Mobilization and distribution of trace metals in the Scheldt sediments

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As a macrotidal estuary, Scheldt Estuary connects terrestrial industrial zones with the North Sea, and receives diverse pollutants and also massive organic matter from anthropogenic activities. The accumulation and mobilization of metal contaminants in the Scheldt sediments were impacted by several environmental parameters including pH, redox potential, and organic matter contents. The recent studies showed mercury (Hg) concentration levels in the sediment of Groot Buitenschoor (GB) were still comparable with those 40 years ago[1]. Therefore, in this study we investigate the mobilization of trace metals in the intertidal sediments of GB and also another nearby station S15, which is all the time covered by water. Two sampling methods were applied in these sediments including an active porewater extraction for a depth interval of 2 cm and a passive sampling technique of Diffusive Gradients in Thin-Films (DGT) for higher resolution (0.5 cm) analysis of Fe, Mn, Co, Cd, Pb, Cr, Ni, Cu, and Zn. In addition, dissolved sulfide was also measured by the DGT technique to investigate its impact on metal mobilization. Different from the dissolved concentrations of metals obtained by porewater extraction, the DGT technique provided the bio- available metal fraction in these sediments. The preliminary results showed that Mn, Co, Ni, Pb, and Cr concentrations in the porewater of sediments at GB were higher than those at S15. Nevertheless, DGT measured concentration showed an opposite trend, indicating that trace metals at GB were more bioavailable despite lower concentrations in porewater. The mobilization of bioavailable metal fractions was impacted by pH and redox potential. However, the DGT results showed that dissolved sulfides were below the detection limits at S15, suggesting the possible reason for substantial Fe mobilization in the sediments. The trace metal concentrations in the solid phase of GB are higher than those of S15. Metal precipitation and mobilization in these sediments were also simulated by using Visual MINTEQ software.

These results will help us better understand the pattern of metal mobilization and distribution in these typical estuarine sediments: one with intertidal impact and another one submerged by water, which can be used as a case study for colleagues working in this field.

Reference

[1] Ma, T., Perrot, V., Baeyens, W., Li, G., Lievens, S., Thi Thuy Ngo, H., *et al.*, 2023. Mercury distribution, mobilization and bioavailability in polluted sediments of Scheldt Estuary and Belgian Coastal Zone. J. Hazard. Mater 465, 133209. https://doi.org/10.1016/ j.jhazmat.2023.133209

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