How do marine microplankton survive during global warming?

*Yurika Ujiie[1], Kyoko Hagino[1], Tatsuhiko Hoshino[2], Jeremy R. Young[3], Ian Probert[4], Richard Jordan[5]

1. CMCR, Kochi University, 2. JAMSTEC, 3. University College London, 4. Roscoff Biological Station, 5. Yamagata University

Global warming has been accelerating since the 1990s and has dynamically changed the global environment, often leading to climate hazards. Marine microplankton, particularly phytoplankton, play important roles in driving biogeochemical cycles because they are CO_2consumers in the atmosphere–ocean CO_2 exchange, and exporters of organic and inorganic compounds in the water column through the biological pump. There is growing concern that global warming significantly modifies the habitats of microplankton, and so their biogeochemical functions could be impaired resulting in reduced CO_2 absorption by the marine ecosystem. However, the impact of anthropogenic climate change on marine microplankton has been poorly investigated based on actual measurements. The present study enables us to directly observe the photic biosphere before the acceleration of global warming. The Okada & McIntyre collection of filter (0.8–64 μm) samples from ~6000 sites across the world ocean in the 1960–1970s represents a unique resource for the investigation of microplanktic diversity from half a century ago. We are employing both morphological and molecular techniques to these collections to unveil species diversity. Extracted DNA from the filter samples are enough quality to be used for Next Generation Sequencing (NGS) metabarcoding. This metabarcoding can be compared with those of the TARA-Oceans expeditions, which provided the database of the current genetic diversity of plankton communities in the world ocean.
Our first priority is to study the calcifying phytoplankton coccolithophores among the microplankton, because they crucially contribute to the carbon, nitrogen and other cycles via the calcification of coccoliths and their symbiotic relationship with bacteria. Morphological studies of modern coccolithophores have provided knowledge on their ecology, physiology, and geochemical roles. A comprehensive survey of morphological-genetic approaches can reveal the changes of species composition and geographic distribution of coccolithophores in the late Anthropocene. These changes will be related to the actual response of marine microplankton to global warming and will help to improve our prediction of the future impact of climate change on the marine biosphere.

Keywords: anthropogenic climate change, marine diversity, phytoplankton, biogeochemical role

