A paleolimnological approach to understanding metal retention and mobility associated with salt-water inundation at Laytons Lake, Nova Scotia

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Sediments in constructed wetlands and lakes have the potential to retain metals mobilized by natural and anthropogenic disturbance. The Cumberland Marsh Region on the Nova Scotia - New Brunswick border is an important waterfowl refuge where arsenic (As) and lead (Pb) that exceed sediment quality guidelines (SQG) are widespread. The role of variable water column chemistry and nutrient load on metal retention and mobility in wetland sediments is not well understood. Laytons Lake, in the Amherst Marsh, Nova Scotia, was documented in the 1970s as becoming a density stratified, incompletely mixed (meromictic) lake by a sudden marine inundation which resulted in a saline bottom layer and a fresh top layer. New water column chemistry data indicate that the lake is no longer saline and has since mixed. A detailed paleolimnological assessment has been undertaken to investigate how these water column chemistry changes have influenced metal retention. Limnology and geochemical analysis of lake sediments using a portable X-ray Fluorescence (pXRF) analyzer, total C, total N and stable isotopes ($\delta^{15}N$, and $\delta^{13}C$) will be used to determine how salinity changes influence nutrient availability and the retention of As and Pb in aquatic sediments. Preliminary results indicate Laytons Lake is now dimictic with the former dense saline layer no longer present and average conductivity of 503 µs/cm at the surface and 1012 µs/cm at 11 m. When the lake was meromictic the average conductivity was 538 µs/ cm at the surface and 26,000 µs/cm at 11 m. It is nutrient rich (high TP) averaging 0.09 mg/L at the surface and 0.42 mg/L at 10 m depth. A depth-time profile of 100 years was established for the core based on the Pb curve. The Pb curve indicates atmospheric deposition is considerable and correlates with lead curves from other lakes in the region. Arsenic indicates a slight increase associated with the saltwater inundation. Distinct sediment stratigraphy compares with chemical changes seen in the pXRF data.

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