The Application of Diatoms to Environmental Earth Sciences

Rod Smith
Geological Survey of Canada

Diatoms (class Bacillariophyceae) are a diverse group of microscopic algae (5->200 μm) found within a wide range of aquatic and sub-aerial environments. They posses a cell wall (frustule) of biogenic silica, whose unique morphology permits the taxonomic identification at the species level. Two factors make diatoms particularly useful in reconstructing environmental change. First, upon death of the organism, diatom frustules generally remain well preserved within sediment (frustule abundance in lakes and ponds may be up to 10^9 per cm^3). Second, individual species' autecology, or environmental distribution, is usually constrained by one or more environmental parameters (e.g., habitat, pH, nutrients, salinity). Using calibration studies to identify the ecological optima and tolerances of indicator species, statistical transfer functions can be developed. Applying these transfer functions to diatom species distributions, identified in sediment cores, permits quantitative reconstruction of specific environmental variables. A classic example of such studies is the identification and quantitative assessment of acidification of lakes in the Adirondacks and Great Britain as a result of modern acid rain deposition. In the present study, diatoms are being used to assess the recent (<200 yr) paleoenvironmental record from Fisherman Lake, NWT (60°21'N 123°15'W). Local residents have suggested that perceived, recent water quality changes are related to natural gas development in the lake basin. Diatoms, in combination with high resolution dating (Pb^{210} and Cs^{137}) and other sedimentological analyses, will address these concerns. Results will demonstrate what environmental and limnological changes have occurred in this lake, when such changes began, and whether these are due to natural environmental fluctuations or, as suggested, industrial pollution.