

VARIABILITY IN BIOLOGICAL PROXIES FOR UNDERSTANDING PALEOENVIRONMENTAL CHANGE AT PTARMIGAN LAKE, ALASKA

Mary L. Carson, Caleb Schiff, and Darrell S. Kaufman

School of Earth Sciences and Environmental Sustainability, Northern Arizona University, Flagstaff,
AZ 86011, mlc239@nau.edu

Arctic lakes can provide records for understanding the influence of modern warming trends in the context of long-scale environmental change. Biogenic silica (BSi) is a measure of diatom abundance in lakes and reflects lake productivity. Total organic matter (OM) is a sum of aquatic biota and input of terrestrial biological material from the watershed. A 0.62-m-long (07-PT-1A) surface core and a 2.66-m-long percussion core (08-PT-02) were retrieved from 6.5-m-deep Ptarmigan Lake (61° 1' 52" N, 145° 43' 24" W, 705 m asl) in south-central Alaska, and BSi and OM were determined for the last ~3600 years. Plutonium dating and three radiocarbon ages were used to develop a sediment age-depth relationship for both cores. A wet alkaline extraction method was used to determine BSi. OM was determined through loss-on-ignition analyses. Low but measurable BSi ranged from 0.1-2.9% and OM from 3.2-5.6%.

The instrumental period (1910-2006 AD) is represented by 39 samples from the upper 10 cm of 07-PT-1A (one sample per 2.5 years). In this interval, OM is correlated with January temperature ($r=0.42$, $p=0.038$ (adjusted for autocorrelation)), October temperature ($r=0.38$, $p=0.023$), October precipitation ($r=0.44$, $p=0.009$) from Valdez, Alaska (~10 km south of Ptarmigan Lake), and winter (Oct-Mar) Aleutian Low (AL) intensity ($r=0.44$, $p=0.004$) in the North Pacific. A strong AL is generally associated with warmer wetter winters in this region, possibly leading to increased spring runoff, avalanching and a greater input of terrestrial OM into lakes. BSi and modern climate records are not correlated, but there is a general increase in BSi during the period.

Prior to the instrumental period, changes in OM are not consistent with other regional records of AL strength, indicating that long-term controls on OM at Ptarmigan Lake may be different. OM displays an overall increase from ~2480 BP to the present, and two spikes in OM are observed in the record between the onset of the Medieval Warm Period (MWP) at ~960 BP and near the end of the Little Ice Age (LIA) ~100 BP. These spikes suggest a rapid pulse of OM. BSi values generally decline from ~2920 BP until an increase is observed during the MWP. An overall decline in BSi during the LIA is observed. An increase in OM during the LIA, while BSi declined, suggests that additional influences on OM should be investigated.