SEDIMENTATION IN THE CENTRAL BALTIC SEA AS VIEWED BY NON-DESTRUCTIVE Pb-210 DATING

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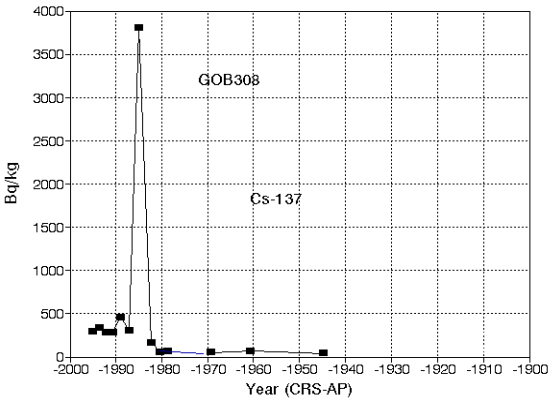
At present, there is renewed interest in the recent sedimentation history of the deep basins of the Baltic Sea. A major tool to study rates of sedimentation is Pb-210 dating of sediment cores. When Pb-210 dating is chosen for such investigations it is mainly because new detector technology has made it possible to assay dried 5 or 10 mm sediment slices directly, i.e. without use of wet chemistry and alpha-spectrometry. In other words, a non-destructive technique now exists which also makes it possible to detect other natural and anthropogenic radioisotopes by gamma-spectrometry. This furthermore allows testing the validity of the Constant Rate of Supply (CRS) model in Pb-210 dating by identification of anthropogenic signals, such as that of Chernobyl (1986).

In this study, dating results of four cores from two deep basins of the Baltic Sea are presented; the cores were taken in the Gotland Basin (3 cores) and in the Gdansk Basin (1 core). All cores were collected during a Gotland Basin Experiment (GOBEX) cruise conducted by the Baltic Sea Research Institute, Warnemünde, Germany, in 1996.

A general tendency for the Gotland Basin cores is that Pb-210 activities are rather high (up to 1000 Bq/kg) which partly may be explained by occurrences of extremely fine unconsolidated sediments, i.e. sediments with very high water contents. Such sediments have rarely been dated before and the results presented strengthen the applicability of the Pb-210 dating method considerably. Interestingly, there is some regional variation in unsupported Pb-210 profiles of the cores from the Gotland Basin, even though the distances between the cores are moderate (10–15 km). There is a slight tendency that the more central (deeper) cores (GOB302 and GOB303) show in general higher sedimentation rates than GOB301 from the northwestern part of the basin. There is some variability in Cs-137 in the Gotland Basin. The surface activities of the core from the southwestern part of the basin, core GOB303, are the highest reaching more than 250 Bq/kg while the other two cores have activities below 100 Bq/kg. This may be explained by differing hydrographic regimes (GOB303 placed along a NE-SW trending basin is more influenced by secondary bottom water flow) but it may also just reflect the path of the Chernobyl plume.



The core from the Gdansk Basin is characterized by much higher sedimentation rates, 4–7 mm/a, than those from the Gotland Basin. The unsupported Pb-210 activities are, however, generally lower than those observed in the Gotland Basin and there is a distinct Cs-137 peak in the sediment slice 80–90 mm (see figure) which due to the dating of the core is ascribed to year 1986, i.e. the Chernobyl signal.

The presented data show that non-destructive Pb-210 dating of sediment cores from deep basins of the Baltic Sea is a powerful tool when unravelling recent pollution history and is probably also of value when interpreting environmental changes on a larger time scale for which the main dating tool is ^{14}C. The high-resolution Pb-210 data can then in general be used as an anologue for the past sedimentation processes and will strengthen the interpretation of past sedimentation conditions based on detailed geochemical records.