Geophysical Research Abstracts
Vol. 21, EGU2019-12414, 2019
EGU General Assembly 2019

Spatial variation in the concentration and colloidal distribution of trace elements in a large Boreal river—implications for representative sampling

Chad W. Cuss (1), Marjan Ghotbizadeh (2), Iain Grant-Weaver (1), Tommy Noernberg (1), and William Shotyk (1)

(1) University of Alberta, Renewable Resources, Canada (cuss@ualberta.ca), (2) University of Alberta, Civil and Environmental Engineering, Canada

The tributaries of Boreal rivers often have source waters that are constituted by groundwaters which oxidize as they reach the surface in densely vegetated wetlands. Such tributaries may contain high concentrations of dissolved organic matter (DOM), iron and other trace elements that are associated with these colloidal carriers due to complexation, adsorption, or entrapment within oxyhydroxides. Given the proper physical conditions at confluences in large rivers, the complete mixing of such tributaries may be delayed for several km downstream.

Several Fe- and DOM-rich tributaries empty into the lower Athabasca River in Alberta, Canada, where the width of the river varies between ~300 and 900 m. This reach of the river is also associated with the mining and refining of bitumen, leading to concerns about the contribution of trace elements from industrial operations. Typically, the potential for industrial contributions has been assessed by collecting single samples at the surface, in the middle of the river, at locations upstream, alongside and downstream of industry.

To assess the potential influences of tributaries and industry on trace element concentrations, samples were collected at three points and two depths across transects of the lower Athabasca River, at locations upstream, alongside, and downstream of industry and tributaries, using a metal-free, closed-loop sampling device and protocols that are normally used for polar ice cores and snow. The concentrations of Fe and trace elements were measured using ICP-MS in the ultraclean, metal-free SWAMP laboratory at the University of Alberta. Asymmetrical flow field-flow fractionation coupled to a UV-Visible diode array detector and ICP-MS was also used in the SWAMP lab, to measure the distribution of trace elements amongst mainly ionic and small species < ca. 1 nm, organic-associated colloids, and primarily inorganic colloids < 450 nm.

Results show that significant differences in the concentration and colloidal distribution of some elements persist on the east and west sides of the river for 50–70 km downstream of tributary inputs, with clear implications for representative sampling. The value of using the colloidal distribution of trace elements for source assessment will also be discussed.