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Total and methylmercury concentrations in Canadian alpine proglacial freshwater rivers (Banff and Jasper National Parks)

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Anthropogenic activities have resulted in increased mercury (Hg) emissions, and the deposition of inorganic and methyl Hg to watersheds, including those that are glaciated. Alpine glaciers are melting at unprecedented rates due to climate change, with glacier-fed rivers potentially transporting contaminants such as mercury historically archived in glacial ice to downstream proglacial environments. Hg in glacial rivers can also be derived from natural sources such as the erosion of subglacial and proglacial geologic material as glaciers melt and retreat. Furthermore, as inorganic Hg moves downstream, methylation can occur in regions of the watershed that contain wetlands, for example, transforming into it into toxic methyl Hg (MeHg) that can biomagnify in the watershed's food web.

We conducted detailed monthly water quality surveys along three major glacial river transects (the Athabasca, North Saskatchewan, and Bow) in the Canadian Rocky Mountains (Banff and Jasper National Parks, Alberta), that included sampling for total and dissolved concentrations of total Hg (THg; all forms of Hg in a sample) and MeHg up to 100 km downstream of glacial termini. The resultant inter-seasonal data, spanning from May to December in this mid-latitude region, will be used to assess the amount of Hg originating from glacial melt in these systems and how it is transformed as it moves downstream. We will also examine contributions of Hg from the erosion of subglacial and proglacial bedrock material. Preliminary results show that THg and MeHg concentrations are very low in these rivers, consistently measuring at less that 3 ng/L. Additionally, as one moves downstream a larger proportion of THg is in the dissolved fraction. MeHg always measured around or below our laboratory's detection limit (0.01 ng/L) regardless of the sampling location on our river transects.

The presence of contaminants such as Hg can have negative impacts on freshwater quality, organisms within the watershed, and downstream human populations. Quantifying the amount and speciation of Hg in the headwaters of three primary watersheds in Canada could have important implications for future research and the ongoing challenge of properly planning for drastic climate change effects in glaciated alpine regions despite concentrations of THg and MeHg being so low.