Vertical distributions of ^{129}I in the Southern Canada Basin and the prospect of combining ^{236}U

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Radionuclides present in the marine environment predominantly stem from human activities, notably emanating from nuclear fuel reprocessing plant and nuclear weapons testing. Notably, Sellafield and La Hague facilities in Europe have been significant sources of ^{129}I emissions into the Atlantic Ocean. Subsequently, ^{129}I transported via ocean currents reaching the Canada Basin. The current system in the Canada Basin is intricate and changes by years, this study is based on the most recent data from our laboratory, collected in 2023. The dynamics in the Canada Basin ocean current system intertwined with climate changes. A thorough analysis of currents system serves to enhance our comprehension of Arctic climate change. This study investigates two depth profiles of the St.14 (72.4°N, 155.4°W) and St.32 (74.0°N, 162.0°W) in this region. In the vertical dimension, the ^{129}I/^{127}I ratio exhibits a minimum (2×10^{-10}) followed by maximum (138×10^{-10}) values. Based on the ratio, the water column divided to freshwater mixed layer (0–20 m), Pacific-origin water (20–100 m), Atlantic-origin water (200–1000 m), and bottom aged water mass (~2000 m), with vertical mixing layer existing between these water masses. However, relying solely on analysis of ^{129}I presents limitations. We aim to attain a more precise determination of the water mass movement. The different proportions of each source and input functions result in differing ^{129}I/^{236}U atomic ratio across different sources and time scales. Consequently, the ^{129}I/^{236}U atomic ratio is highly sensitive for analyzing the origins of water mass. This distinctive characteristic enables a more detailed analysis of the pathway and mixing regime of the water mass. The dual-tracer method offers a sensitive and robust approach to investigating ocean current circulation and vertical mixing processes.

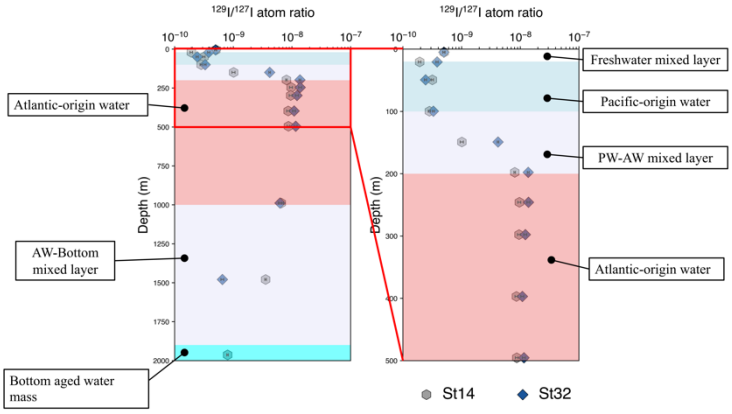

Figure1. Water mass stratification