

メタオミクスを利用した海洋プランクトン動態に関する研究

Study on the dynamics of marine plankton using meta-omics data

京都大学 化学研究所 バイオインフォマティクスセンター 化学生命科学 江 思宇

研究成果概要

The increasing anthropogenic CO₂ emissions and the induced climate change had become one of the biggest global crises. The ocean had been estimated to absorb about 25% of this anthropogenic CO₂, thus plays a critical role in the global carbon cycle. The marine biological pump is one of the most important mechanisms of carbon sequestration in the ocean. However, the efficiency of biological pump, i.e., whether the carbon fixed by phytoplankton photosynthesis can be exported to the deep ocean or remineralized to CO₂ in the surface layer largely depends on phytoplankton groups and the quality and sinking speed of biogenic matters. In my current study, I introduced a comprehensive dataset consisting of both the oceanic CO₂ absorption (indicated by the partial pressure of seawater CO₂) and eukaryotic 18S rRNA gene composition across the surface North Pacific Ocean. The qiime2 software installed on the SuperComputer System was applied to analyze the 18S rRNA gene amplicon sequencing data. By using this software, the composition of marine eukaryotic communities in 519 water samples were generated, which allows us to draw a linkage between oceanic CO₂ absorption with marine phytoplankton groups. The results showed at most sampling sites in the North Pacific Ocean, there was a net air to sea CO₂ flux. Therefore, the North Pacific Ocean generally appears as a sink of atmospheric CO₂. Furthermore, the Weighted correlation network analysis (package WGCNA, in R program) was applied to the Genus-level taxonomic profiles evaluated with 18S rRNA gene amplicon sequencing, to elucidate which phytoplankton groups are accounted for the air to sea CO₂ flux. The results showed diatoms might contribute much of this flux through their active photosynthesis during spring blooms. I am now preparing a manuscript with this dataset, and these results are expected to publish on an international scientific journal soon.