analyses of siderite, Fe-phosphates, Fe-oxides, and Fe-oxyhydroxides were tested and compared to conservative trace elements and Rock-Eval data. Disentangling the various processes mobilizing iron (i.e. dissimilatory reduction, diagenesis, precipitation and dissolution of Fe-oxides) will be critical to define how Fe-fractionation relates to the dominant redox reactions taking place in this particular environment.