Assessing sources and fate of heavy metals in the northeast Pacific Ocean

Miling Li*[1,2], Dominique Weis[1,2], Kate E. Smith[1,2], Wade D. Smith[3,4], Brian P. V. Hunt[1,3,4], Evgeny A. Pakhomov[1,3,4], Elsie M. Sunderland[5]

[1] Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, BC, Canada.
[2] The Pacific Centre for Isotopic and Geochemical Research, University of British Columbia, Vancouver, BC, Canada.
[3] Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, BC, Canada.
[4] Hakai Institute, Heriot Bay, BC, Canada.
[5] Harvard University, Cambridge, MA, USA.
* Corresponding author: mli@eoas.ubc.ca

Human activity has greatly perturbed the natural biogeochemical cycle of heavy metals and released large quantities of previously sequestered metals into the oceans. Some heavy metals, such as lead (Pb) and mercury (Hg), are toxic and exposure to these metals can lead to adverse health effects on marine biota and humans. Asian industrial emissions from intense coal combustion and metal smelting have become the dominant Pb sources in the northwest and central Pacific Ocean and have contributed notably to airborne particulate matter collected in Western North America[1,2].

Here we investigate the major contamination sources, regional transport, and food-web transfer of Pb and Hg across inland British Columbia (BC), in coastal waters and pelagic regions of the northeast Pacific using a variety of shellfish and fish species collected in BC as bioindicators. We report measured Pb and Hg concentrations and isotopic composition. Preliminary results from these bioindicators indicate that natural sources (i.e., local bedrock, Garibaldi volcanic belt) of Pb dominate freshwater ecosystems in the central BC coast. However, distinctly less radiogenic Pb compositions are observed in fish that forage in the northeast Pacific Ocean and resemble the Pb isotopic composition of honey samples from Metro Vancouver,[3] indicating unradiogenic Pb sources prevail in the western North America and the northeast Pacific Ocean. Both open ocean and inland BC marine species receive little input from Asian Pb sources whereas about one third of total Pb found in coastal organisms as of Asian origin. Mercury concentrations and isotopic composition will be further used to elucidate the sources, regional transport, and food-web bioaccumulation of these heavy metals in this region.

[1]Zurbrick et al. (2017) *Env. Sci. & Tech.* 51(3), 1203-1212;
[2]Ewing et al. (2011) *Env. Sci. & Tech.* 44(23) 8911-8916;
[3]Smith et al. (2019) *Nat. Sustain* 2 223-232.