^{241}Am in the bottom sediments of the southern Baltic Sea

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INTRODUCTION

The fieldwork and sampling for this project were carried out during a cruise on the Polish Academy of Sciences (PAN) ship *r/v Oceania*. Several sediment cores were collected from the southern Baltic Sea in 2010 and 2019. The occurrence of artificial radioactive isotopes like ^{241}Am ($T_{1/2}$ = 432 y) in the Baltic Sea can be attributed to a few factors. The Chernobyl nuclear power plant disaster in April 1986 was an important event that introduced ^{241}Am into the environment. ^{241}Am has a distinctive characteristic: its activity in the environment increases by its primary intermediate source, ^{241}Pu. Bottom sediments are integral to the aquatic environment and form specific ecological niches for many aquatic organisms. Currently, there is a lack of information conducted to assess the status and trends of changes in the contamination of the bottom sediments of the southern Baltic Sea with the radioactive isotope ^{241}Am. This underscores the importance of monitoring this radionuclide in the marine environment.

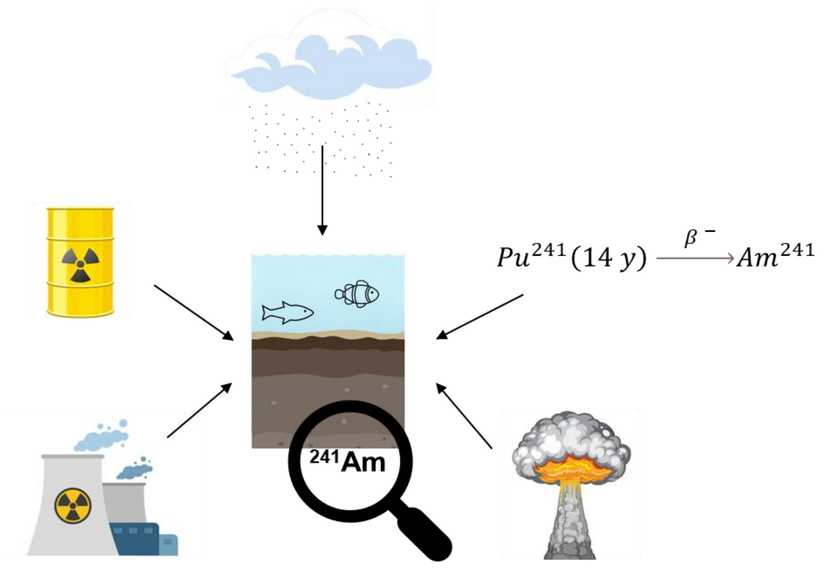


Figure 1. Sources of Americum isotopes in the Baltic Sea

AIM

Determination of activity and examination of the distribution of americium ^{241}Am radionuclide in dated bottom sediments of the southern Baltic Sea.

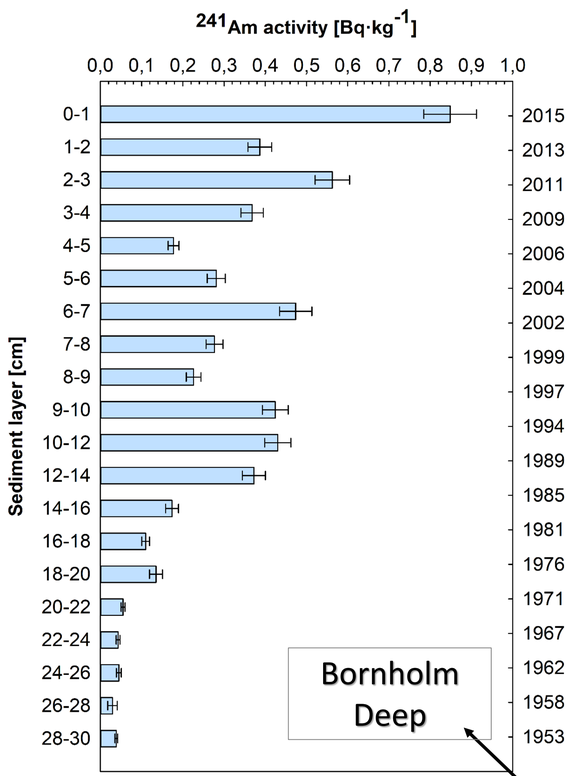
METHODS

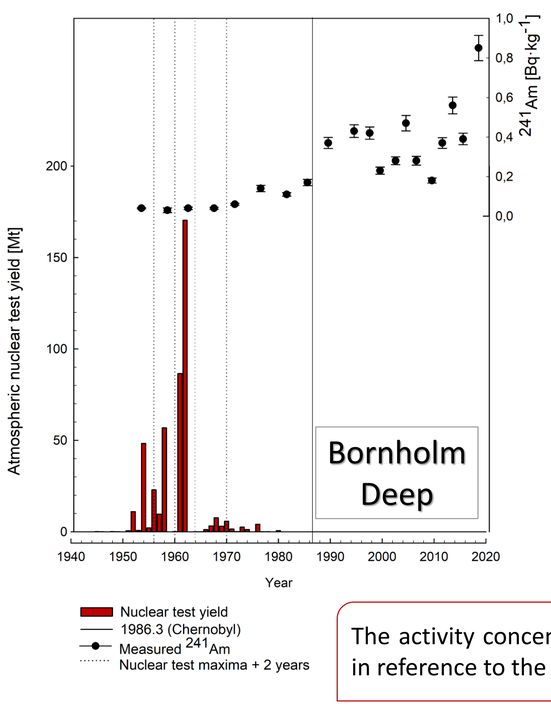
Marine sediments

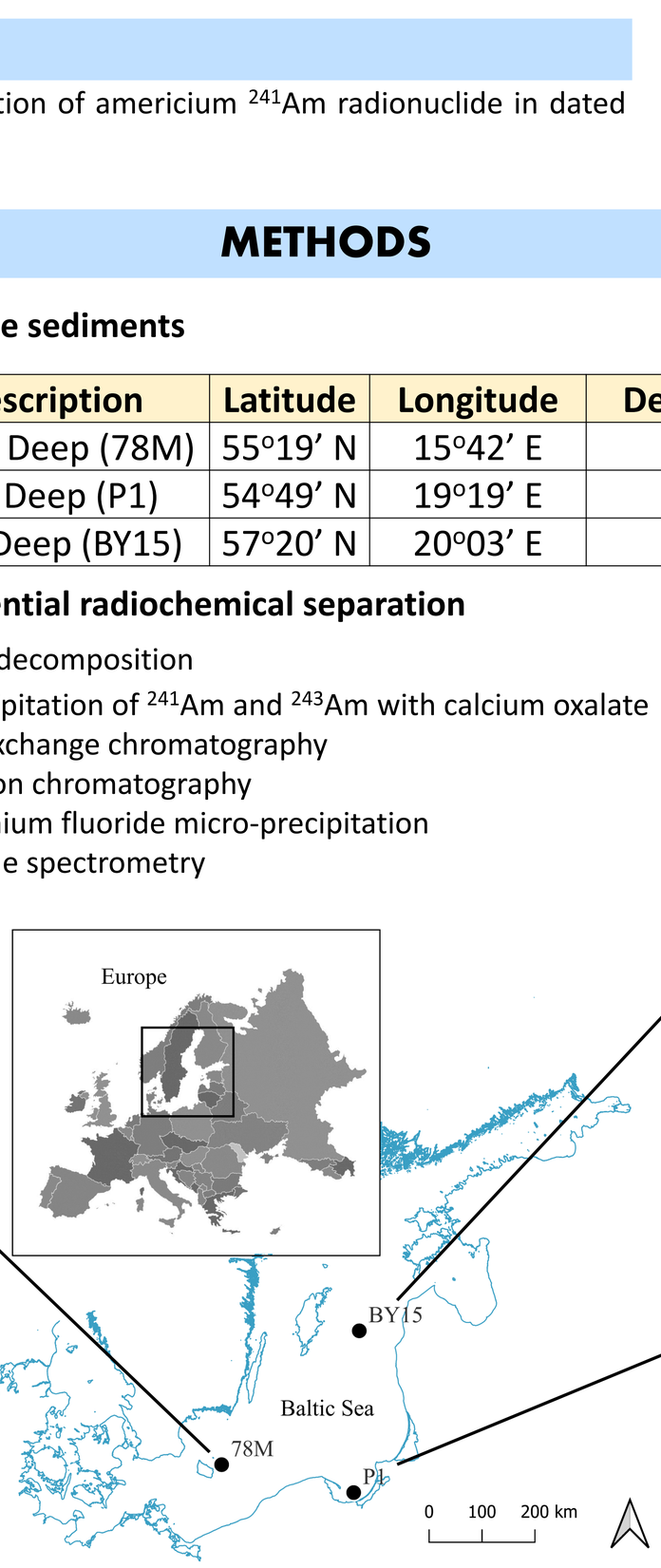
Site description	Latitude	Longitude	Depth [m]
Bornholm Deep (78M)	55°19’ N	15°42’ E	86
Gdańsk Deep (P1)	54°49’ N	19°19’ E	102
Gotland Deep (BY15)	57°20’ N	20°03’ E	228

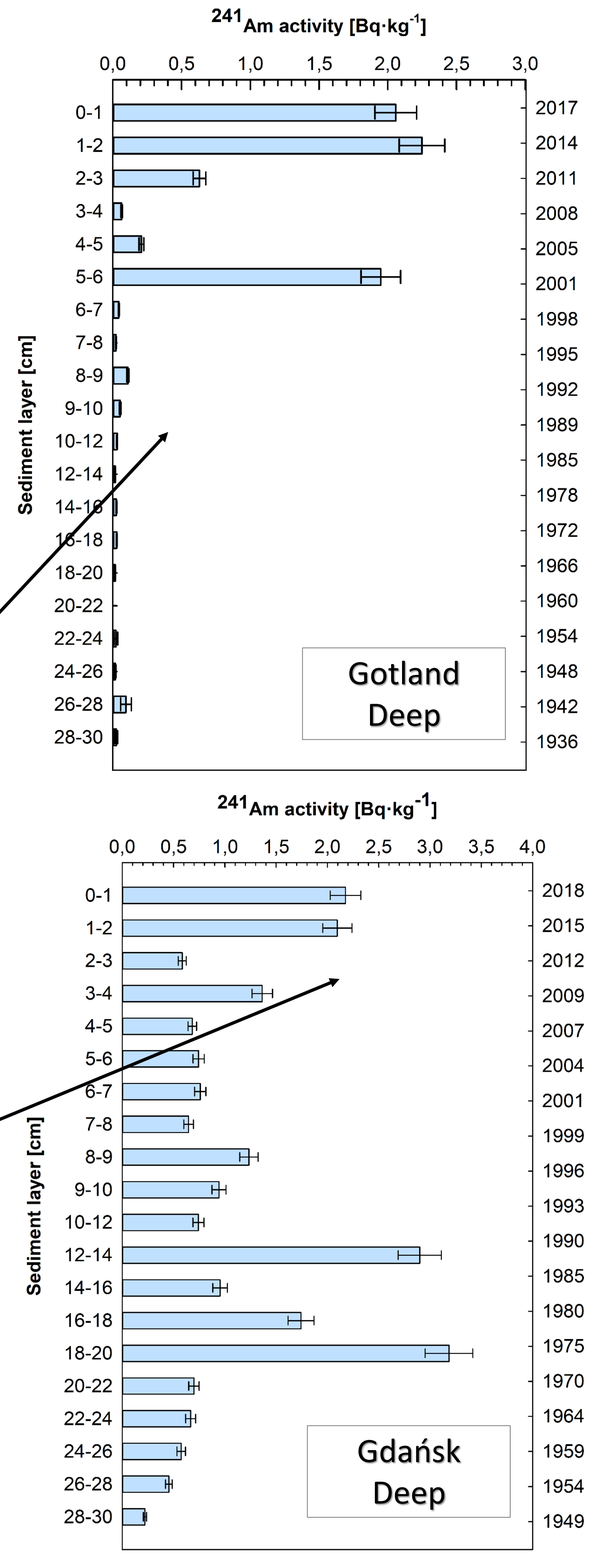
Sequential radiochemical separation

- ✓ Sample decomposition
- ✓ Co-precipitation of ^{241}Am and ^{243}Am with calcium oxalate
- ✓ Anion exchange chromatography
- ✓ Extraction chromatography
- ✓ Neodymium fluoride micro-precipitation
- ✓ α-particle spectrometry

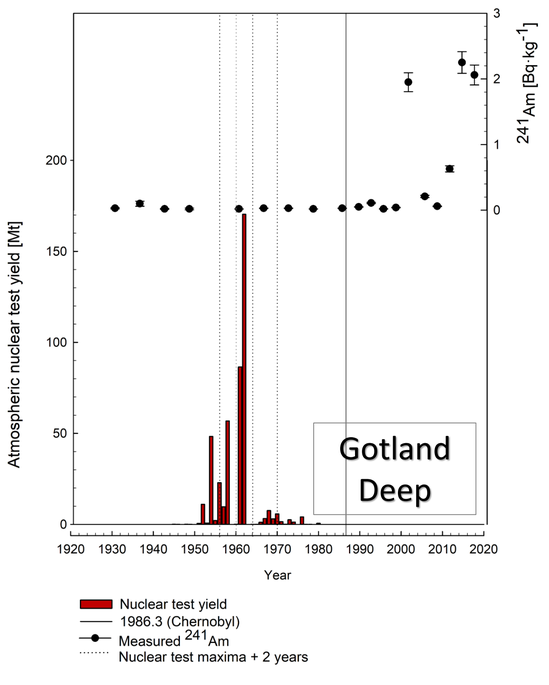


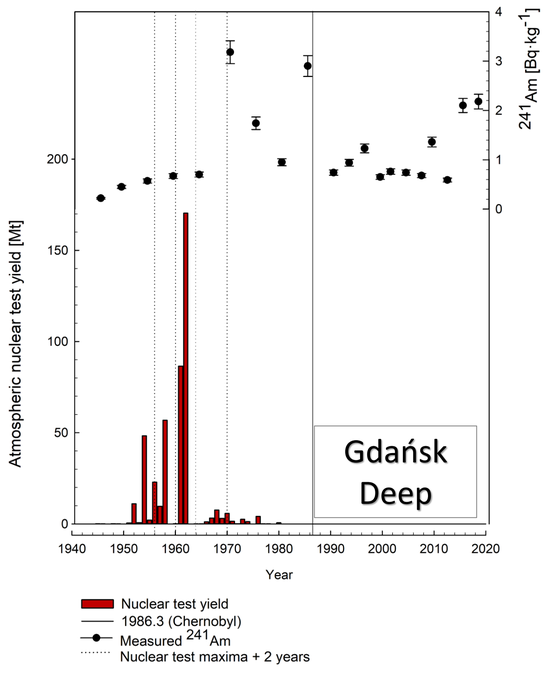






The activity concentrations of ^{241}Am in sediments collected in 2019 in reference to the history of atmospheric nuclear weapon tests





CONCLUSIONS

In 2010, sediment samples from Gdańsk Deep (GG) showed ^{241}Am activity ranging from **0.009±0.003 to 0.938±0.070** Bq·kg^{-1}, while Gotland Deep (Got) had **0.024±0.004 to 2.568±0.189** Bq·kg^{-1}. The activity concentrations were generally below **3 Bq·kg^{-1}**, higher in the upper sediment layers and lower in the deeper, except for a slice 18-20 cm from the Gdańsk Deep that is assumed to represent the **global atmospheric fallout** (1958-1970) when the United States and the Soviet Union conducted a large amount of **nuclear weapons tests**. Estimating ages from ^{210}Pb-derived rates is challenging, with **10-20 years of uncertainties**. The 1985 spike in Gdańsk Deep is likely due to **Chernobyl disaster**. Differences in ^{241}Am between areas stem from sediment **mixing, bioturbation, and chemical processes**. This study evaluated the current state of ^{241}Am contamination levels, which should be consistently monitored to ensure reliability, particularly when the new nuclear power plant in northern Poland becomes operational.