# On the Origin of the Deep N Deficit in Baffin Bay: Insights from Isotopic Signatures of Nitrate and Nitrous Oxide

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Baffin Bay, a semi-enclosed marginal sea surrounded by Greenland and the Canadian Archipelago, connects the high Arctic with the north-western Atlantic and therefore significantly affects the salt, heat and nutrient budgets of the Labrador Sea in specific and the North Atlantic Ocean more generally. Yet, little is known about the spatial variation of nutrient supply and N transformation processes in this highly understudied ocean basin. Water column nitrogen (N) and oxygen (O) isotope ratios of nitrate ($NO_3^-$) and nitrous oxide ($N_2O$) in Baffin Bay and in the Labrador Sea sampled during the Canadian GEOTRACES expedition reveal diverging trends between the two basins. Exceptionally low $\delta^{18}O\text{-}NO_3^-$ and correspondingly elevated $\delta^{15}N\text{-}NO_3^-$ values in the deep Baffin Bay suggest substantial *in-situ* remineralization of $^{15}N$-enriched organic matter, consistent with surface productivity fuelled by Pacific-derived nutrients. A pronounced deficiency in both oxygen (~ 100 µmol/$L^{-1}$) and dissolved inorganic nitrogen in the deep basin is also associated with an increase in $N_2O$ concentrations and saturation. The observed enrichment in both $\delta^{15}N\text{-}N_2O$ and $\delta^{18}O\text{-}N_2O$ argues for a primarily sedimentary denitrification source of this $N_2O$ in the deep Baffin Bay.