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A 400-year record of glaciomarine sedimentation associated with the dynamics of the Penny Ice Cap (Baffin Island, Nunavut, Canada)

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Climatological studies show that Baffin Island ice caps (Barnes and Penny) are highly sensitive to global climatic changes. However, there is little high temporal resolution data available to study the long-term response of Baffin Island ice caps to climate change. While most of the sedimentary climate records in the region are obtained from lake sediments, there is less information from glaciomarine sediments. High sedimentation rates that characterize fjords in glaciomarine environments make these sites ideal to study the impact of climate and oceanographic changes on tidewater glacier dynamics at high-temporal resolution. In this context, a piston core (AMD2019-804-12PC) recovered in the Coronation Fjord (Baffin Island, Nunavut, Canada) in an ice-proximal environment was investigated using physical, grain-size, mineralogical, geochemical, and magnetic properties to document changes in sediment transfers from the Penny Ice Cap (PIC) in relation to Late Holocene climate variability. The chronostratigraphic framework of this core was developed by combining AMS ^{14}C and paleomagnetic analysis. The physical and sedimentological analysis show that core 12PC is characterized by laminated mud sediments interspersed with fine sand and disseminated ice-rafted debris (IRD). The biotite+chlorite-plagioclase-feldspar ternary diagram reveals a homogeneous detrital input with a composition characteristic of the Cumberland Batholith. These sedimentary characteristics are interpreted as a product of suspension settling and muddy density flows from turbid meltwater plumes related with the PIC dynamic. Results also reveal two lithofacies (LF) related with distinct glacial regimes. LF1 (601-280 cm; 1500-1800 AD), which covers the Little Ice Age period, is characterized by a high IRD content, below-average values in biotite+chlorite/quartz, low variations in Zr/Ti and Fe/Al, suggesting enhanced tidewater glacier discharge likely associated with the growth of the PIC. LF2 (280-0 cm; 1800 AD to present) is defined by a decrease in IRD content, above-average values in biotite+chlorite/quartz, and high variations in Zr/Ti and Fe/Al, interpreted as representing the retreat of the glacier to its present-day extent in response to modern warming. Similar trends observed between our detrital proxies and the Arctic surface air temperature anomalies, the chironomid-inferred summer-temperature from a nearby lake, and melt feature record from the PIC, suggest high connectivity between atmospheric temperatures variations and the sedimentary dynamics of the PIC during the last 400 years.