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Deglacial and Holocene Dolomite delivery to the Arctic Ocean from the Mackenzie River

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Carbonate bedrock in the Canadian-Arctic and Northern Greenland are considered the primary source of dolomites in sediments of the Arctic Ocean. Sedimentary dolomite abundance is routinely used as a proxy for ice sheet decay along the Canadian and Northern Greenland coastlines, variations in sea ice production in the Beaufort Sea and changes in Arctic Ocean circulation. Increased dolomite abundances in Younger Dryas aged sediments from the Mendeleev and Lomonosov Ridges have also been argued as evidence for an outburst of proglacial Lake Agassiz into the Arctic via the Mackenzie Valley.

The Mackenzie River is a prominent transport system of weathered bedrock, and of all the Arctic rivers, delivers the largest amount of suspended sediment to the Arctic Ocean. However, no detailed and proximal study of dolomite content of suspended material carried by the Mackenzie River exists. Here we investigate the mineralogy of the fine fraction (>38 um) material in Late Pleistocene to Holocene sediments from an 81.5 m long borehole drilled in the landward part (45 mwd) of the Mackenzie Trough by the Geological Survey of Canada in 1984. The borehole penetrated a 52 m progradational facies deposited during deglacial sea-level rise, and an overlying 30 m unit of marine silts and clays deposited after marine inundation at this site. This study aims to (i) quantify the abundance of dolomites in sediments delivered to the Arctic Ocean by the Mackenzie River and (ii) investigate deglacial and Holocene variations in the dolomite content.

Mineralogical analysis (XRD) of 23 samples reveals the presence of dolomite throughout the core (0-81.5 mbsf) while calcite is present mainly below 22 mbsf. The relative intensity of dolomites varies between 5-10% with an average intensity of 6%. We conclude that Mackenzie Trough has been a source of dolomites for the last 14 ka, and provides a significant and sustained input of fine-grained dolomite to the Arctic Ocean.