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## Application of radioactive and stable isotopes to trace organic matter in the Baltic Sea

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### Application of radioactive and stable isotopes to trace organic matter in the Baltic Sea

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Pu isotopes,  $\Delta^{14}\text{C}$  and  $\delta^{13}\text{C}$  of total organic carbon, lipid and phospholipids (PL) fractions as well as humic acids of the sediments were applied to study the sources of organic substances including chemical warfare agents (CWA). The compound-specific  $\delta^{13}\text{C}$  analysis, PL-derived fatty acid biomarkers and an end-member mixing model were used to estimate a relative contribution of the marine, terrestrial and fossil, petroleum hydrocarbon sources to organic carbon in the sediments, to assess a possible effect of petroleum hydrocarbon contamination on radiocarbon signatures and to elucidate a possible leakage of CWA at the Gotland Deep dumpsite.

Liquid extraction, chromatography (GC-FID, Restek Rxi-1ms column and GC/MS - QP2010, Rxi-5Sil MS 0.22 mm x 25 m column), mass spectrometry and stable isotope compound specific analyses (Finnigan Trace GC ultra gas chromatograph, combined with the Thermo Finnigan Delta plus Advantage stable isotope spectrometer) as well as AMS (1.0 MV HVE Tandatron AMS) were applied. Measurements of  $\Delta^{14}\text{C}$  and  $\delta^{13}\text{C}$  in sediments and in different classes of organic substances as well as concentrations of n-alkanes in bottom sediments collected during 2011-2017 in the open Baltic Sea waters were carried out to clarify their role in the formation of complicated organic carbon mixtures.

In addition phospholipid derived biomarkers were measured in samples of sediments and suspended matter in order to obtain information about microbial communities and their response to the contamination. Radionuclide studies of sediments sampled during 2011-2014 in the open Baltic Sea and in Curonian Lagoon showed wide variations with low <sup>137</sup>Cs and <sup>239,240</sup>Pu activity concentrations in the Lagoon and higher levels in the open Baltic Sea, including the Gotland Deep. Similarly, more depleted  $\delta^{13}\text{C}_{\text{TOC}}$  values in sediments were found in the Curonian Lagoon when compared with the open Baltic Sea, in agreement with the expected transport of natural organic matter of the terrestrial origin to the Baltic Sea. It has been shown that contrary to the variation of  $\delta^{13}\text{C}_{\text{TOC}}$ , the most depleted  $\Delta^{14}\text{C}_{\text{TOC}}$  values were found in the Gotland Deep, which could indicate a leakage from dumped chemical warfare agents, rich in fossil carbon (petroleum, natural gas, coal).

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