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Controls on the Mackenzie River sediment geochemistry

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Large rivers are the main conveyors of solid material to the ocean. In this study we have investigated the geochemical composition of the sediments transported by the Mackenzie River (northwest Canada), which is one of the largest river discharging into the Arctic Ocean. Sediments were collected along channel depth-profile in order to characterize the geochemical variability of the sediments with depth in the water column.

We observe an important vertical geochemical stratification of suspended sediments, confirming observation made on other river systems (Amazon, Ganges). For most of the elements, calculated depth-integrated geochemical fluxes are lower by 20% compared to the fluxes calculated using surface sediments only. In addition, we show that the enrichement / depletion of some chemical elements relative to the mean Upper Continental Crust (UCC) composition is mostly controlled by erosion source (igneous vs. sedimentary rocks) rather than modern weathering processes. Taking into account this lithological variability, we calculate the soluble element depletion related to modern weathering processes only. Using a geochemical mass balance, we estimate the bedload contribution to the total sediment load. We find that 25% for the sediments are exported as bedload in the Mackenzie river and its major tributaries. Altogether, these results have important implications for deciphering the controls on river sediments chemical composition at high latitude.