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

Debany FONSECA PEREIRA BATISTA

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

N2 fixation as a source of new nitrogen in the Atlantic Ocean

Promotor:
Prof. dr. Frank Dehairs

The defence will take place on
Wednesday July 5 2017 at 13.00h

in Auditorium E.0.12 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. Filip Meysman (chairman)
Prof. Dr. Marc Kochzius (secretary)
Prof. Dr. Marc Elskens (co-promotor)
Prof. Dr. Harry Olde Venterink
Prof. Dr. Lei Chou (ULB)
Prof. Dr. Patricia Bonin
(Mediterranean Inst. of Oceanology, Marseille, F.)

Curriculum vitae

Debany Fonseca Pereira Batista was born in 1987 in Senegal, from a Bissau-Guinean father and a Cape Verdean mother. He received his education in Algeria and Portugal among other countries. He finally graduated from a Bachelor's Degree in Biochemistry and Molecular Biology (in 2008) at the University Denis Diderot (Paris VII), and then obtained two Master's Degree in Environmental Sciences and Engineering Master's (on Aquatic Systems and Water Management, at Paris VII) and in Oceanography and Marine Environments (at University Pierre and Marie Curie, Paris VI), in 2010 and 2012, respectively. Debany is the (co-)author of 5 international peer-reviewed publications, referred to as Fonseca-Batista, D.

Abstract of the PhD research

Dinitrogen (N_2) gas is the largest N reservoir in the ocean, but it can only be drawn and converted into bioavailable N (or fixed-N) by a small community of marine microorganisms, namely the diazotrophs. Marine primary production (i.e., biological fixation of atmospheric carbon dioxide, CO_2) is limited by the availability of dissolved inorganic nitrogen (e.g., nitrate, ammonium) over large areas of the world's ocean. Therefore, in these nutrient depleted regions biological N_2 fixation contributes considerably in maintaining marine primary productivity and atmospheric CO_2 sequestration into the deep ocean. In addition, N_2 fixation also contributes to counterbalancing the loss of bioavailable N from natural biological processes (denitrification and anaerobic ammonium oxidation) occurring in oxygen depleted zones of the global ocean. Recent discoveries suggested that field measurements of oceanic N_2 fixation from the past decades may have underestimated *in situ* activities due to a methodological bias in the incubation protocol.

The present work investigated the importance of community N_2 fixation as a source of N to the Atlantic Ocean, using the lately-adapted "$^{15}N_2$ dissolution method". Our work has confirmed the widespread occurrence of biological N_2 fixation across the North and South Atlantic Ocean, including regions where the process had previously been considered as negligible, for instance the temperate Northeast Atlantic and the eastern South Atlantic. We discuss the potential environmental drivers of N_2 fixation activity, including iron supply from atmospheric dust deposition and nitrate deficit relative to phosphorus (P) in comparison to the common ratio of N to P requirements for the marine microalgae (i.e., Redfield stoichiometry). Finally, we re-assess the annual basin-wide N input via N_2 fixation, compare it with earlier estimates and evaluate to what extent N_2 fixation may counterbalance basin scale fixed-N losses.