SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Analytical, Environmental and Geo-Chemistry

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

Arnout ROUKAERTS

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

Novel insights in nitrogen and carbon biogeochemistry of Antarctic sea ice: the potential role of a microbial microfilm.

Promotor:

Prof. dr. ir. Marc Elskens

The defense will take place on

Monday December 10 2018 at 16:00h

in Auditorium P. Janssens, building K at the campus Humanities, Sciences and Engineering of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, and will be followed by a reception.

Members of the jury:

Prof. dr. Harry olde Venterink (chairman)
Dr. Nathalie Brion (secretary)
Prof. dr. em. Frank Dehairs (co-promotor)
Prof. dr. Daniel Charlier
Prof. dr. Lei Chou (ULB)
Dr. Bruno Delille (univ. Liège)
Dr. Martin Vancoppenolle
(Univ. Pierre et Marie Curie)

Curriculum vitae

Arnout Roukaerts started his Chemistry studies in 2007 at the University of Hasselt. He then continued at the Vrije Universiteit Brussel in 2010 to obtain a master's degree and chose optional courses in Analytical and Environmental Chemistry. He successfully completed his master thesis in 2012 at the research group Analytical, Environmental and Geo-Chemistry, where he subsequently started his doctoral research. During his doctoral studies, he participated in several international field sampling campaigns and presented his work at international conferences. This PhD research resulted in two first author articles, published in international peer reviewed journals and contributed to seven others.

Abstract of the PhD research

Antarctic sea ice covers up to 40 % of the Southern Ocean and is characterised by extreme changes in temperature, salinity and light. For a long time sea ice was considered a physical barrier between the polar ocean and the atmosphere with limited biological importance. In the past 50 years it became clear that the porous sea ice creates an ideal habitat for algae to thrive. Sea ice is host to large annual blooms during the austral spring and biomass concentrations in the ice easily exceed those observed in the underlying seawater by several orders of magnitude. Particularly bottom sea ice in coastal regions (land-fast sea ice) can be considered as one of the most productive marine ecosystems in the world. Sea ice also plays an important role in structuring the polar marine ecosystem and is pivotal in the survival of Antarctic krill. Especially juvenile krill needs sea ice algae in order to survive the long Antarctic winters. Difficulties in sampling the ice, its isolated location, and the absence of remote sensing techniques that are applicable to the sea ice environment, are the main reasons why sea ice is understudied. The nutrient dynamics that control the growth of sea ice algae are far from being fully understood.

During this thesis sea ice samples from several locations in East Antarctica were analysed for nutrient and biomass concentrations. Isotope ratios of carbon, nitrogen and oxygen in several substrates were measured to better constrain the different biological processes that take place. A strong decoupling between phytoplankton growth and biomass decay was observed in the ice during the growth season. A mathematical model was developed to better understand the observations and interactions of the different nutrient pools. Incorporation of a biofilm in the model proved essential in understanding and explain the observations for nitrogen, carbon, phosphate and silicon in sea ice. The presence of a microbial biofilm in sea ice can have far going implications on the biogeochemical dynamics.