The distribution of $^{236}U/^{238}U$ and $^{129}I/^{236}U$ in the North Atlantic and Arctic Oceans

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Anthropogenic ^{236}U has been introduced into the oceans as a result of nuclear weapons tests (global fallout), and, more locally, into the North Atlantic Ocean and the North Sea by releases of radionuclides from the nuclear reprocessing facilities Sellafield (UK) and La Hague (F). While the natural (lithogenic) $^{236}U/^{238}U$ ratio in ocean waters is expected to be $\approx 10^{-13}$, ratios of 10^{-9} – 10^{-8} have been measured in surface waters on the Northern Hemisphere [1-3].

This presentation gives a comprehensive overview about the first data sets of $^{236}U/^{238}U$ in the Northwest Atlantic Ocean (sampled in 2010) [4], the Arctic Ocean (2011/2012) [5], and the North Sea (2009/2010) [6]. Our results show that nowadays the North Sea and the Arctic Ocean are dominated by ^{236}U from nuclear reprocessing, while the Northwest Atlantic Ocean (64°N – 2.5°N) is still dominated by ^{236}U from global fallout.

Our recent studies in the North Sea and the Arctic Ocean demonstrate that the combination of ^{236}U with ^{129}I allows identification of the sources for these nuclides in a water mass according to the respective $^{236}U/^{238}U$ and $^{129}I/^{236}U$ ratios. For example, waters labelled by global fallout are characterised by $^{129}I/^{236}U$ atom ratios below 1, while the combined releases from the Northwestern European reprocessing facilities can be identified by $^{129}I/^{236}U$ ratios of about 100 at/at with increasing trend over the past ≈25 years. Following this approach we conclude that the deep and bottom waters in the Amerasian Basin contain <1% waters of anthropogenic origin. Implications of this new dual tracer concept for the calculation of transit times and the estimation of mixing ratios e.g. of Atlantic Waters in the Arctic Ocean will be discussed.

[1] A. Sakaguchi et al. (2012) EPSL **165**, 333–334. [2] M. Christl et al. (2013) NIM B **294**, 530-536. [3] M. Christl et al. (2012) GCA **77**, 98-107. [4] N. Casacuberta et al. (2014) GCA **133**, 34-46. [5] N. Casacuberta et al., JGR Oceans, in review. [6] M. Christl et al. (2015) NIM B, in press.