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Authigenic lead isotopes in high latitude marine sediments sensitively trace elevated continental freshwater fluxes in the past

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Glacial terminations in circum-Arctic high-latitude settings experienced repeated substantial continental ice sheet retreat, and the conversion of previously glaciated areas into vegetated temperate climate zones. An intensifying hydrological cycle and elevated physico-chemical weathering reactions in previously glaciated regions transfers substantial quantities of dissolved solids from easily weatherable material into the adjacent ocean basins during warming phases. While deglacial freshwater runoff reconstructions raised scientific interested for decades already, we still lack spatially and temporally well-resolved records of continental runoff events. Such records are not only key for continental ice sheet reconstructions, but also extend to associated consequences regarding surface water buoyancy forcing in the Arctic and North Atlantic region during times of excessive meltwater discharge.

Earlier studies usually employed planktonic oxygen isotope reconstructions ($d^{18}O$) for detecting elevated freshwater runoff in NW Atlantic or Arctic settings. Unfortunately, such records are rare, and in cases of more extreme meltwater events, ambient seawater may have become too fresh to sustain presence of marine planktic foraminifera. Authigenic Pb isotopes in marine sediments are a largely unused yet excellent alternative for tracing elevated continental freshwater runoff. The deglacial retreat of the Laurentide Ice Sheet can be particularly well traced with this proxy because of the North American bedrock geology. In the absence of intensified continental runoff into marginal ocean basins due to the presence of an extensive continental ice sheet, the Pb isotopic composition of seawater and authigenic substrates in marine sediments reflects regional ocean circulation dynamics. Intensified freshwater input following glacial climates in turn can be identified because elevated weathering inputs will equally transfer substantial quantities of occasionally exotic weathered Pb runoff from the hinterland.

In this presentation I will show how such elevated freshwater runoff phenomena cannot only be detected in the Northwest Atlantic and the Labrador Sea, but also in the Gulf of Mexico and the Arctic Mackenzie Delta. An additional record from the Siberian Laptev Sea in the Arctic Ocean that traced deglacial runoff from the Siberian Lena River will further corroborate that this proxy is not only suitable in Laurentide Ice Sheet-proximal settings but also works for other continentally glaciated areas.