Spatial and historical variations in sediment and organic matter supply to the Mackenzie Delta

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The Mackenzie River represents the largest fluvial sediment flux to the Arctic Ocean (124 Mt/yr), delivering as much sediment as all other major Arctic Rivers combined. During the annual Spring flood, a large fraction of Mackenzie River suspended sediments is efficiently trapped in the wide mosaic of deltaic lakes. These lakes offer great potential for reconstructing past records of sediment and fluvial discharge, and can provide context for ongoing climate-induced changes in the drainage basin.

Here we present molecular and bulk ^{14}C data from a laminated deltaic sediment core, spanning the last ~100 years. Additionally, we will use a blend of sedimentological (grain size, mineral surface area), organic (%TOC, %TN, $\delta^{13}C$, $\delta^{15}N$, $\Delta^{14}C$) and inorganic (major/trace elements, Nd isotopes) geochemical analyses to characterize river suspended matter, along with bank, channel, lake and shelf sediments in the Mackenzie delta and near-coastal zone. With this approach we seek to (i) assess recent changes in fluvial discharge of pre-aged (permafrost) soil input, (ii) constrain fluvial sediment provenance, (iii) identify spatial variations in delta sedimentation, and (iv) assess organic carbon burial fluxes.

Our results indicate a loss of mineral-bound terrestrial OC (55-70%) during transport through the delta and deposition on the shelf. Sharp differences in Nd isotopes of the detrital sediment component throughout the delta reveal distinct depositional patterns, reflecting differential supply of sediments emanating from young (i.e. Peel River basin) or old (Canadian shield) geological terrain within the Mackenzie River network. Sediments are characterized by high contributions of fossil OC (bulk ^{14}C-OC 14-27 kyrs) derived from petrogenic source rock material. Leaf wax ^{14}C ages, providing an unbiased (permafrost) soil signal, which vary between 5.1 and 8.8 ^{14}C-kyrs, suggest an increase in pre-aged soil OC input in the last ~20 years.