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Tracing the footprint of permafrost carbon supply to the Canadian Beaufort Sea

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The Canadian Beaufort Sea receives large quantities of sediment, organic carbon and nutrients from rapid coastal erosion and permafrost degradation. In addition, the Mackenzie River, the largest North American Arctic river, discharges great amounts of freshwater, dissolved solids and suspended sediments to the Beaufort Sea. Current changes in these fluxes in response to the warming climate have uncertain consequences for the carbon budget on the shelf and in the deep ocean. To investigate the movement and transformation of organic matter along the land-ocean continuum, we collected water and surface sediment samples along five major transects across the Beaufort Sea during the 2021 expedition of the Canadian Coast Guard Ship Amundsen. Sampling locations span from shallow, coastal, sites with water depths ≤ 20 m, to shelf-break and deep-water settings on the continental slope (water depths of ≥ 1000 m). For this study, we use stable and radiocarbon isotopic ($\delta^{13}\text{C}$ and $\Delta^{14}\text{C}$) analyses of dissolved inorganic (DIC), dissolved organic (DOC) and particulate organic carbon (POC) for surface and bottom waters, as well as surface sediments, in order to compare, contrast and constrain the relative source contributions and ages of these different forms of carbon. Our results will help to better understand the fate of permafrost organic matter in the marine environment and to ultimately improve assessments of the Canadian Beaufort Sea shelf as a carbon source or sink and its potential trajectory with ongoing environmental changes.