

Reconstruction of the deposition history of anthropogenic uranium in Baltic Sea sediments using $^{233}\text{U}/^{236}\text{U}$ and $^{236}\text{U}/^{238}\text{U}$ as tracers

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Here we report the first $^{233}\text{U}/^{236}\text{U}$ and $^{236}\text{U}/^{238}\text{U}$ record of the Baltic Sea reconstructed from a dated Landsort Deep sediment core [1].

The $^{233}\text{U}/^{236}\text{U}$ atomic ratio, a novel sensitive fingerprint for environmental processes and nuclear forensics [2], demonstrates its promising prospect to identify the potential source terms of anthropogenic U in the Baltic Sea. The highest $^{233}\text{U}/^{236}\text{U}$ value of $(1.13 \pm 0.03)\%$ in 1970 indicates global fallout as the dominating source of ^{236}U in this site (Fig. 1). The following decrease in $^{233}\text{U}/^{236}\text{U}$ ratio during 1971-1979 reveals that reactor-derived ^{236}U and ^{233}U gradually reached the Landsort Deep, which is likely related to discharges from the European nuclear reprocessing plants La Hague and Sellafield. From 1980 until present, reactor-derived ^{236}U is calculated to account for 46-58% of total ^{236}U based on the narrow distribution of $^{233}\text{U}/^{236}\text{U}$ ratios (0.60-0.78%). A small drop in $^{233}\text{U}/^{236}\text{U}$ ratio and the corresponding peak of $^{236}\text{U}/^{238}\text{U}$ ratio observed around 1986/87 require further investigation to approve the Chernobyl accident as a possible source.

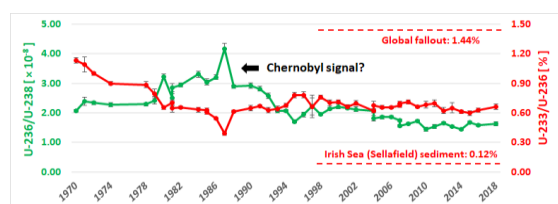


Figure 1: Depth profiles of $^{233}\text{U}/^{236}\text{U}$ and $^{236}\text{U}/^{238}\text{U}$ ratios in a sediment core from the Landsort Deep (Baltic Sea).

The presented record will contribute to the understanding of temporal distribution, transport processes, and the sediment inventory of ^{236}U and ^{233}U in the Baltic Sea.

[1] Häusler et al. (2018) Mar. Geol. 395, 260-270. [2] Hain et al. (2020) Nat. Commun. in press.