Factors Regulating the Diurnal Variation in Suspended Particulate Organic Carbon in the Euphotic Zone of South China Sea Basin

Yueping Deng1,2, Peihong Kang1,2, Zixiang Yang1,2, Tianjian Tang1,2*

1 School of Ocean and Earth Sciences, Xiamen University, Xiamen, Fujian, 361102, China;
2 State Key Laboratory of Marine Environment Science (Xiamen University), Xiamen, Fujian, 361102, China;
*Email: tianjian.tang@xmu.edu.cn

Abstract: As a major constituent of ocean biological pump, the export of particulate organic carbon (POC) from the euphotic zone is important for the evaluation of ocean carbon budget. However, it is not clear the major drivers that regulate the POC export in the euphotic layer. In this study, the diurnal variations in POC and amino acids (AA) concentrations and stable carbon isotope values were analyzed. The POC δ13C ranged from -26.0‰ to -21.1‰, which shows no diurnal variations. The AA δ13C ratios varied from -26.7‰ to -19.9‰ with different profiles observed between samples collected at 14:00 PM and 20:00 PM. A Linear relationship between POC δ13C and carbon weighted AA δ13C (wAA δ13C) was observed at 14:00 PM, while this disappeared in samples collected 20:00 PM, indicating the decoupled contribution of labile POC and the bulk during the night, which possibly result from the particle export. This study observed for the first time the diurnal variation in labile and bulk particulate organic carbon δ13C in the upper layer of the South China Sea basin, which helps to distinguish the factors regulating the POC export in the euphotic zone.

Study Area

![Figure 1. Location of sampling site in the South China Sea. SEATS indicates the main site of the South China Sea basin, which is less affected by rivers around it. It has typical characteristics of low latitude marginal marine oligotrophic. At this site, we performed 24h continuous sampling in the upper 200 m water column using a Multiple Unit Large Volume in situ Filtration System (MULVFS).](image1.png)

Diurnal variation of POC and Amino acids

![Figure 2. Profile of POC δ13C, AA δ13C and chlorophyll a observed at the SEATS Station at different time. Gray areas indicate the depth of chlorophyll maximum layer(DCM). δ13C_POC reaches the minimum value at DCM and varied with DCM in a day.](image2.png)

POC δ13C and AA δ13C varied with DCM

![Figure 3. The diurnal fluctuation of concentration and δ13C of POC and amino acids.](image3.png)

- The diurnal fluctuation of POC and amino acid concentration was not significant.
- The POC δ13C does not fluctuate obviously in a diurnal cycle, while AA δ13C shows some differences between samples collected at 14:00 PM and 20:00 PM.

Conclusions

- The minimum of POC δ13C in euphotic zone presents at the depth of chlorophyll maximum layer. The AA δ13C vertical distributions generally parallels to those of POC δ13C, but variation can be observed from samples collected at 14:00 PM and 20:00 PM.
- A linear correlation was observed between POC δ13C and AA δ13C at 14:00 PM, while this disappeared in samples collected 20:00 PM, indicating the decoupled contribution of labile POC and the bulk during the night, which possibly result from the particle export.

![Figure 4. Linear regression of POC δ13C and carbon weighted AA δ13C (wAA δ13C) of samples at different times. A strong linear correlation was observed at 14:00 PM with a slope of 9.4, while at 20:00 PM the slope was only 0.1.](image4.png)