The geochemical behavior of trace metals in the water column of the Belgian Coastal Zone

Gaulier, Camille; Superville, Pierre-Jean; Guo, Wei; Baeyens, Willy; Billon, Gabriel; Gao, Yue

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The geochemical behavior of trace metals in the water column of the Belgian Coastal Zone

Camille Gaulier[1,2], Pierre-Jean Superville[2], Wei Guo[1], Willy Baeyens[1], Gabriel Billon[2] and Yue Gao[1]

[1] Analytical, Environmental and Geochemistry, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium
[2] LASIR (CNRS UMR 8516), Lille 1 University, Cité Scientifique, 59655 Villeneuve d'Ascq Cedex, France

INTRODUCTION

The **metallic and organic contamination** of marine ecosystem in the Belgian coasts has lead to a better understanding of their impact on the aquatic environment. The fate and the ecotoxicity of these trace elements are strongly linked with their **chemical speciation**, which constantly evolves in space and time.

objectives

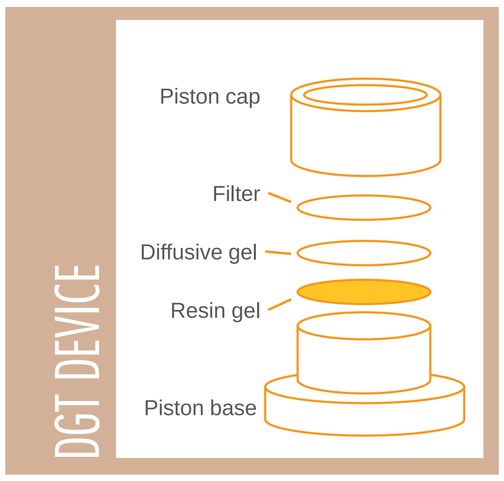
Development of novel speciation-sensitive procedures for the monitoring of **contamination levels** in the Belgian coastal environment

Trace the suspended particulate matter towards its **origin**, in order to assess the chemical **anthropogenic pressures** on coastal ecosystems

MATERIAL & METHODS

Six sampling stations:
- ➔ 4 in harbour zones: Oostende and Zeebrugge
- ➔ 2 offshore, in the North Sea

Two campaigns:
- ➔ In March & November 2016



PHASE 1 : Chemical speciation of trace metals, using **active** sampling

- **Total dissolved metal** measurement from a preconcentration technique thanks to a solid-phase extraction on filtered (0,45µm pore size) & acidified seawater
- **Particulate metal** measurement from suspended matter caught with pre-weighted Durapore filters (0,45µm pore size) after seawater filtration

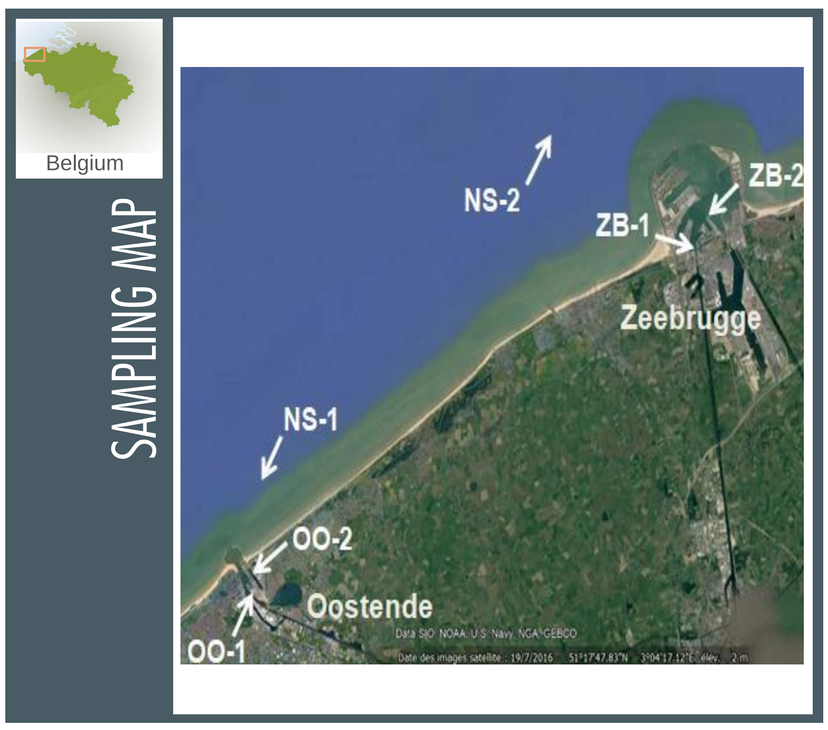
PHASE 2 : Chemical speciation of trace metals, using **passive** sampling

Labile metal measurement from an in situ deployment of DGT (Diffusive Gradients in Thin films) probes, integrative measurement over two weeks

DGT enables to measure the labile fraction of trace metals which is a good indicator of their **bioavailability**

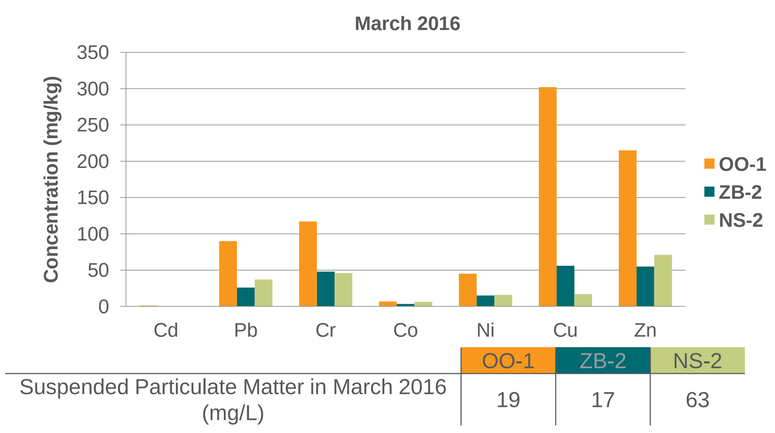
PHASE 3 : Suspended Particulate Matter (SPM) **origin**

Stable **C and N isotopic ratio** determination in particulate organic matter from water filtration with pre-treated and pre-weighted glass fiber filters (0,70µm pore size)
Depending on the value of the $\delta^{13}C$ ratio, we can trace back the origin of SPM

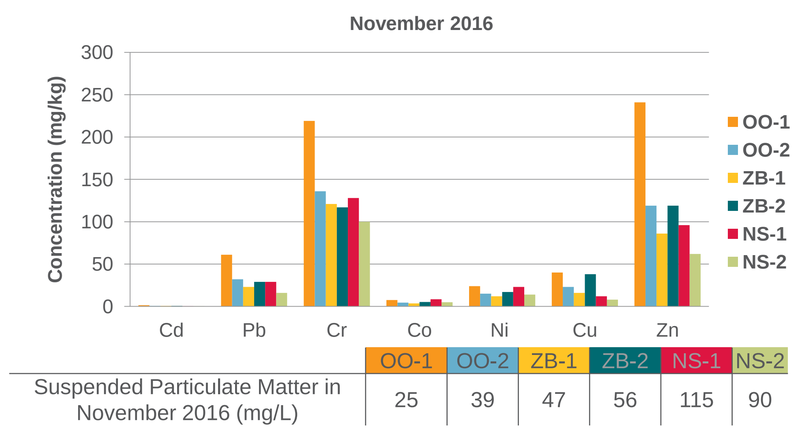


RESULTS

Particulate metal distribution



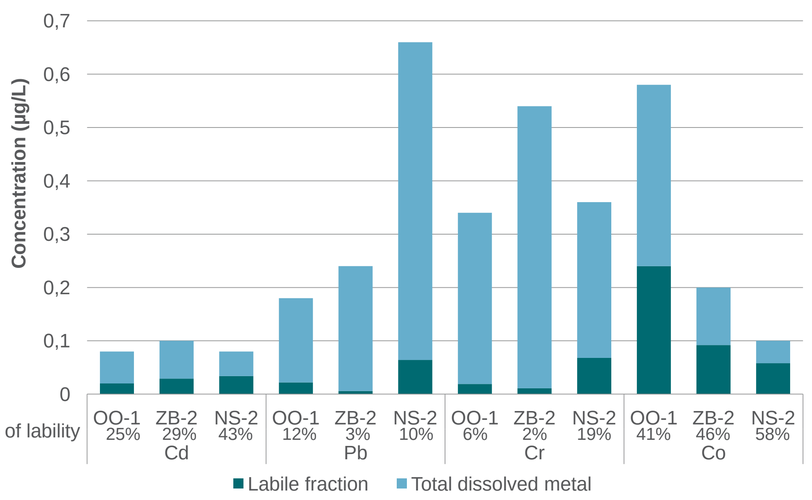
Suspended Particulate Matter in March 2016 (mg/L)	OO-1	ZB-2	NS-2
	19	17	63

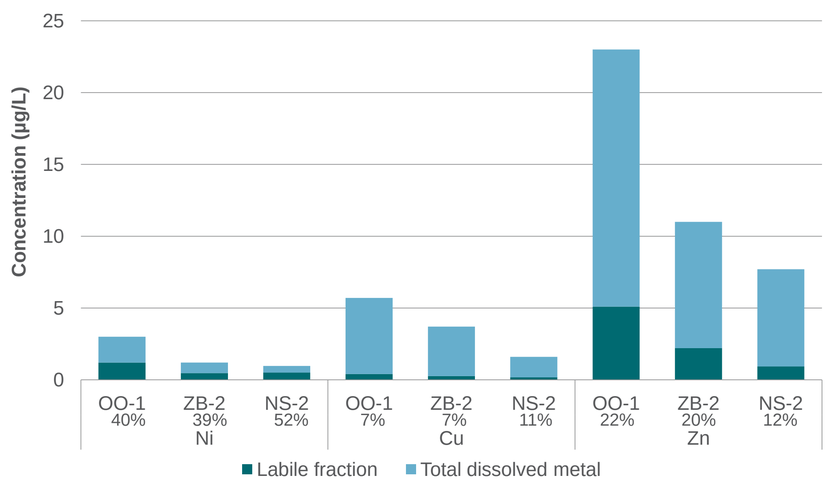


Suspended Particulate Matter in November 2016 (mg/L)	OO-1	OO-2	ZB-1	ZB-2	NS-1	NS-2
	25	39	47	56	115	90

Analysis of metals in March and November 2016 , the case of particulate metal fraction

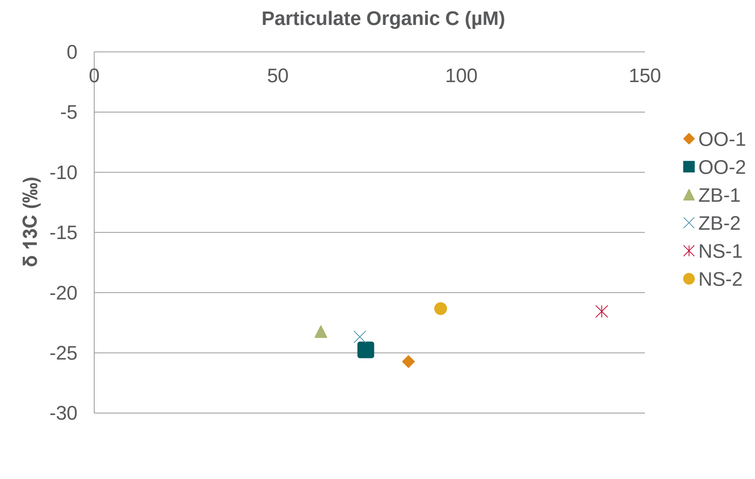
Labile metals, the bioavailable fraction of total dissolved metals

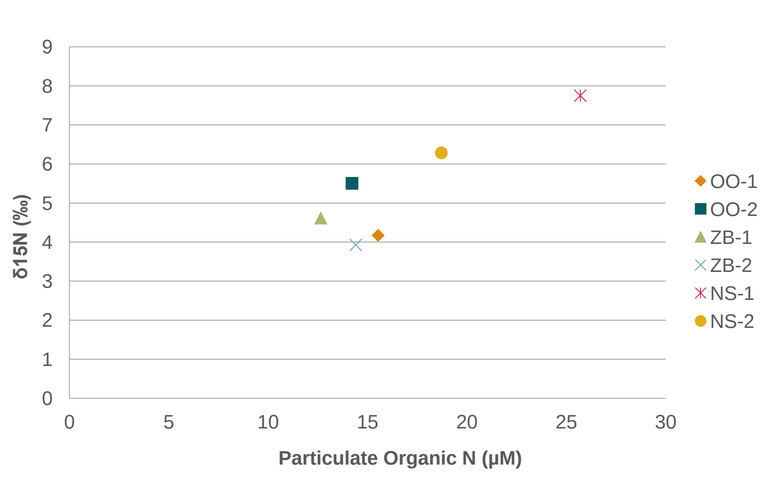




Analysis of metals speciation in March 2016, the case of labile and total dissolved fractions

Stable carbon & nitrogen isotopic ratio





Stable C and N isotope determination of suspended particulate matter in November 2016

CONCLUSION

- Particulate and total dissolved metal concentrations in harbour sites are much higher than the offshore ones
- Labile fractions do not differ significantly, Moreover, the potential bioavailable species are at low level in Belgian coastal area compare to toxicity criteria
- SPM in the harbour zones is likely from allochthonous sources, while for the two offshore stations it appears to be mainly from marine origin
- Higher dissolved and particulate metal concentrations do not correlate well with their bioavailability

Even though trace metal contamination is higher in the harbour zones, the effect of trace metal toxicity is most likely not higher than in the open sea

With increasing acidification of the ocean, higher particulate trace metal concentrations might lead to increasing adverse effect on the coastal environment

Future work:
- ➔ Follow-up sampling in 2017
- ➔ Identification of spatial and temporal trends
- ➔ Validation of a new seawater extraction method
- ➔ Comparison between DGT and Voltammetry measurement
- ➔ Investigating SPM trap samples for metal and isotopes composition

References
OSPAR (1997). Ecotoxicological Assessment Criteria

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More information available on: www.newstheps.be

Camille Gaulier
PhD student
cgaulier@vub.be