Recognition of a modern sediment oscillation in Loon Lake, Halifax County, Nova Scotia: implications for paleoclimate and environmental research

Janet Fownes and Ian Spooner
Department of Geology, Acadia University, Wolfville, Nova Scotia B0P 1X0, Canada

In this study the physical properties of Loon Lake near Halifax were studied with the intent of understanding the processes that influence sedimentation and sediment mobility in small, shallow, organic-dominated lakes. Organic lakes are of interest as productivity shifts resulting from climate change events are often preserved within the lake sediments. As well, remediation of contaminated organic lakes is often hampered by a lack of understanding of the physical processes that govern sedimentation and sediment mobility.

Loon Lake was chosen for this study on the basis of size, shape, depth and location. Loon Lake is located along the path of a recent hurricane. We hypothesised that hurricanes may be significant in the mobilization of lake bottom and watershed sediments. Sonar profiling was carried out to determine basin stratigraphy, using a King 1570 sonar unit. Lake sediment sampling was accomplished with a Glew gravity sediment corer. Sediment traps and thermistor strings were employed to ascertain the lakes present trophic state. 3-D reconstruction of sediment distribution was accomplished using the Rockworks 99 program. Loss on ignition and thin section analyses were carried out on core sediment. Wind speed and precipitation data were used to model basin and watershed dynamics. Loon Lake is highly productive and exhibited very high organic sedimentation rates and much of the organic sediment is algae. A clastic sediment oscillation was evident near the top of all cores recovered. The sediment oscillation is characterized by an increase in the clay content within the lake sediment core and a decrease in L.O.I. The clastic oscillation is asymmetrically distributed, with thickest accumulations in the north end of the lake. The lack of any ice rafted silt or sand within the oscillation indicates that the sediment was deposited during ice-free conditions. Wind speeds associated with recent hurricanes were sufficient enough to produce turbulent conditions and re-suspend previously deposited organic sediment within the lake basin. Rainfall amounts were sufficient and of short enough duration that saturated conditions and overland flow likely existed. We conclude that the oscillation is a product of the transfer of surface sediment (made available in part by physical disturbance) into the lake basin and the transfer within the basin of this sediment by turbulent suspension. These results indicate that shallow organic lakes are susceptible to hurricane induced mixing and sediment redistribution. They also illustrate that significant sediment oscillations can be produced by very short term, catastrophic events and do not necessarily need to be a product of a period of climate change.