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Plutonium speciation in the southern Baltic Sea sediments

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Wet and dry atmospheric fallout from nuclear weapon tests is one of the most important sources of plutonium in Baltic Sea. The other sources: plutonium releases from spent fuel facilities in Sellafield (UK) and Cap de la Hague (France) are less important. Since April 26, 1986 there is a new source of plutonium – Chernobyl plutonium, which should be taken under note in estimation of its radiological effects on the environment. In marine environment plutonium exists on III, IV, V and VI oxidation state and in the Baltic Sea 99% of total plutonium is deposited in sediments.

In this study 6 different chemical forms of plutonium (the fraction dissolved in water, connected to carbonates, connected to oxides, complexed with organic matter, mineral acids soluble and the rest) in sediments from the delta of Vistula River, Gdańsk Bay, Gdańsk Deep and Bornholm Deep were determined.

The distribution of $^{239+240}\text{Pu}$ in analyzed sediments samples was not uniform and depended on its chemical form, depth and geomorphology of the sediments. The highest $^{239+240}\text{Pu}$ concentrations were found in muddy sediments of Gdańsk Bay at 8-9 cm layer while the lowest, 10 times lower than in Gdańsk Bay, near the delta of Vistula River. The lowest plutonium concentrations were found in the lowest layers (below 22 cm).

According to all analyzed fractions the biggest amount of $^{239+240}\text{Pu}$ in all sediments was found in the fraction connected to carbonates: the delta of Vistula River –34%, Gdańsk Bay –42%, Bornholm Deep –35%. In sediments of Gdańsk Deep plutonium was mostly connected to fraction soluble in mineral acids (40%). Significant $^{239+240}\text{Pu}$ amount was also connected to organic matter (29%), but the lowest amount of plutonium was in fraction dissolved in water.

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