Geophysical Research Abstracts
Vol. 15, EGU2013-12761, 2013
EGU General Assembly 2013

Denitrification, anammox and fixed nitrogen removal in the water column of a tropical great lake

François Darchambeau (1), Fleur Roland (1), Sean A. Crowe (2), Loreto De Brabandere (2), Marc Llirós (3,4), Tamara Garcia-Armisen (5), Ozgul Inceoglu (5), Céline Michiels (5), Pierre Servais (5), Cédric D.T. Morana (6), Steven Bouillon (6), Filip Meysman (7), Bart Veuger (7), Pascal M. Masilya (8), Jean-Pierre Descy (3), and Alberto V. Borges (1)

(1) University of Liège, Chemical Oceanography Unit, Belgium (francois.darchambeau@ulg.ac.be), (2) University of Southern Denmark, Nordic Center for Earth Evolution, Odense, Denmark, (3) University of Namur, Research Unit in Environmental and Evolutive Biology, Namur, Belgium, (4) Autonomous University of Barcelona, Department of Genetics and Microbiology, Barcelona, Spain, (5) Université Libre de Bruxelles, Ecologie des Systèmes Aquatiques, Bruxelles, Belgium, (6) Katholieke Universiteit Leuven, Department of Earth and Environmental Sciences, Leuven, Belgium, (7) Royal Netherlands Institute for Sea Research, Department of Ecosystem Studies, Yerseke, The Netherlands, (8) Institut Supérieur Pédagogique de Bukavu, Unité d'Enseignement et de Recherche en Hydrobiologie Appliquée, Bukavu, Democratic Republic of the Congo

If rates of microbial denitrification in aquatic systems are poorly constrained, it is much more the case for tropical water bodies. Lake Kivu [2.50˚S 1.59˚S, 29.37˚E 28.83˚E] is one of the great lakes of the East African Rift. It is an oligotrophic lake characterized by anoxic deep waters rich in dissolved gases (methane and carbon dioxide) and nutrients, and by well oxygenated and nutrient-depleted surface waters. During the seasonally stratified rainy season (October to May), a nitrogenous zone characterized by the accumulation of nitrite (NO_2^-) and nitrate (NO_3^-) is often observed in the lower layer of the mixolimnion. It results from nitrification of ammonium released by decaying organic matter. With the seasonal uplift of the oxygen minimum zone, the nitrogenous zone becomes anoxic and might be the most preferential area for fixed nitrogen (N) removal in Lake Kivu. Our work aimed at identifying and quantifying the processes of N losses by denitrification and/or anammox in the nitrogenous zone of the Lake Kivu water column. During 5 sampling campaigns (March 2010, October 2010, June 2011, February 2012 and September 2012), isotopic labelling experiments were used to quantify denitrification and anammox rates along vertical profiles at two pelagic stations of the main lake. Moreover, N_2:Ar ratios were estimated during the September 2012 campaign, and 16S rDNA pyrosequencing was used to describe bacterial community composition during the last 2 campaigns. No bacteria related to organisms performing anammox was observed and labelling experiments failed to detect anammox at any locations and any depths. In Lake Kivu, denitrifying bacteria were mainly related to *Denitratisoma* and *Thiobacillus* genus. Significant denitrification rates were observed at several occasions, especially under the oxic-anoxic interface in the bottom of the nitracline. The annual average denitrification rate was estimated at $\sim$150 μmoles N m^{-2} d^{-1}. Denitrification was not the only nitrate-consuming process: dissimilative nitrate reduction to ammonium led to oxidized N removal with the same magnitude than denitrification alone. Isotopic labelling accompanied by addition of elemental sulfur evidenced that the upper vertical expansion of denitrification was limited by the abundance of reducing agents, while oxidized forms of N limited the lower expansion of denitrification.