The effects of road salt influx on the geochemical cycling of Woods Lake, Kalamazoo, MI

R.J. SIBERT, C.M. KORETSKY*, C. SNYDER, A. MACLEOD AND S. BARONE

Dept of Geosciences, Western Michigan University, Kalamazoo, MI 49008
(*correspondence: carla.koretsky@wmich.edu)

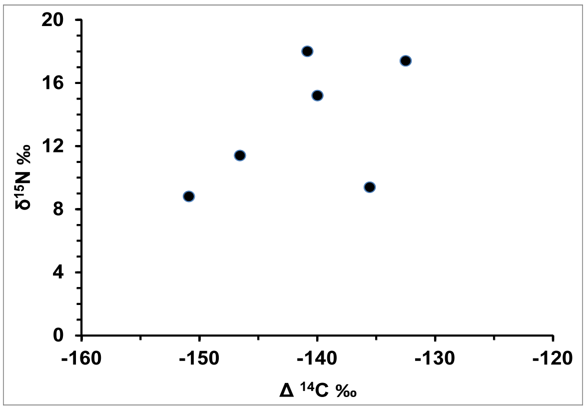
The seasonal application of road deicing salts in densely populated areas can exacerbate eutrophication, and change the seasonal geochemical/mixing cycles of urban lakes through the gradual elevation of chloride concentrations. Elevated chloride levels in hypolimnetic waters may lead to persistent density and redox stratification (i.e. meromixis), stable anoxia in bottom waters, and a decrease in biological diversity. Therefore, the goal of this study is to examine the influence of road salt influx on the geochemical and physical mixing cycles of Woods Lake, a small, kettle lake in urban Kalamazoo, MI (Z_{max} ~13 m). Water samples were collected monthly between May and July 2010, and approximately twice a month between August 2010 and March 2011 at 1 m intervals using a van Dorn sampler. Temperature, pH, conductivity, and dissolved oxygen (DO) values were obtained *in situ* using a YSI 650MDS/600QS multiparameter sonde. Laboratory samples were analyzed colorimetrically for Fe^{2+}, total alkalinity, ΣNH_4^+, ΣPO_4^{3-}, ΣH_2S, and Mn^{2+}, by IC for Cl^- and SO_4^{2-}, and by ICP-OES for major ions and trace metals (Mg, Ca, K, Na, Zn, Ni, Co, Cu, and Pb). The data indicate that temperature varies seasonally in a predictable manner; typical summer and fall thermal stratification is antecedent to inverse wintertime stratification, punctuated by a transition period of thermal homogeneity (November) within the water column. However, analyses of redox sensitive species (i.e. Fe^{2+}, Mn^{2+}, ΣPO_4^{3-}, ΣH_2S, etc) show that Woods Lake displays persistent redox stratification and hypolimnetic anoxia throughout the entire sampling period. For example, maximum Fe^{2+} concentrations are >290 μM in fall and >250 μM in winter below 9 m, indicative of the relative persistence and magnitude of hypolimnetic anoxia. Conductivity profiles indicate the presence of a chemocline that varies from ~8 m in the spring, summer, and fall, to ~10 m in the winter. Conductivity and Cl^- data correlate strongly throughout the sampling period, typically with an $R^2 > 0.95$. Concentrations are more than one hundred times higher than those found in rural lakes of the same region. These data imply persistent hypolimnetic anoxia and redox stratification, presumably due to nutrient and road salt inputs, and that both fall and spring turnover events never fully reach completion.

Radiocarbon depression in aquatic foodwebs of the Colorado River, USA: Coupling between carbonate weathering and the biosphere

J.O. SICKMAN*, M.A. ANDERSON, D.M. LUCERO, J. MCCULLOUGH AND W. HUANG

Department of Environmental Sciences, University of California, Riverside CA 92521
(*correspondence: jsickman@ucr.edu)

The ^{14}C content of living organisms is generally considered to in isotopic equilibrium with the atmosphere. We measured substantial radiocarbon depression of organisms within planktonic and benthic foodwebs of Copper Basin Reservoir, a short residence-time lake at the intake to the Colorado River Aqueduct in California, USA. All levels of the foodweb, had depressed radiocarbon content with inferred 'age' of ca. 1100 to 1200 radiocarbon years ($\Delta^{14}C$ range: -137 to -151‰, Figure 1).



We presume that 'dead' carbon from carbonate weathering entered into the foodweb via photosynthesis, depressing the ^{14}C content of organisms below that of the atmosphere. A two-component mixing model incorporating carbonate weathering and atmospheric CO_2, shows that 15-17% of the carbon in the aquatic foodwebs of Copper Basin is derived from weathering of carbonate minerals in the Colorado River basin. Worldwide, only a few cases of radiocarbon depression have been reported for aquatic ecosystems and the degree of ^{14}C depression in the Colorado River is much larger than that observed in the Arctic or deep ocean environments.