Combining physiological modeling at the cellular scale and in situ biogeochemical data to investigate the deep niche of *Emiliania huxleyi* in the South Pacific Gyre

Laura Perrin
Université Pierre et Marie Curie-CNRS-IRD-MNHN, LOCEAN-IPSL, 75252 Paris, France; lpelod@locean-ipsl.upmc.fr

Ian Probert
Station Biologique de Roscoff, 29680 Roscoff, France; probert@sb-roscoff.fr

Gerald Langer
The Marine Biological Association of the United Kingdom, Plymouth PL1 2PB, UK; gerlan@mba.ac.uk

Luc Beaufort
Aix-Marseille University, CNRS, IRD, Col. France; CEREGE, Aix en Provence, France; beaufort@cerege.fr

Giovanni Aloisi
Université Pierre et Marie Curie-CNRS-IRD-MNHN, LOCEAN, 75252 Paris, France; galod@locean-ipsl.upmc.fr

The distribution of *Emiliania huxleyi* from subarctic to subequatorial regions and from eutrophic to oligotrophic waters makes it the most widely studied coccolithophore species. However, its physiologic response under key environmental conditions, such as the co-limitation of light and nutrients, remains poorly investigated in the laboratory and in the field in coccolithophores deep niches in oceanic gyres. We conducted laboratory culture and numerical modeling experiments in order to understand the controls on the physiology of *Emiliania huxleyi* in low-nutrient and low-light conditions with the aim of gaining a better understanding of the deep ecological niche of coccolithophores in the South Pacific Gyre.

We carried out batch culture experiments to test the co-limitation of nutrients (nitrate and phosphate) and light with an *E. huxleyi* strain that was isolated from the BIOSOPE transect (South Pacific Gyre). A simple physiological model that was based on the Droop theory was applied to the culture experiments in order to constrain the key physiological parameters of *E. huxleyi* that are usually obtained in more costly and time-consuming chemostat experiments. Our approach provided a rapid, simpler procedure to estimate these fundamental parameters. Evidence of this capacity to grow in different environments can be found in the deep niche reported in the South Pacific Gyre during the BIOSOPE cruise. This coccolithophore niche, which is characterized by a strong community of Isochrysidales, such as *E. huxleyi*, *Gephyrocapsa* spp., and *Reticulofenestra* spp., was investigated by combining physiological parameters and in situ biogeochemical data. The modeled spatial distribution of growth rate matches the in situ observed abundance of *Emiliania huxleyi* cells. We highlighted nitrate and light as the two forcing environmental parameters that control growth in the niche, and we are now working on the potential estimation of the calcification rate of *Emiliania huxleyi* in this niche.