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Spatio-temporal variations in Mn-enrichment of Quaternary deep-marine Arctic Ocean sediments with implications for sea-ice coverage, ocean circulation, and terrestrial-marine sediment transfer

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In marine sediments, Mn-enriched layers are often interpreted as the result of synsedimentary or early-diagenetic redox processes. However, in the Arctic Ocean, several lines of evidence suggest that the interglacial Mn-enrichments characterizing Quaternary deep-marine sediments are due to an increased input of terrestrial-derived Mn. This Mn, which is delivered to the Arctic shelves by rivers and coastal erosion, undergoes a large number of redox cycles on the organic-rich continental shelves before entering the Arctic basins and eventually being deposited on ridges and abyssal plains through scavenging processes in the water column. In contrast, glacial deep-marine sediments are typically depleted in Mn because the Arctic rivers are blocked from entering the Arctic Ocean by ice sheets, and coastal erosion of Mn-rich sediments is limited due to subaerial exposure of the continental margins.

Notwithstanding our general understanding of the processes driving Mn enrichment in deep marine Arctic Ocean sediments, there are large differences in both spatial and temporal distribution of these Mn-enriched layers. In this contribution, downcore variations in Mn content are compared to other proxy indicators such as planktic foraminifera, bioturbation, organic biomarkers, and variations in IRD, in order to better understand differences in sea-ice coverage, sea-ice drift patterns, and fluvial input between the different late Pleistocene interglacial stages. Moreover, many Arctic sediment cores display a clear increase in both the average Mn content and the amplitude of Mn fluctuations over the Quaternary, suggesting a link between the growth of continental ice sheets and the Arctic Mn-budget.