Canadian lakes are changing in response to anthropogenic disturbances: a Pan-Canadian geochemical study using micro-X-ray fluorescence sediment core-scanning.

David R Zilkey, Jean-Philippe Jenny, Alexandre Baud, Pierre Francus, Dermot Antoniades, Irene Gregory-Eaves

EGU24-16100, updated on 03 Dec 2024
https://doi.org/10.5194/egusphere-egu24-16100
EGU General Assembly 2024

Canadian lakes are changing in response to anthropogenic disturbances: a Pan-Canadian geochemical study using micro-X-ray fluorescence sediment core-scanning.

David R. Zilkey[1,2], Jean-Philippe Jenny[3], Alexandre Baud[1,2], Pierre Francus[4,5], Dermot Antoniades[2,6], and Irene Gregory-Eaves[1,2]

[1]Department of Biology, McGill University, Montréal, Canada
[2]Groupe de Recherche Interuniversitaire en Limnologie, Montréal, Canada
[3]CARRTEL, INRAE, Université Savoie Mont Blanc, Thonon-les-Bains, France
[4]Centre Eau Terre Environnement, Institut National de la Recherche Scientifique, Québec, Canada
[5]GEOTOP Research Centre, Montréal, Canada
[6]Département de géographie, Université Laval, Québec, Canada

Understanding how lake ecosystems respond to anthropogenic disturbances including mining, agriculture, deforestation, and more is often best answered with historical time series. Unfortunately, a lack of long-term monitoring data can make this difficult; paleolimnology offers an alternative, allowing for the reconstruction of past conditions using proxies from sediment records. As part of the nationally funded Canadian Lake Pulse Network, we analyzed sediment cores from 116 lakes across Canada using micro-X-ray fluorescence core-scanning (μXRF). μXRF served to generate abundance profiles for several elements (e.g., Ca, Sr, Ti, Pb, Cu, Zn), allowing for the assessment of spatiotemporal geochemical changes in Canadian lakes dating back to ~1850 AD. We calibrated μXRF core-scanning with conventional geochemical methods in a 48-lake subset and found strong correlations for numerous elements between conventional wet chemistry and μXRF-measured concentrations (Zilkey et al., accepted, *Environmental Advances*). We then assessed the temporal variability in sediment cores using constrained hierarchical cluster analysis and generalized additive models. Our preliminary results indicate that geochemical change demonstrates significant regional structure. On balance, lakes in eastern Canada predominantly demonstrated a temporal enrichment in metallic elements (e.g., Pb and Zn), while lakes in central and western Canada had a temporal enrichment of elements commonly associated with catchment erosion (e.g., Ti, Sr, K). Our results highlight the heterogeneity in responses across a vast landscape with diverse geological characteristics and land uses, and in the relative importance of anthropogenic disturbances shaping lake sediment geochemistry over time. Key next steps include the investigation of lakes that are distinct relative to their regional trends and the local environmental factors that might explain their contrasting response.