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Iron and manganese species at the redox-interfaces in the Black Sea, the Baltic Sea and the Oslo Fjord

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The joint analysis of the data of iron and manganese species distributions (dissolved Fe(II) and Fe(III), dissolved Mn, dissolved bound Mn, particulate Fe and Mn) obtained in the Black Sea, the Baltic Sea and the Oslo Fjord allowed to reveal the common features, that testify the similarity of the mechanism of the redox layer biogeochemical structure formation in these regions. Our investigations demonstrated that Mn bound in stable complexes with hypothetically organic matter or pyrophosphate is observed in the redox zones in significant concentrations (up to 5 uM), and is likely presented by Mn(III), an intermediate product of Mn(II) oxidation. This bound Mn(III) can explain phosphate distribution in redox interfaces – formation of so-called “phosphate dipole” with a minimum above the sulfidic boundary and a maximum just below, and with a steep increase of the concentrations between these two. This dipole structure serves as a geochemical barrier that decreases the upward flux of phosphate from the anoxic layer. On the base of the recent data obtained in the 100th cruise of RV “Professor Shtokman” (March-April, 2009) it was found that the bound Mn could exist in two forms – colloidal (0.02-0.40 [U+F06D]m) and truly dissolved (<0.02 [U+F06D]m) that perhaps results from complexing with different types of ligands.

The flushing events, river input, from time to time increased mixing and anoxygenic photosynthesis affect the distributions of the redox zone parameters. Response time for changes in the microbial processes involved in reduction and/or reoxidation of Mn and Fe lags behind that for oxygen injection into water. Concentrations of redox-sensitive species of Mn and Fe should thus be useful as a tracer to inter prior hypoxic/anoxic conditions not apparent from oxygen levels at the time of sampling.

Modeling results shown that exactly manganese cycle (formation of sinking down Mn(IV) and presence of dissolved Mn(III)) is the main reason of oxygen and hydrogen sulfide direct contact absence.