Petite diazotroph is a key player in the marine nitrogen cycle

WIEBKE MOHR[1]*, CLARA MARTÍNEZ-PÉREZ[1], CAROLIN R. LÖSCHER[2], JULIEN DEKAEZEMACKER[1], STEN LITTMANN[1], PELIN YILMAZ[1], NADINE LEHNEN[1], BERNHARD M. FUCHS[1], GAUTE LAVIK[1], RUTH A. SCHMITZ[2], JULIE LAROCHE[3], MARCEL M.M. KUYPERS[1]

[1]Max-Planck-Institute for Marine Microbiology, Bremen, Germany (*correspondence: wmohr@mpi-bremen.de)
[2]Department of General Microbiology, Christian-Albrechts-University Kiel, Germany
[3]Department of Biology, Dalhousie University, Canada

Biological dinitrogen (N_2) fixation is yet the largest source of new N to the ocean and thus exerts control on the export of organic matter and the sequestration of atmospheric carbon dioxide (CO_2). Although much of the N_2 fixation research has focused on larger N_2-fixing microorganisms (diazotrophs) in the past (namely *Trichodesmium* sp.), more recent molecular and size-fraction studies suggested that smaller, unicellular organisms could be major contributors to oceanic N_2 fixation [1]. On a longitudinal transect through the tropical North Atlantic, we measured bulk N_2 fixation rates in the euphotic zone and determined the single-cell N_2 fixation rates of the two most abundant diazotrophs using nanoSIMS. Beside the filamentous cyanobacterium *Trichodesmium* sp., we found the small, unicellular UCYN-A to be most abundant. UCYN-A is a cyanobacterium that lives in symbiosis with a small picoeukaryotic alga with which it exchanges carbon and nitrogen compounds [2]. Surprisingly, both *Trichodesmium* and UCYN-A contributed equally to N_2 fixation in the tropical North Atlantic despite their large size difference. This was mainly attributable to the higher activity and faster growth of UCYN-A. In addition to the originally described, small UCYN-A type, we also found a larger UCYN-A type at lower abundances. Together, these two types of UCYN-A contributed ~ 20% to total N_2 fixation in the tropical North Atlantic indicating their importance in this region. Based on the analysis of publically available databases, we determined that UCYN-A is widely distributed in the ocean, much farther than the tropical and subtropical ocean in which N_2 fixation is typically found. We thus hypothesize that UCYN-A is not only important in the tropical ocean but is also a key player in the global oceanic N cycle [3].

[1] Zehr et al. (2001) *Nature* 412, 635-638, [2] Thompson et al. (2012) *Science* 337, 1546-1550, [3] Martínez-Pérez et al. (2016) *Nature Microbiology* 1, 16163.