Similarity of phytoplankton growth in different oligotrophic waters of the northwest Pacific and Yellow Sea in response to nutrients and Asian dust additions

CHAO ZHANG[1], ZONGBO SHI[2], HUIWANG GAO[1*], XIAOHONG YAO[1]

[1] Key Laboratory of Marine Environment and Ecology, Ministry of Education of China, Ocean University of China, Qingdao, China. (llyz_c3911@163.com, hwgao@ouc.edu.cn, xhyao@ouc.edu.cn)

[2] School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, U.K. (Z.Shi@bham.ac.uk)

Previous studies showed that atmospheric depositon of nutrients to oligotropic coastal seas and open oceans can stimulate phytoplankton growh. However, the dynamics of phytoplankton growth in these regions after atmospheric nutrient addition are poorly understood.

In this study, five on-board microcosm experiments were carried out in seawater from oligotrophic regions of the Northwest Pacific (NWPO, open ocean) and Yellow Sea (YS, coastal sea of China) to investigate the responses of chllorphyll a (chl a, an indicator of phytoplankton growth) to added nutrients and Asian dust. We found that pico-phytoplankton was the dominated algae at all stations and phytoplankton growth were mainly under nitrogen (N) and phosphorus (P) colimitation or N, P and iron (Fe) colimitation at most stations except the G6 station (in YS) which is limited by P alone. Based on the maximum chl a concentration and N and P usage in various nutrient addition cultures, we estimated the uptake of N/P for phytoplankton to be 18-19 in YS and 15-18 in NWPO, all of which are close to the Redfield ratio. Although the dissolved P from dust was at nanomolar-level in the cultures, the combination of N and P from dust supported chl a increases at most stations except the G7 station (in NWPO), which is likely N, P and Fe limited.

Our results suggested that the fertilization effect of dust on phytoplankton growth is greater in oligotrophic oceans limited by multiple nutrients than those by a single nutrient.