Fixed-nitrogen and atmospheric N2 contribution to biological productivity along a North-South transect in the Eastern Atlantic Ocean

FONSECA BATISTA, DEBANY AND DEHAIRS, FRANK 1

L. BRUNELLI, C. GIL-FERNANDEZ, M. REMBAUVILLE, D. RIBICIC, T. SCHWENKE 2

1 Analytical and Environmental Chemistry, Earth System Science – Vrije Universiteit Brussel – Belgium

2 Second year Masters Students, MARES & EMBC networks

Marine primary production is limited by nitrogen availability over large areas of the world's ocean but especially in tropical and subtropical waters [Moore et al., 2009]. Nitrogen thus plays a critical role in the sequestration of atmospheric carbon into the deep ocean via the biological pump [Sohm et al., 2011]. The fixed-nitrogen budget in oceanic systems presently indicates that sources and sinks for nitrogen are not balanced. Biological nitrogen fixation provides the largest input of nitrogen to the oceans [Codispoti, 2007], while its removal through sediment and water column denitrification and anaerobic ammonium oxidation represents the loss function. The latter is generally considered to exceed the input via N2 fixation [Codispoti, 2007]. The past few years this condition has triggered several studies into the importance of N2 fixation as a source of new nitrogen to the ocean. We seized the opportunity offered by a scheduled north-south cross-Atlantic expedition to investigate the contributions of different N-nutrients (fixed nitrogen and atmospheric N2) to the biological production process and their variability between the different oceanographic provinces crossed.

The EUROPA cruise (European Universities & Research On board Polarstern in the Atlantic; [Auel et al., 2012]) took place on board R/V Polarstern sailing from Bremerhaven (Germany) to Cape Town (South Africa, ANT XXIX/1; Oct.-Nov. 2012). The cruise section followed the NW African coast, possibly affected by Saharan dust input, and crossed the area of marked nutrient doming (centered on the equator) and O2 depletion (on both sides of the equator) between 20°N and 20°S. At 17 stations, between 37.83°N and 26.26°S, we sampled the upper 700m of water column for nutrient distributions (ammonium, nitrate, phosphate) and for the natural isotopic composition of nitrate (δ15N and δ18O) to trace the major biological transformations of the nitrate pool, including N2-fixation [Großkopf et al., 2012]. We also conducted incubation experiments, using stable isotope enrichment techniques (15N2; 15NO3-;15NH4+; H13CO3-), for assessing primary production (PP) and the contribution of different N-sources, including atmospheric N2, NO3-, and NH4+, to the PP process over the euphotic layer (surface to 0.5 % PAR depth level). Shipboard data and first results of the enrichment experiments will be discussed.

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1 Vrije Universiteit Brussel : Pleinlaan 2, B-1050 Brussels - Belgium
defonsec@vub.ac.be and fdehairs@vub.ac.be respectively.