Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35203

The Transformation of Trace Metal Distributions through the Beaufort Sea and Western Canadian Arctic Archipelago

TIA ANDERLINI[1], JEAN-ÉRIC TREMBLAY[2] AND JAY T CULLEN[1]

[1]University of Victoria
[2]Université Laval

Understanding the distributions of trace elements, like iron (Fe), manganese (Mn), cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), cadmium (Cd), lead (Pb), barium (Ba), and vanadium (V), in the Arctic Ocean is important because they act as micronutrients or toxins for primary producers and can serve as water-mass tracers, revealing modification of Atlantic and Pacific endmembers during Arctic transit. Dissolved trace metal concentrations were measured in seawater in 2021 from the shelf of the Mackenzie River Delta and through the Northwest Passage of the Canadian Arctic Archipelago (CAA) and compared with samples collected in 2009 across the Beaufort Sea shelf. A four-dimensional linear system, using salinity, barium (Ba) concentrations, and Arctic nitrate-phosphate (ANP) endmembers, was applied to determine water mass distributions and associated trace element signatures. This approach identifies sources and sinks of trace metals as waters move from the western Arctic through the Canadian Arctic Archipelago toward Baffin Bay, with implications for Arctic ecosystems and the properties of waters exported to the North Atlantic. Pacific waters entering the western Arctic have greater Zn, Cd, Fe, Mn, Co and Ni concentrations than underlying Atlantic waters, reflecting enrichment along the thermohaline circulation and sedimentary inputs from the Bering Strait and Chukchi shelf. Elevated Cd and Zn in upper halocline waters extend from the Chukchi shelf into the Beaufort Sea, Mackenzie shelf, and Amundsen Gulf. During transit, waters are further modified by inputs from the Mackenzie River (Mn, Co, Ni, Cu), sea ice melt (Mn, Co, Fe, Cu), sediment resuspension on the Mackenzie Shelf (Fe, Pb) and riverine Cu inputs within the CAA. As Arctic warming accelerates hydrological changes, this study provides a baseline for assessing future climate-driven impacts on trace metal distributions.