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Mercury in deep ice-rich permafrost deposits of Siberia

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The ice-rich permafrost in Siberia (‘Yedoma′) is extra prone to thawing due to Arctic warming resulting in an increased sediment input from coastal shorelines and river floodplains to the Laptev Sea. Freeze-locked deposits including hazardous heavy metals are now entering the Arctic Ocean.

Shallow Arctic soil layers often show high levels of mercury (Hg). In this study, we determined Hg concentrations from various deposits in Siberia′s deep permafrost soil. We explored linkages between sediment properties and the Hg enrichment in order to assess a first deep Hg inventory in Pleistocene permafrost down to 36 m below surface. Sediment material from seven sites of different permafrost degradation states on Bykovsky Peninsula (Northern Yakutia) and in the Yukechi Alas region (Central Yakutia) were analysed for Hg content using a Direct Mercury Analyzer (DMA-80), based on photometric absorption. Total carbon and organic carbon and grain size distribution were investigated as sediment property parameters.
First results reveal a Hg concentration from 0.86 to 34.52 μg/kg and a significant correlation of Hg to organic and inorganic carbon. Moreover, Hg concentrations are higher in the sandier sediment of the North-Yakutian Bykovsky Peninsula than in the siltier sediment of the South-Yakutian Yukechi Alas, which is counter intuitive and may well be explained by proximity to the ocean.

This case study showed that the deep permafrost sediments, frozen since millennia, contain Hg. Even though it might not be an alarming amount it could re-enter the recent biogeochemical cycles after thaw with ongoing Arctic warming.