Dissolved and particulate trace metals (Mn, Fe, Ni, Cd) in the bottom boundary layer of the Ulleung Basin, East/Japan Sea

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In order to investigate the dynamic biogeochemistry in bottom boundary layer (BBL) and the importance of BBL in biogeochemical cycles of metals [1] in this marginal sea, synoptic features of dissolved (<0.2 μm) and labile particulate (total dissolvable - dissolved) metals (Fe, Mn, Ni, Cd) in water column and sediment porewater of upper (500 m) and lower slope (1000-2000 m), and basin (>2100 m) regions were acquired through high resolution water sampling near the seafloor.

Dissolved Mn and Fe concentrations varied widely in the range of 0.14-64.8 nM and 0.17-8.65 nM, respectively, and especially were enriched in the BBL, which showed about 100-200 m thickness from the seafloor. Dissolved Ni and Cd concentrations varied in the range of 3.42-5.11 nM and 0.04-0.45 nM, respectively, showing typical nutrient profiles without any enrichment in BBL. Although labile particulate Fe and Mn varied in opposite with dissolved metals in the upper water column regardless of regions, they increased rapidly with dissolved metals together to the seafloor within the BBL [2]. Particulate Ni and Cd were measurable (>0.1 nM) only in the surface waters with high biological activity. Dissolved oxygen was consumed as much as from 0.1 M/m^2 (upper slope) to 0.9 M/m^2 (basin) within the BBL. Standing stocks of dissolved and particulate Mn and Fe in the BBL were estimated, and compared to diffusive fluxes from sediments using porewater metal profiles and the amount of depleted dissolved oxygen within the BBL. Since the diffusive fluxes of Mn^{+2} and Fe^{+2} from sediments were positively correlated with the standing stocks of dissolved and particulate metals, the oxidation processes of reducing materials emitted from porewaters might play a significant role for the consumption of dissolved oxygen in the BBL.

[1] Pilskaln et al., 2013. Deep-Sea Research II, 103:55-65 [2] Laës et al., 2007. Biogeosciences, 4: 181-194