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Unraveling Biogeochemical Dynamics of Phosphorus, Manganese and Iron in Arctic Sediments in Baffin and Hudson's Bays

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The Arctic Ocean coastal seafloor represents a diverse and heterogeneous ecosystem vulnerable within the ocean system. Recent transformations in the Arctic Ocean, driven by climate change and human activity, also occur in often-overlooked ecological hotspots, such as large embayments like Baffin and Hudson Bays. The biogeochemistry of Arctic sediments is intricately linked to the dynamics of organic matter deposition, microbial activity, and mineral interactions. Essential elements such as carbon, nitrogen, phosphorus (P), sulfur, iron (Fe), and manganese (Mn) undergo complex diagenetic processes mediated by abiotic and biotic factors. These transformations are crucial for understanding nutrient cycling, carbon sequestration, and the overall functioning of Arctic marine ecosystems. The primary objective of this study is to analyze and clarify the spatial distribution, concentration, and potential biogeochemical interactions of carbon, phosphorus, iron, and manganese in Arctic sediments.

Our sampling focused on the transition zones from terrestrial ecosystems to the deep locations in the Bays. The sediment cores were collected from various water depths, ranging from approximately 30 meters in the fjords of Hudson Bay to 1,558 meters between the Northwestern Passages and Greenland at the central axis of Baffin Bay. We examined the sediment porosity, organic matter, binding forms of P, Fe, and Mn in solid sediments, their concentrations in porewater and microbial communities in 27 locations in Hudson Bays and its catchment and vertical sediment depths profiles in seven locations in Baffin Bay.

In this contribution, we will discuss carbon burial and the biogeochemical cycling of phosphorus, iron, and manganese, as well as their potential impact on water quality as a response to changes in climate, erosion regimes, and increasing anthropogenic pressure.