Geochemical provenance of postglacial sediments from the Canadian Beaufort and Chukchi-Alaskan margins (western Arctic Ocean)

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Major, trace and rare earth element (REE) concentrations of two sediment piston cores, recovered from the Canadian Beaufort (AMD0214-02PC) and Chukchi-Alaskan (HLY0501-05JPC) margins, were investigated to better constrain the evolution of detrital sediment provenance and transport related to ocean-climate changes since the last deglaciation. The significant correlation observed between REE versus grain-size distribution, elemental and mineralogical ratios suggests that grain-size and clay minerals (notably, illite and kaolinite) are the two most important factors that control the REE composition in the sediment cores. The shale-normalized REE patterns, combined with discriminant plots based on major elements and REE ratios, suggest the following: (1) felsic sediments derived from the Mackenzie River and Canadian Arctic Archipelago are dominant in core 02PC, and (2) felsic sources are dominant in core 05JPC during the deglaciation, which likely reflects the enhanced transport of sediment-laden sea ice from the Mackenzie River and Russian sources linked to an intensified Beaufort Gyre. However, the proportion of this felsic source gradually decreases during the early to late Holocene, whereas sediments of mafic composition from the Bering Strait increase. The Lake Agassiz outburst through the Mackenzie Valley at the onset of the Younger Dryas (~ 13k cal a BP) is characterized in core 02PC by lower light REE and high Si-Zr-Hf-Sc and middle and heavy REE contents, indicating that sediments derived from the northwest part of the Mackenzie River watershed. In core 05JPC, the opening of the Bering Strait at ~11k cal a BP is typified by a marked decrease in La/Sc and REE/Ti ratios, which is related to the depleted nature of the mafic sediment source from the Gulf of Anadyr and Aleutian Arc. Overall, this study demonstrates that REE can be successfully used to track Late Quaternary sediment provenance changes in the western Arctic Ocean.