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Carbon dioxide production in surface sediments of temporarily anoxic basins (Baltic Sea) and resulting sediment-water interface fluxes

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Organic matter is mineralized in marine sediments by microbial activity using predominantly oxygen, sulfate, and metal oxides as electron acceptors. Modern euxinic basins as found in the Baltic Sea or the Black Sea are of particular importance because they may serve as type systems for anoxia in Earth´s history.

We present here results from biogeochemical investigations carried out in the Baltic deeps (Gotland Basin, Landsort Deep) during the first scientific cruise of RV M.S. MERIAN in 2006, additionally during RV Prof. Penck cruises in 2006 and 2007. Short sediment cores were obtained with a multi-corer and analyzed for particulate and dissolved main, minor and trace elements, pH, DIC, methane alkalinity, besides the stable carbon isotopes of dissolved inorganic carbon (DIC). Microsensors were applied to analyze steep gradients of oxygen, sulphide and sulphate. Pore water profiles are evaluated in terms of process rates and associated element fluxes using the PROFILE software (Berg et al., 1998, L&O). Gross and net anaerobic mineralization rates were additionally obtained from core incubations with 35S. Steep gradients in DIC are associated with a strong enrichment of the light stable isotope resulting in the Gotland basin from oxidized OM. Element fluxes across the sediment-water interface are compared with literature data and show for the Baltic Sea a dependence from bottom water redox conditions, and sediment compositions and formation conditions (e.g., accumulation rates).

DIC in the anoxic part of the water column in the Landsort Deep and the Gotland Deep show relatively similar isotope values, close to the bottom water value, but steep gradients towards heavier values above the pelagic redoxcline.

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