



A simple method for determination of dissolved Mn(III) at pelagic redoxclines: Examples from the Black and Baltic Seas

B. Schnetger (1) and O. Dellwig (2)

(1) Institute for Chemistry and Biology of the Marine Environment, ICBM, University of Oldenburg, 26111 Oldenburg, Germany, (2) Leibniz Institute for Baltic Sea Research, IOW, Seestrasse 15, 18119 Rostock, Germany

In the suboxic environment of the Black Sea water column, dissolved Mn(III) was recently discovered by Trouwborst et al. (2006) using an electrochemical method. During Meteor cruise M72/5 into the Black Sea a much more simple analytical method for dissolved Mn(III) quantification was developed. We could demonstrate that within 48 h at laboratory conditions (ambient temperature and oxygen atmosphere) dissolved Mn(III) is completely oxidized to particulate MnOx. The disproportionation of dissolved Mn(III) into dissolved Mn(II) and solid Mn(IV) was not observed and autocatalytic oxidation of Mn(II) by MnOx is insignificant within the applied oxidation period. Based on these observations dissolved Mn(III) concentration is calculated from the difference between total dissolved Mn(II+III) passing a 0.45 μm filter immediately after sampling and the dissolved Mn(II) remaining after oxidation of dissolved Mn(III) within 48 h. This simple method has the advantage that sample preparation may easily be done onboard followed by total dissolved Mn determination with common methods in the home lab.

In water samples from the suboxic redoxcline of the Black Sea dissolved Mn(III) profiles comparable to those described in Trouwborst et al (2006) were determined. In the upper suboxic part of the redoxcline dissolved Mn(III) partly amounts to almost 100% of the total dissolved Mn pool and decreases rapidly when H₂S concentrations increase.

For comparison, water samples from the redoxclines of the Landsort Deep and Gotland Deep (Baltic Sea) were analysed by the same method. Although less pronounced, dissolved Mn(III) is present in the Landsort Deep with values distinctly increasing from the margins towards the central basin. In contrast, no dissolved Mn(III) could be detected within the redoxcline of the Gotland Deep. However, at all sites MnOx particles were found which evidence ongoing oxidation of dissolved Mn. As a completely different process of Mn oxidation seems to be rather unlikely in the Gotland Deep, we suggest that oceanographic properties are responsible for these differences. While the redoxcline of the Black Sea is established since several millennia, the Baltic Sea is frequently influenced by intrusions of salty water pulses from the North Sea leading to partial oxygenation of the deeper basins. Due to its geographical position, the Gotland Deep is more often subjected to oxygenation events than the Landsort Deep. Additionally, temperature-salinity diagrams demonstrate that pronounced lateral currents and turbulences in the Gotland Deep are supplying small amounts of oxygen even into the suboxic layer of the water column. Such oxygen supply possibly causes immediate oxidation of dissolved Mn(III) and prevents its accumulation.

References:

Trouwborst R.E. et al. (2006): Soluble Mn (III) in suboxic zones. *Science* 313, 1955-1957.