ALGAL SCAVENGING OF MERCURY IN PREINDUSTRIAL ARCTIC LAKES

P.M. Outridge[1] G.A. Stern[2], P.B. **Hamilton**[3] and H. Sanei[4]
[1] Geological Survey of Canada, Natural Resources Canada, Ottawa, K1A 0E8, Canada.
[2] Centre for Earth Observation Science, University of Manitoba, Winnipeg, R3T 2N2, Canada.
[3] Canadian Museum of Nature, Ottawa, K1P 6P4, Canada.
[4] Geological Survey of Canada, Natural Resources Canada, Calgary T2L 2A7, Canada.

The geochemical speciation of total mercury (THg) was examined in pre-1800 Arctic lake sediments to improve understanding of the natural factors controlling "baseline" THg concentrations and fluxes. Solid-phase binding forms of THg were determined by sequential extraction of dated cores from three lakes in different ecozones (barren tundra, grassy tundra, boreal forest). Sediment organic matter (OM) was mostly of algal origin. Mercury was highly concentrated in the OM fraction of sediment (OM-Hg), comprising 60 – 87% of THg, while OM constituted only 0.6 – 13% (as total organic carbon) of sediment dry wt (DW). OM-Hg concentrations were equivalent to 159$\pm$13 to 776$\pm$215 ng Hg/g DW in algal OM, and were enriched 2–39 times compared to sediment THg, indicating that even small changes in algal OM inputs could significantly alter THg. OM-Hg explained 76 – 96% of the variation in THg concentrations over many centuries. Concentrations of S2 carbon (an algal productivity proxy) and OM-Hg were significantly correlated in two lakes, but not in the boreal forest lake possibly because of algal OM remineralization in its deep water column. Fluxes of S2 carbon, OM-Hg and THg were highly correlated in the barren tundra lake, but could not be calculated for the other lakes. The results overall indicate that high algal Hg concentrations due to scavenging of available Hg controlled the OM-Hg flux to sediments, thus driving changes in the THg concentrations and fluxes. These findings are relevant for our understanding of the long-term stability of baseline THg values in northern lakes under the changing Arctic climate, including in the modern era.