Trace metal and iron isotope cycling in the meromictic Lake Cadagno

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Lake Cadagno is a 21 m deep alpine meromictic lake that is permanently stratified. It has two chemically distinct water layers; an oxic mixolimnion and an anoxic monimolimnion with a narrow chemocline separating the two. The chemocline is located across a narrow band between 10 to 13 m with a large chemical gradient in dissolved oxygen, redox potential, nutrients (nitrate, ammonia), dissolved and particulate trace elements (iron, manganese, vanadium, chromium, copper etc), and sulfur species. The reaction series for changes in nutrient and trace metal concentrations associated with the tansition from oxic to anoxic conditions follow the "classical" sequence seen for meromictic lakes and sediment porewaters.

Iron isotope analysis of both dissolved (δ^{56}DFe) and particulate (δ^{56}PFe) iron revealed at very sharp transition between 11.5 and 12 m with heavier δ^{56}DFe values above (~0.75 ‰) and lighter δ^{56}DFe values below the ferrocline (-0.61 ‰). The isotope composition of δ^{56}PFe was opposite with lighter δ^{56}PFe values (relative to δ^{56}DFe) above and heavier δ^{56}PFe values below the ferrocline. Our results indicate that δ^{56}DFe fractionation is under kinetic control with the rate of reduced iron diffusion across the chemocline, and its subsequent oxidation, being the key steps in setting δ^{56}DFe.