CYTOMETRIC SORTING OF PINACEAE POLLEN AND ITS IMPLICATIONS FOR RADIOCARBON DATING AND STABLE ISOTOPE ANALYSES

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Several members of the Pinaceae family, for example: *Pinus, Abies*, and *Picea*, produce vast quantities of wind-dispersed pollen. So much so that in some areas of the Northern Hemisphere Pinaceae pollen makes up a significant fraction of the sediment accumulating in lakes. Pinaceae pollen is also found in significant quantities in marine sediments and glacial ice. Most Pinaceae pollen grains are large, i.e., their longest axis is over 50 micrometers. This means that they can be easily concentrated by sieving, although other non-pollen material of the same size, e.g., microscopic charcoal fragments, is typically present in the residue. The development of radiocarbon dating by AMS has made it possible to use pollen directly as a means of dating sediment cores. However, because of the difficulties involved in extracting a pure pollen concentrate, the technique has not been widely applied. Also, there are some reports that radiocarbon ages based on pollen residues may be unexpectedly old, although whether this is due to lag effects in pollen transport or to the extraction techniques themselves is not clear. In addition to its usefulness in radiocarbon dating, Pinaceae pollen in lake and marine sediments may also provide a proxy record of climate change. For example, changes in $\delta^{13}C$ and $\delta^{18}O$ of Pinaceae pollen could theoretically provide evidence of changes in temperature and/or evaporation in the terrestrial environment.

In this paper, we show how new developments in cell cytometry have made it possible to concentrate large quantities of Pinaceae pollen from sediments in a relatively short period of time, i.e., ca., 25,000 grains/hour. Cytometric sorting of Pinaceae pollen is relatively easy because Pinaceae pollen autofluoresces at several wavelengths. We have found that excitation at 514 nm with a yellow filter (emission 545 nm) gives the best results. As a preliminary test of the potential paleoclimatic usefulness of cytometrically concentrated Pinaceae pollen, we have analyzed the stable isotopic (oxygen and carbon) composition of four samples from a sediment core taken at Lake Moran in the central Sierra Nevada. The samples date to 500, 6000, 10000, and 14000 years B.P. These results are compared with the stable isotopic composition of modern pine pollen samples collected at different elevations throughout the state.