Carbon-Cycling in Lake Untersee, Dronning Maud Land, East Antarctica

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Lake Untersee is one of the largest (11.3 km^2) and deepest (>160 m) freshwater lakes in East Antarctica. Perennially ice-covered and bounded at one end by the Anuchin Glacier, the lake hydrological balance is controled by input from englacial meltwater and output by sublimation of the ice-cover [1]. The lake is well-mixed, alkaline (pH ~ 10), and supersaturated with dissolved oxygen (~ 150%), with the exception of an anoxic basin in the southwest of the lake that is dominated by methanogenesis processes [1,2]. The lake supports exclusively a microbial ecosystem with no higher plants, invertebrates, or fish. The lake water column is clear and ultra-oligotrophic, with volumetric planktonic primary productivity close to the lowest on record. Meltwater from the glacier contribute solutes and gases to the lake, whereas microbial communities populating the bottom of the lake may influence the carbon isotope signature (^{13}C- and ^{14}C-CO_2) through carbon fixation (*i.e.*, photosynthesis) by cyanobacteria and/or and CO_2 respiration by heterotrophs.

The objective is to investigate geochemical evolution and trace carbon cycling and weathering in Lake Untersee through major and trace element geochemistry and compound-specific carbon isotopic analysis. Results for DIC, DOC, and $\delta^{13}C_{DIC}$ show stable values through the oxic water column (0.3-0.4ppm, 0-0.2ppm and -10 to -7‰, respectively). In the anoxic waters, however, DIC, DOC and $\delta^{13}C_{DIC}$ increases with depth (100-160ppm, 4-12ppm, 22-26‰, respectively), potentially reflecting methanogenesis activity and CO_2 production. Radiocarbon of DIC (0.2-0.9pMC) suggests a system that recycles a dominantly Holocene-age carbon pool controlled by physical input from the glacier, and in-situ biological proccesses.

[1] Steel, McKay, & Andersen (2015) Limnology and Oceanography 60(4), 1139-55 [2] Andersen, Summer & Hawes (2011) Geobiology, 9(3), 280-293