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Permafrost organic carbon transport and degradation on a transect from the Kolyma River to the East Siberian Shelf

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Arctic rivers will be increasingly affected by the hydrological and biogeochemical effects of thawing permafrost. During transport, permafrost thaw-derived organic carbon (OC) can be degraded into greenhouse gases and potentially add to further climate warming, or transported to the shelf seas and buried in marine sediments, attenuating this 'permafrost carbon feedback'. To assess the transport pathways and fate of permafrost-OC, we focus on the river-shelf continuum of the Kolyma River, the largest river on Earth completely underlain by continuous permafrost. Three pools of riverine OC were investigated: dissolved OC (DOC), suspended particulate OC (POC), and river sediment OC (SOC). Preliminary results of bulk carbon isotopes ($\delta^{13}C$, $\Delta^{14}C$) and molecular biomarkers (lignin phenols, leaf wax lipids) show contrasts in composition and degradation state for these carbon pools. Old permafrost-OC seems to be mostly associated with SOC, and less dominant in POC. However, while SOC shows the oldest $\Delta^{14}C$ signal, lignin phenol results (e.g., acid to aldehyde ratios) suggest this material is the least degraded. In contrast, DOC shows more degraded signal, even at the outflow of an active permafrost thaw site. Our study serves as a terrestrial extension to earlier investigated marine sediments from the Kolyma paleoriver transect in the East Siberian Sea. It also highlights the value of connecting terrestrial and marine observations to gain insight into the complete pathway of permafrost-OC, from the moment of thaw, via aquatic transport and degradation, towards storage in marine sediments.