Biogeochemistry of Selenium compounds in the water column of a warm monomictic lake (Lake Kinneret, Israel)

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Lake Kinneret (LK, Israel) is a sub-tropical lake stratified from April to December and the main freshwater resource of Israel [1]. Beside previous studies focused on major elements in LK (nutrients, sulfur), we conducted a three years survey (2015-2017) to study the speciation and cycling of trace micronutrient Selenium (Se). For the first time, the distribution of inorganic Se, reduced (Red.Se) and/or organic (Org.Se) Se, alongside volatile Se compounds was investigated in lake waters.

Total Se fluctuated on small scale (range 74-203 ng Se L^{-1}) with average value of 130±23 ng Se L^{-1}, indicative of internal re-cycling processes. The concentrations of Se(IV), Se(VI), Org.Se and Red.Se exhibit large seasonal variations following lake stratification and the biogeochemical dynamics. During lake mixing period depth profiles are uniform whereas variations become significant in summer-fall periods. This study exhibits the dominance of reduced (probably organic) Se in contrast to mid 90's when Se oxyanions predominated [1]. Results also indicate a strong link between Org.Se and the phytoplankton productivity in surface waters in spring, followed by a high production of volatile Se compounds during summer-fall period, probably as a result of Se containing organic matter degradation mediated by microbial processes in the chemocline region. Bottom waters become gradually anoxic during stratification leading to dominant Red.Se pool, meanwhile Se(VI) is below the LoD (1 ng Se L^{-1}) and Se(IV) concentrations are depleted.

Overall, Lake Kinneret allowed a unique and simultaneous study of Se speciation under oxic and anoxic conditions and its inherent relationship to the seasonal and annual biogeochemical dynamics of the lake.

[1] A. Nishri, I. B. Brenner, G. E. M. Hall, and H. E. Taylor, Aquat. Sci., 61, 215–233, 1999.