The University of Oxford Department of Earth Sciences

EARTHSCIENCES

UNIVERSITY OF OXFORD

Hidden Ocean Forests: Understanding the Ecological and Physiological Properties of Phytoplankton in Subsurface Layers

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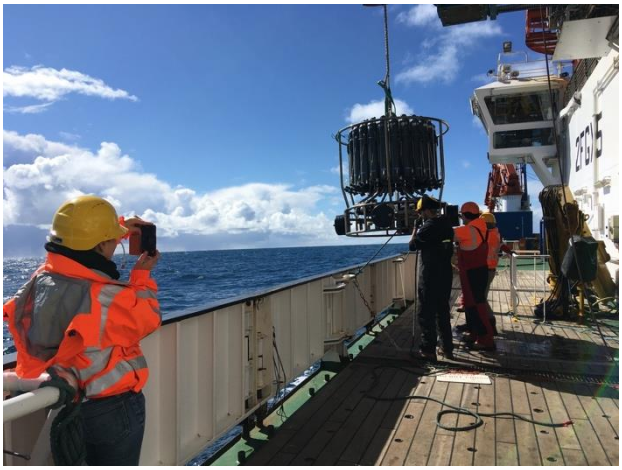
Key Words	**Ocean biogeochemistry, phytoplankton ecology, biological oceanography**

Overview

Satellite sensors have provided an unprecedented view of changes in phytoplankton chlorophyll in the surface ocean. Yet in many ocean regions, from the poles to the tropics, the maximum concentration of chlorophyll occurs at depths which are invisible to earth-orbiting satellites. The formation of subsurface chlorophyll maxima is primarily caused by the exhaustion of surface nutrients within the surface mixed layer and an increase in the intracellular pigment concentration of shade-adapted phytoplankton growing at depth. Studies have shown that even though these phytoplankton assemblages are growing in dimly-lit waters, they can contribute a significant fraction of the total and new water-column production in shelf and open-ocean ecosystems. Moreover, the communities of cells that occupy these chlorophyll layers serve a pivotal role in both the ecological and biogeochemical functioning of the global ocean.



Methodology

This study will examine the ecological and biogeochemical properties of the photosynthetic organisms that occupy subsurface and deep chlorophyll layers and compare their cellular and photosynthetic properties to surface mixed-layer assemblages. Datasets used in this study will cover a large latitudinal gradient and a wide range of marine settings (marginal ice zones to subtropical gyres). You will determine the factors leading to the formation of these layers over a range of environmental conditions through the statistical analysis of global oceanographic datasets (including Bio-Argo) and numerical modelling. Combining both sensor and bottle data, you will examine how the productivity, size structure and biodiversity of these subsurface communities are structured across ocean provinces and basins.

Timeline

Year 1: Develop an understanding of the parameterisation of marine primary production models. Using in situ and sensor datasets, assemble a global dataset of parameters describing the vertical structure of chlorophyll layers and their photosynthetic and cellular properties.

Years 2 and 3: Continue database assembly. Examine the spatial and temporal variability in the vertical structure of chlorophyll fields for a range of biogeochemical provinces. Compute primary production using refined parameterisation and interpret results. Visit collaborators and/or participate in a research cruise.

Year 4: Write publications characterizing the biodiversity and productivity of chlorophyll layers across the Atlantic basin and attend UK and international conferences.

Training & Skills

The successful applicant, whose first degree might be in marine, environmental or earth sciences, will have an aptitude for multidisciplinary research and good quantitative and computing skills. The student will receive guidance in working with large oceanographic datasets including pigment and flow cytometry data, satellite images of sea-surface temperature and chlorophyll and Bio-Argo profiles. They will acquire a thorough grounding in the modelling of marine primary production. There will be opportunities to attend national and international conferences, and to participate in an ocean research expedition if the student wishes.

References & Further Reading

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Further Information

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