Geochemical depth profiles of modern sediments in the south-western Baltic Sea: Description of methods

Dennis Bunke, Thomas Leipe, Matthias Moros & Helge W. Arz
Department of Marine Geology, Leibniz Institute for Baltic Sea Research Warnemünde (IOW)

On several research cruises, short cores of the seafloor sediments (muds and fine sands) were retrieved using a multicorer, subsampled and frozen on board. The samples were then freeze-dried, grinded and homogenised and subsequently analysed in the various laboratories.

The following parameters have been analysed:

- Grain size (laser diffractometry)
- Caesium-137 activity (gamma-ray spectrometry)
- Content of organic carbon, nitrogen and mercury (elementary analysis)
- Content of biogenic silica (ICP-OES after alkaline extraction)

The grain size was determined by laser diffractometry. Besides the grain size characterisation of the whole sediment, the separated fine fraction ≤ 63 µm was used for the subsequent geochemical analyses, because the investigated elements are predominantly bound in the fine fraction and are diluted by geochemically inert coarser sediments (mostly quartz sand). This procedure results in more precise results and is especially important for the analysis of coarser (sandy) sediments, where the analyses of the total sediment often reaches instrumental detection limits. Since the grain size composition of the samples is known, the contents of the elements measured on the fine fraction can be recalculated to the contents in the original sample. In addition, this method allows a better comparison of sediment samples of different grain size composition (Leipe et al., 2017).

The activity of the radionuclide caesium-137 was determined by gamma-ray spectrometry using a High-purity Germanium Detector (Moros et al., 2017). Because of the tendency of ^{137}Cs to bind to fine and organic particles (Ikäheimonen et al., 2009) and in order to enhance the comparability between different sedimentological environments, the ^{137}Cs activity was normalised by the total organic carbon (TOC) content of the respective sample.

The TOC content was calculated from the measured contents of total carbon minus inorganic carbon. Total carbon as well as total nitrogen contents were measured by combustion, chromatographically separation of the released gases and their determination with a thermal conductivity detector. Total inorganic carbon content was measured by acidic removal of carbonates and analysis of the released carbon dioxide with a nondispersive infrared detector (Leipe et al., 2011). Mercury (Hg) content was measured by thermal decomposition, gold amalgamation and atomic absorption spectrophotometry. Because of the high affinity of Hg to organic material (Leipe et al., 2013) and in order to enhance the comparability between different sedimentological environments, the Hg content was normalised by the TOC content of the respective sample.

In the case of biogenic silica (SiO_2), an alkaline extract was prepared from the samples using sodium hydroxide (Müller and Schneider, 1993) and then analysed for silicon by means of inductively coupled plasma optical emission spectrometry (ICP-OES).

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