Lake Winnipegosis through time: A paleolimnological perspective

LAKE WINNIPEGOSIS is Manitoba's second largest lake and one of the world's great inland waters. Despite its size and cultural importance, its long-term ecological history remains poorly understood compared with many other large lakes. My research uses paleolimnology, the study of lake sediments, to reconstruct how Lake Winnipegosis has changed over time. Conducted within the Gushulak limnology lab at the University of Manitoba, this study contributes to the lab's ongoing research goals to understand how and why lakes across climate and land-use gradients respond differently to human stressors.

Lake Winnipegosis has long been a cultural and lifeways resource for local First Nation and Métis communities. In recent years, rising concerns over declining water quality and fisheries health have highlighted the need to understand how the lake is changing. This study is one of the first to look at the lake's past and present water conditions, and I hope to help communities to protect and manage this important resource for generations.

Lake sediments act as archives. Layer by layer, they preserve biological remains, chemical signals, and particles washed in from the surrounding landscape. By extracting sediment cores from the lake bottom, we can look back in time and track changes in water quality, nutrient inputs, and ecosystem structure. Indicators such as diatom communities, sedimentary pigments, and stable isotopes help reveal how the lake has responded to climate and land-use changes across its large and complex watershed.

This study explores long-term and spatial patterns in the water quality of Lake Winnipegosis, focusing on the influence of land-use change, multiple inflows, and climate gradients across the lake. We collected four sediment cores from distinct depositional basins across the lake and established their chronologies using ^{210}Pb alpha spectroscopy, producing age models that extend back to around 1850. We analyzed organic matter content (by loss on ignition) and algal and cyanobacterial pigment concentrations (using high-performance liquid chromatography). To identify periods of major changes in sedimentary pigments, we applied constrained cluster analysis, a statistical method that groups successive layers with similar characteristics. This analysis showed that the lake experienced clear changes in water quality over time, and that these changes differed between basins depending on their location, river inputs, and surrounding land use. Future analysis using other water quality proxies, such as stable isotopes and diatom assemblages, will provide a more detailed understanding of the timing and magnitude of water quality changes in Lake Winnipegosis.

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Extracting a sediment core from the bottom of Lake Winnipegosis. *Photo by Geoff Klein, Manitoba Natural Resources and Indigenous Futures.*

The author will be presenting this research at the IAGLR & SCAS Joint Conference in May in the session *Studying Canada's Other Great Lakes.*