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Mercury and methylmercury along a transect from the Lena river estuary across the Laptev Sea Shelf

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Widespread accelerated permafrost thawing is predicted for this century and beyond. This threatens to remobilize the large amounts of Mercury (Hg) currently 'locked' in Arctic permafrost soils to the Arctic Ocean and thus potentially lead to severe consequences for human and wildlife health. Future risks of Arctic Hg in a warmer climate are, however, poorly understood. One crucial knowledge gap to fill is the fate of Hg once it enters the marine environment on the continental shelves. Arctic rivers are already today suggested to be the main source of Hg into the Arctic Ocean, with dissolved and particulate organic matter (DOM and POM, respectively) identified as important vectors for the land to sea transport.

In this study, we have investigated total Hg (HgT) and monomethylmercury (MeHg) concentrations in surface sediments from the East Siberian Arctic Shelf (ESAS) along a transect from the Lena river delta to the Laptev Sea continental slope. The ESAS is the world's largest continental shelf and receives large amounts of organic carbon by the great Arctic Russian rivers (e.g., Lena, Indigirka and Kolyma), remobilized from continuous and discontinuous permafrost regions in the river catchments, and from coastal erosion. Data on HgT and MeHg levels in ESAS sediments is however limited. Here, we observed concentrations of Hg ranging from 30 to 96 ng Hg g^{-1} d.w. of HgT, and 0.03 to 9.5 ng Hg g^{-1} d.w. of MeHg. Similar concentrations of HgT were observed close to the river delta (54 ± 19 ng Hg g^{-1} d.w.), where >95 % of the organic matter is of terrestrial origin, and the other section of the transect (42 ± 7 ng Hg g^{-1} d.w.) where the terrestrial organic matter is diluted with carbon from marine sources. In contrast, we observed higher concentrations of MeHg close to the river delta (0.72 ± 0.71 ng Hg g^{-1} d.w. as MeHg) than further out on the continental shelf (0.031 ± 0.71 ng Hg g^{-1} d.w. as MeHg). We also observed a positive correlation between the MeHg:Hg ratio and previously characterized molecular markers of terrestrial organic matter (Bröder et al. Biogeosciences (2016) & Nature Com. (2018)). We thus suggest riverine inputs, rather than in situ MeHg formation, to explain observed MeHg trends.