SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Analytical, Environmental and Geo- Chemistry (AMGC)

has the honour to invite you to the public defense of the PhD thesis of

Camille Gaulier

to obtain the degree of Doctor of Sciences

Joint-PhD with the University of Lille, LASIRE, France

Title of the PhD thesis:

Trace metals in estuarine and coastal waters: dynamics, speciation and bioavailability under various environmental conditions

Promotors:

Prof. dr. Yue Gao

Prof. dr. Gabriel Billon (U-Lille)

Co-promotor:

Prof. dr. em. Willy Baeyens

The defense will take place on

Thursday July 16, 2020 at 16h00

in Auditorium D.0.05 at the Campus Etterbeek of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene.

Members of the jury

Prof. Dr. ir. M. Elskens (VUB, chairman)
Dr. P-J. Superville (U-Lille, secretary)
Dr. V. Lenoble (U-Toulon, external)
Dr. J. Knoery (IFREMER, external)
Dr. P. Roose (RBINS, external)

Curriculum vitae

Camille Gaulier obtained her Engineer degree in Agriculture, Food Sciences and Environment, in 2016 with a specialization in Environment and Natural Resources Management. In 2017, she then started a joint-PhD under the supervision of Yue Gao (VUB) and Gabriel Billon (U-Lille). Her PhD research focuses on the biogeochemical behavior of trace metals in estuarine and coastal environments, with a specific attention to their bioavailability towards marine organisms. Her work has led to the publication of two scientific articles in international peer-reviewed journals. She also presented her results to many international conferences, spend several days at sea to collect her samples and helped in supervising of bachelor and master projects.

Abstract of the PhD research

Estuarine and coastal ecosystems provide multiple ecological, social and economic services. They are a source of food, income and are at the heart of marine trade, merchant shipping and sea transport. They therefore play a key role in our modern world and their conservation from an environmental point of view is today critical.
Despite all the efforts done in environmental management, pollution associated with the rapid coastal development and intensive industrialization was certain and still remains one of the main threats towards marine ecosystems today. Specifically, trace metal contamination is of high concern as coastal areas are generally prone to accumulate them. Most trace metals exhibit a dual role in marine waters: they act as nutrients in low concentrations, yet rapidly have toxic effects in higher concentration ranges. Continuous monitoring of their concentrations in estuarine and coastal ecosystems is therefore needed to better understand their biogeochemical behavior in such marine environments. However, limited knowledge exists on their bioavailability towards marine organisms: especially as the toxicity of these metals is not only related to their concentration but also strongly linked with their speciation which shows both seasonal and spatial variations.
Thus, the main objective of this PhD research was to investigate the biogeochemical cycles of various trace metals and unravel their speciation and bioavailability in various aquatic systems: from very dynamic mixing zones of the Scheldt estuary to coastal harbors and shallow seawaters of the North Sea, and even to deeper and anoxic regions of the Baltic Sea. Trace metal concentrations and speciation were explored seasonally and spatially along horizontal and vertical gradients, and a comparison of classic active samplings of dissolved trace metals with a passive sampling technique (Diffusive Gradients in Thin-films; DGT) was carried out. The DGT technique was successfully used for the in-situ measurement of labile metals and eventually constitutes a good surrogate to the biomonitoring of trace elements (e.g. use of mussels, algae, etc.). This method offsets the lack of knowledge in terms of water quality monitoring and the results challenge the classic criteria which are used by international regulatory requirements (e.g. WFD, MSFD) and local commitments (e.g. OSPAR, HELCOM). Indeed, new criteria based on labile metal species instead of total dissolved species should be considered in the future.
Such approach of trace metal speciation and assessment in aquatic systems could surely lead to a more integrated environmental management and improve our knowledge on anthropogenic impacts and pollutant fluxes. Moreover, it is eventually the main key to explain and predict bioavailability and potential toxicity of trace metals to the marine fauna and flora. This work therefore invites you to dive into a journey along our coasts, from urbanized areas to wild open seas, from their surface to their deepest waters.