Arsenic and selenium in the lower Athabasca River, Alberta, Canada

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Originating from glacial water in the mountains of western Alberta, Canada, the Athabasca River extends over 1200 km and passes through the third-largest oil reserves in the world, the Alberta bituminous (oil) sands. Due to the recent expansion of oil sands mining and close proximity to large surface mines and refineries, water quality in the Athabasca River has come under intense scrutiny. Arsenic (As) and selenium (Se) have been identified as potential contaminants that pose a threat to aquatic organisms and wildlife. What is not well studied however, are the trace metal contributions from natural geological formations and the oil sands activities in the region to the lower Athabaca River. The concentration and chemical speciation of As and Se are critical for assessing their environmental fate and behavior as well as the quality of Athabasca River water.

Water samples were collected from Athabasca River and its tributaries as well as the groundwater seeping into the river downstream of oil sands operations. Preliminary results have proven regional groundwater inputs to be complex and highly variable due to vastly different converging geology. Groundwater ranges from normal (EC ~1500 µS cm^{-1}) to extremely saline (EC >200,000 µS cm^{-1}). The concentrations of total dissolved As were measured as high as 20 µg L^{-1} at some locations and appeared to be variable depending on the groundwater origin. Despite areas of elevated As in shallow groundwater (predominantly As^{III}), surface water values averaged below 0.5 µg L^{-1} at all sampling locations along ~125 km of the river (excluding tributaries). Initial results for Se concentrations average < 0.15 μg L^{-1} in surface water and has resulted in the need for specialized speciation techniques, particularly for high salinity groundwater. Future results will be compared with concurrent studies evaluating isotopic signatures and other sourcing techniques to link natural and anthropogenic influences. This study provides critical information to communities living on the river that use the river as source of food and drinking water.