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Degradation and composition of organic carbon in the flocculation layer on the Laptev, East Siberian, and Kara seas

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Rapidly rising temperatures in the Arctic cause thaw of permafrost and increase coastal erosion that mobilizes permafrost-derived organic carbon (OC) into coastal waters. In the water column, permafrost-OC may either degrade and thus, enhance climate warming by adding greenhouse gases to the atmosphere or settle on the seabed and be buried in the sediments. In this study, we focused on the composition and degradation of particulate OC (POC) within the flocculation (nepheloid) layer - a turbulent layer close to seabed that holds a high amount of suspended sediments/particles and transports them across the vast Siberian Arctic shelves. More importantly, previous studies have shown that permafrost-OC, exported to the Arctic Ocean via coastal erosion, is largely carried in the POC fraction of the flocculation layer.

To study flocculation layer dynamics, sediment cores were collected using a multicorer device from the East Siberian Sea, Laptev Sea, and Kara Sea onboard R/V Akademik Mstistlav Keldysh in 2020. The overlying water of the sediment cores was stirred under controlled conditions to mimic sediment resuspension. The entrained suspended sediments were collected and incubated for two weeks (in the dark) to assess their susceptibility to degradation. During the incubation, dissolved O_2, POC, dissolved OC (DOC), dissolved inorganic carbon and $\delta^{13}C$ of each carbon pool were measured at set time points. Additionally, to better understand sediment entrainment and degradation, sediment physical properties, including grain size and mineral-specific surface area, and macromolecular composition were determined.

Our preliminary results show that stirring largely entrains the smallest sediment particles, while it seems not to influence sediment macromolecular composition suggesting that none of the compound classes such as polysaccharides or aromatic compounds are preferentially entrained.

Our incubation data show losses in dissolved O_2 suggesting microbial degradation, however, instead of decreases in the OC pools, especially POC shows increases combined with increases or decreases in DOC. These carbon dynamics likely result from interactions between different carbon pools such as adsorption of DOC to particles and/or leaching of POC to the DOC pool. With accelerated coastal erosion and increase in storminess in the Arctic Ocean due to sea ice loss, understanding dynamics of the flocculation layer and degradation of permafrost-OC on the Arctic sea shelves is becoming even more important to better constrain their potential climate impact.