Precipitation Proxies in Arctic Lakes

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Accurate records of the pattern and timing of climate change in the Arctic are important to understanding how the global climate system functions. The effects of global climate change might be identifiable in the Arctic before they can be found elsewhere, as suggested by the large and rapid changes documented throughout the Arctic environment in recent years. In addition to showing sensitivity to global changes in climate, the Arctic may also be capable of forcing widespread climate shifts. Changes in Arctic precipitation and river runoff could alter the flow of freshwater to the North Atlantic Ocean and influence the rate of circulation in the great ocean conveyor, thus impacting heat transport and possibly global climate. Models predict that warmer global conditions will generate increases in high-latitude precipitation, and such changes have been observed in the analyses of 20th-century freshwater discharge from Eurasian rivers into the Arctic Ocean. However, evidence for correlation between Arctic precipitation and global mean temperature is controversial, and additional records of precipitation change in the Arctic are critical to resolving this important question.

With support from the Clark Arctic Research Initiative and with several of my colleagues, I began to develop and refine new precipitation proxies based on analyses of specific organic compounds found in sediment samples taken from lakes throughout the Arctic. We are now using the mass spectrometer facilities at WHOI to analyze the samples with the goal of comparing measurements of the organic compounds found in leaf waxes of terrestrial plants with organic compounds found in aquatic algae in order to establish an index that would reflect the amount of evaporation occurring from plants and soils at different time periods.

Konrad Hughen examining a sediment core sample.

We are hopeful that our precipitation proxies will establish linkages between temperature and precipitation in the Arctic during recent decades and in the context of different past climate conditions. Quantifying changes during past intervals when the Arctic may have been ice-free may provide a benchmark for estimating the potential impacts of ongoing anthropogenic (man-made) warming. I am grateful to the Clark Arctic Research Initiative for making this research possible and look forward to sharing the results when our analyses are completed.