Gonna take a sedimental journey…

In September 2007, Cliff Callinan and John Donlon from the NYS DEC came to Lakes Waccabuc and Oscaleta to sample lake sediments and to get a vertical water profile of these lakes for comparison with other lakes in New York. We don't expect to get the results for a while. However, because the purpose and the observations were interesting, we're summarizing it now.

The profile of the lake waters was done with a probe that was similar to the probe that our own volunteers use to obtain dissolved oxygen (DO) and temperature readings, but this probe was superpowered. It recorded information on depth, temperature, DO, oxidation / reduction potential (basically the potential to gain or lose electrons), pH, turbidity, conductivity, and chlorophyll *a*. Even as these readings were recorded, we found that we had chlorophyll *a* at a lower depth than we might have expected (8 meters), and deeper than usually shows up on our DO readings. Cliff said this is a new area of study for the DEC lake staff, and it appears that some blue-green algae (really bacteria and not phytoplankton) can alter their buoyancy to choose their depth. This phenomenon has been observed at a number of other lake systems throughout the state. The blue-green algae appear not to like very strong sunlight, but we don't know if they were avoiding the sunny day or if they are attracted to the phosphate rich areas deeper in the lake. We also don't know from the reading if there is more biomass (more quantity of the algae) or if they are just being more effective at producing chlorophyll *a* in that location. This doesn't lead to any practical application at this point, but it tells us that even in a long-studied area like lakes there is still plenty of science to do and questions to answer.

The sediment analysis is part of a paleolimnology study, which is the study of past lake environments. By taking a core of the sediment at the bottom of the lake, scientists can compare the current conditions to the conditions in the past. The hope is that the sediment is deep enough to get insight into the conditions before the industrial age. The practical implications are that the conditions in the past are likely to be the "best case" conditions for the lake. If the lakes were anoxic (lacking oxygen) at the bottom in their "natural" state, then it is unlikely that present day technologies can change that situation in any enduring way.

In both Oscaleta and Waccabuc, the samples resulted in 30 cm or more of core sediments. The sediments were definitely available deeper, but our sampling process didn't bring them to the surface. The sampling approach is to put a weighted lucite tube, about 2 inches in diameter, into the sediment. Then a top is put on to create suction, a lot like like holding your finger on top of a straw. Unfortunately, this is a big "straw", and the scientists could tell that they were losing some of the sediment as the tube was pulled back to the surface.

Samples were taken from the core at the top centimeter and at the bottom centimeter that were obtained. Not all of the samples are dated because of the time and expense, but enough are dated to correlate the depths of samples with the general time frame. The cores from our lakes were not dated.

A visual observation of the cores was pretty interesting. The very top layer is just like the lake bottom we can see, where it's almost not clear where the water stops and the sediment begins – it's very soupy, mucky, and easily disturbed. The deepest part of the cores we got, in contrast, has been consolidated by time and pressure, and holds together like a very dark pudding. The texture is gelatinous, and it didn't have a lot of smell. It was also intriguing that the sediment from Waccabuc was very dark almost the entire length of the sediment core, while the sediment from Oscaleta clearly became a lighter brown about 7 cm or 3 inches from the top. We think of the lakes as very similar, but at least in this situation they appeared to be quite different.

The tough part comes next. The samples are analyzed using two different biological indicators, and so they are sent to two different universities for species identification. One location will identify the diatoms that are found in the two different layers of sediment, and the other will look at fossilized chironomids (midge larve). Diatoms are algae that create cell walls out of silica. (You may know of diatomaceous earth, often used as a filter, which is the fossilized remains of diatoms.) Diatoms are widespread in freshwater lakes, and different taxa (genus and species) have different tolerances and preferences for certain ecological conditions (for example, nutrient levels). Similarly, Chironomids (a family of invertebrates that spend a portion of their life cycle in lake bottoms) are widespread in freshwater systems and show wide variation in tolerance and preference for dissolved oxygen.

The first step in the process is to use the surficial sediments along with current water quality information (from numerous water bodies with wide differences in water quality) to define what is termed an inference model. Basically this establishes a series of relationships between given taxa and water quality conditions (from pollution tolerant taxa to pollution intolerant (and everything in between), thus enabling one to *infer* water quality conditions from fossilized remains of the target organism(s). The second step is then to identify the specific taxa in the bottom sediment segment(s) and then use the inference model to estimate water quality conditions (e.g., nutrient and dissolved oxygen levels) in the past. We probably won't get the results of this study until at least 2009.

And before you ask – no, we didn't see any evidence of elephant bones in Lake Waccabuc!