CHEMICAL REACTIVITY/MOBILITY OF METALS IN THE SCHELDT ESTUARY

Contributor: Loes Gerringa

During a cruise with R.V. Navicula in March /April 2002 concentrations of dissolved Cd, Zn, Mn and Fe in 2 size fractions (<0.2µm and < 10kDa) were measured in order to understand their chemical reactivity in the estuary during transport to sea. Changes in salinity, and oxygen are important parameters for the chemical forms of the metals, but UV radiation might also be of importance due to photo-chemical reactions. The chemistry of dissolved Fe, colloid formation and complexation characteristics, was studied more intensively. The chemistry of Fe is completely depending on the oxygen concentration and dissolved organic matter (ligands), which are the variable parameters in the estuary.

The fine fraction (<10 kDa) contained almost all of the dissolved metals, with the exception of Fe (fig 1). Apparently dissolved Fe consisted for a large part of colloids >10 kDa. In the upper estuary the increase of the oxygen concentration with increasing salinity governed the concentration of the dissolved metals by oxidation of sulphides (Zn, Cd) and precipitation/colloid formation of oxides (Fe and Mn). In the middle and lower estuary complex formation ruled the dissolved metal concentration. The formation of chloride complexes increased the solubility and thus mobility of Cd and the presence of dissolved organic ligands permitted high concentrations of dissolved Fe and Zn. For Fe the concentrations of these dissolved organic ligands are equal to or a little smaller than the dissolved Fe concentrations in both size fractions (<0.2µm and < 10kDA) and this concentration decrease steeply with salinity as does the dissolved Fe concentration.

In the middle estuary Fe seemed to be more firmly complexed by the dissolved organic ligands, perhaps even irreversible complexed. The reason is probably the colloidal character of these complexes.

UV irradiation with intensities and wavelength distribution of the solar spectrum did not influence the dissolved ligand concentration of Fe-complexes.

The data indicate that the precipitation rate decreased with decreasing salinity, however the trend was not found to be significant. No precipitation occurred in the samples of a salinity of 0.3, <0.2 µm. We concluded that a high concentration of weak ligands prevented precipitation here. These weak ligands cannot be measured by conventional techniques.

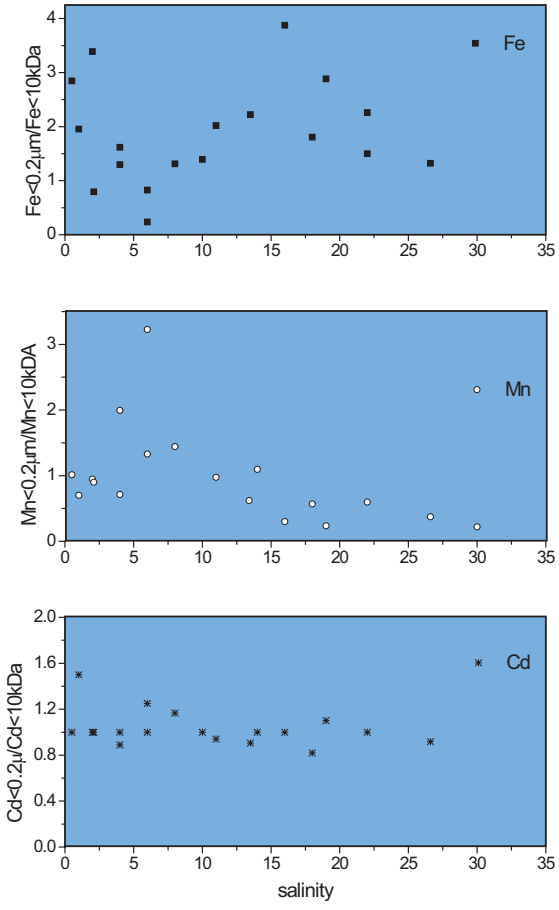

Fig. 1. The ratios of the dissolved concentrations of Fe, Mn and Cd in the size fractions <0.2µm and <10 kDa with salinity in the Scheldt estuary.