The University of Oxford Department of Earth Sciences

EARTHSCIENCES

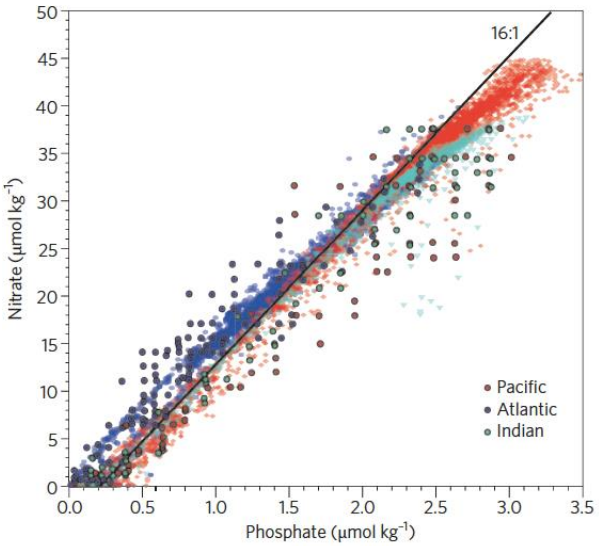
UNIVERSITY OF OXFORD

Probing the Changing Redfield Ratio of phytoplankton

Supervisory Team	• **Rosalind Rickaby** www.earth.ox.ac.uk/people/rosalind-rickaby • **Katsumi Matsumoto** www.esci.umn.edu/people/katsumi-matsumoto
Key Research Question	**What controls the Redfield Ratio amongst algae?**

Overview

In 1934, Alfred Redfield made the notable observation that the relative ratios of C:N:P of organic matter appeared to be constant throughout the surface oceans, and also matched the dissolved ratios of those nutrients (C106N16P1). The Redfield ratio is fundamental in dictating the strength of the biological sequestration of carbon, and the amount of oxygen that is used for respiration hence is an intimate control on the biotic feedback of phytoplankton on future climate. Despite efforts to understand the co-evolution of these ratios between the phytoplankton and the seawater from experimental, field observations and modelling efforts, there is still no mechanistic understanding of what drives the enormous variability seen across different phytoplankton lineages with various environmental conditions (Garcia et al., 2018).



There are two distinct aims to this project. First to document the changing Redfield ratio in the oceans since the start of the anthropogenic perturbation using multiple archives. Second, we will conduct culture experiments on key species with characterised Rubisco and CCM presence, under different conditions of Fe and C availability to test the hypothesis that it is the nutrient efficiency of photosynthesis that dictates the C:N ratio of organic matter.

Applicants would ideally have a background in Biology/Chemistry/Earth Sciences or Environmental Sciences.

Methodology

Methods to be used will include: Phytoplankton Culture and sterile techniques, EA IRMS, Spectrophotometry, and Microscopy.

References & Further Reading

Nature Geoscience have helpfully compiled a number of articles for a special issue entitled Redfield at 80. See the link here: https://www.nature.com/collections/fncspbsnmk.

Garcia N. S., et al., High Variability in Cellular Stoichiometry of Carbon, Nitrogen, and Phosphorus Within Classes of Marine Eukaryotic Phytoplankton Under Sufficient Nutrient Conditions, Frontiers in Microbiology, 9, doi: 10.3389/fmicb.2018.00543, 2018

Further Information

Contact: Rosalind Rickaby (rosalind.rickaby@earth.ox.ac.uk)