

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN BELGIUM
MAY 2014 – JUNE 2015

Meetings

- Delille, B., F. Van der Linden, F. Fripiat, W. Champenois, B. Heinesch, J. Zhou, V. Schoemann, G. Carnat, S. Moreau, F. Vivier, M. Kotovitch, T. Haskell, and J.-L. Tison, Year Round survey of Ocean-Sea Ice-Air Exchanges – the YROSIAE survey. SOLAS open ocean conference, 07-11 September 2015, Kiel, Germany.
- Xuefeng LI, D. Fonseca-batista, H. Ingber, N. Roevros, F. Dehairs and L. Chou, The impact of iron biogeochemistry on the phytoplankton growth and the diazotrophic nitrogen fixation under a changing climate, SOLAS Open Science Conference, 07-11 September 2015, Kiel, Germany.
- Le Roy E., F. Fripiat, A. Roukaerts, D. Fonseca Batista, F. Dehairs, Isotopic composition of nitrate from the Sub-Arctic North Atlantic, Goldschmidt Conference, Prague, 16-21 August 2015.
- Lemaître N., H. Planquette, F. Dehairs, L. Monin, L. André, S. Jacquet and F. Planchon, Mesopelagic carbon remineralisation along the GEOVIDE transect in the North Atlantic (GEOTRACES GA01), Goldschmidt Conference, Prague, 16-21 August 2015.
- Xuefeng-Li, N. Roevros, F. Dehairs, D. Fonseca Batista and L. Chou, Iron biogeochemistry under a changing climate: impact on the phytoplankton growth and the diazotrophic nitrogen fixation, Goldschmidt Conference, Prague, 16-21 August 2015.
- Fonseca Batista, D., Fripiat, F. and Dehairs, F., Contribution of N₂ fixation to biological productivity along a meridional transect in the Eastern Atlantic Ocean, Atlantic Meridional Transect (AMT) Open Science Conference, 23 – 25 June, 2015, Plymouth, UK.
- Lemaître N., Planquette H., F. Dehairs, L. Monin, L. André, S. Jacquet, and F. Planchon, Mesopelagic carbon remineralization along the GEOVIDE transect in the North Atlantic (GEOTRACES GA01), GEOVIDE Post-cruise meeting, 26-27 May, 2015, IUEM, Brest, France.
- Roukaerts A., D. Fonseca-Batista, E. Le Roy, A. Plante, F. fripiat, F. Dehairs and M. Elskens, First results on nitrate isotopic signatures and production regimes, GEOVIDE Post-cruise meeting, 26-27 May, 2015, IUEM, Brest, France.
- Fripiat, F., M. Elskens, T.W. Trull, S. Blain, A.-J. Cavagna, C. Fernandez, D. Fonseca-Batista, F. Planchon, A. Roukaert, and F. Dehairs, Significant mixed layer nitrification in a natural iron-fertilized bloom of the Southern Ocean. Gordon Conference on Polar Ocean, 2015, Lucca, Italy.

Cruises

- Antarctica, Dumont d'Urville fast ice region: Primary production and N-uptake by sea ice and under ice algae (Nov. 2014 - Jan. 2015)
- Belgica 2015/14 (12-26 May 2015): Bay of Biscay and Iberian Margin; nitrogen uptake and cycling; significance of N₂ fixation; nitrate isotopic composition; Role of iron.
- *R/V Atlantic Explorer* cruise: western north Atlantic (Bermuda to the U.S. east coast). Test of underway measurement system for marine nitrogen fixation; Chief scientist: Nicolas Cassar; Debany Fonseca Batista: participant in charge of N₂ fixation rate measurements using via 15N₂ spiking.

New funding

- Nolwenn Lemaître (PhD grant co-funded by Labex-mer, IUEM, Brest and Vrije Universiteit Brussel, Strategic Research Plan). Multi-proxy approach (^{234}Th , Baxs, ^{13}C , ^{15}N) of biopump associated carbon, nitrogen, silicon, trace element export fluxes and remineralisation.

New results

Southern Ocean

- Nitrification appears to be an ubiquitous process in Antarctic Sea Ice, implying that a significant fraction of nitrate is regenerated in sea ice (up to ~100% of the ambient nitrate pool) and can explain the large nitrous oxide accumulation recently observed in spring landfast sea ice (B. Delille, unpublished results, ULG).
- Nitrification is significant over the Kerguelen Southeast plateau, being a naturally iron-fertilized area in the Southern Ocean. This observation challenges the general assumptions that nitrate in the Southern Ocean is mainly supplied through oceanic circulation, and that iron fertilization implies a more efficient biological pump to strip nutrients out of the surface water.
- Compilation of Antarctic sea ice nutrient data (in the framework of the SCOR working group “Biogeochemical exchange processes at the sea ice interface”). We collected ~13500 previously published data (from 1980 to 2015, i.e., nitrate, nitrite, ammonium, phosphate, and silicic acid) which should shed light on the nutrients dynamic in this extensive overlooked ecosystems (up to 8% of the Earth Surface).

Atlantic Ocean

- N_2 fixation rates along a meridional section in the East Atlantic; regional upscaling
- Surprisingly elevated natural N_2 uptake rates off the Iberian margin and strong boosting effect of Fe addition.
- A section showing the particulate non-lithogenic barium distribution across the North Atlantic (GEOVIDE).
- ^{234}Th export and POC export (upcoming) in the North Atlantic (GEOVIDE)
- Isotopic composition of nitrate for selected North Atlantic sites (GEOVIDE)
- Primary production, nitrate, nitrite, ammonium uptake and N_2 fixation rate for selected sites in the North Atlantic (GEOVIDE).

Relevant publications

- Fripiat F., M. Elskens, T. Trull, S. Blain, A.-J. Cavagna, C. Fernandez, D. Fonseca-Batista, F. Planchon, P. Raimbault, A. Roukaerts, and F. Dehairs. Enhanced nitrification in a natural iron-fertilized bloom of the Southern Ocean, *Global Biogeochemical Cycles*, in review.
- Roukaerts A., A.-J. Cavagna, F. Fripiat, D. Lannuzel, K. Meiners and F. Dehairs. Nitrogen uptake rates and primary production using stable isotope tracer experiments in East Antarctic Sea-Ice (SIPEX 2 expedition), *Deep Sea Research II*, accepted.
- Mawji E., R. Schlitzer, E. Masferrer Dodas, et al. (i.e. F. Dehairs and F. Fripiat), 2015. The GEOTRACES Intermediate Data Product 2014, In press in *Marine Chemistry*.
- van der Merwe P., A. Bowie, F. Qu  rou  , L. Armand, S. Blain, F. Chever, D. Davies, F. Dehairs, F. Planchon, G. Sarthou, A.T. Townsend, and T.W. Trull, 2015. Sourcing the iron in the naturally fertilised bloom around the Kerguelen Plateau: particulate trace metal dynamics, *Biogeosciences*, 12, 739–755.

- Trull T.W., D. Davies, F. Dehairs, F. D'Ovidio, E. Laurenceau, M. Lasbleiz, F. Planchon, B. Queguiner and S. Blain, 2015. Chemometric perspectives on plankton community responses to natural iron fertilisation over and downstream of the Kerguelen Plateau in the Southern Ocean, *Biogeosciences*, 12, 1029-1056, doi:10.5194/bg-12-1029-2015.
- Dehairs F., F. Fripiat, A.-J. Cavagna, T.W. Trull, C. Fernandez, D. Davies, A. Roukaerts, D. Fonseca Batista, F. Planchon and M. Elskens, 2015. Nitrogen cycling in the Southern Ocean Kerguelen Plateau area: Evidence for significant surface nitrification from nitrate isotopic compositions, *Biogeosciences*, 12, 1459-148.
- Jacquet S. H. M., F. Dehairs, D. Lefèvre, A.-J. Cavagna, F. Planchon, U. Christaki, L. Monin, L. André, I. Closset, and D. Cardinal, 2015. Early season mesopelagic carbon remineralization and transfer efficiency in the naturally iron-fertilized Kerguelen area, *Biogeosciences*, 12, 1713-1731.
- Jeandel C., M. Rutgers van der Loeff, P.J. Lam, M. Roy-Barman, R. Sherrell, S. Kretschmer, C. German and F. Dehairs, 2015. What did we learn on the oceanic particle dynamics in the GEOSECS-JGOFS era? *Progress in Oceanography*, 133, 6-16.
- Planchon F., D. Ballas, A.-J. Cavagna, A.R. Bowie, D. Davies, T.W. Trull, E. Laurenceau, P. van der Merwe, and F. Dehairs, 2015. Carbon export in the naturally iron-fertilized Kerguelen area of the Southern Ocean based on the ²³⁴Th approach, *Biogeosciences*, 12, 3831-3848.
- Fripiat, F., D.M. Sigman, G. Massé, and J.-L. Tison, 2015. High turnover rates indicated by changes in the fixed N forms and their stable isotopes in Antarctic landfast sea ice. *Journal of Geophysical Research: Oceans* 120, doi:10.1002/2014JC010583.
- Miller, L.A., F. Fripiat, B.G.T. Else, J.S. Bowman, K.A. Brown, R.E. Collins, M. Ewert, A. Fransson, M. Gosselin, D. Lannuzel, K.M. Meiners, C. Michel, J. Nishioka, D. Nomura, S. Papadimitriou, L.M. Russel, L.L. Sorensen, D.N. Thomas, J.-L. Tison, M.A. van Leeuwe, M. Vancoppenolle, E.W. Wolff, and J. Zhou, 2015. Methods for biogeochemical studies of sea ice: The state of the art, caveats, and recommendations. *Elementa: Science of the Anthropocene* 3:000038, doi:10.12952/journal.elementa.000038.

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