PLFA-Stable Isotope Probing: Tracing Carbon Flow from POC and DOC to Microbes

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Marine microbes play a pivotal role in the global ocean carbon cycle. It has been suggested that particle-attached microbes (PAM) are responsible for transformation of particulate organic carbon (POC) to produce dissolved organic carbon (DOC), and the free-living microbes (FLM) for degrading DOC (Fang et al., 2015. Science China (Earth Sciences) 58, 106-115). However, this hypothesis has never been tested.

Seawater samples collected at 75, 2000, and 4000 m in the New Britain Trench were filtered sequentially through 3 and 0.22 μm pore-size polycarbonate membrane to collect PAM and FLM. ^{13}C-labelled POC was produced by *Thalassiosira weissflogii* using $NaH^{13}CO_3$ as carbon source. After 30-day incubation under in-situ pressure conditions, concentrations and $\delta^{13}C$ of POC, DOC, and microbial cellular fatty acids were determined. Our results show that (1) both PAM and FLM degraded the ^{13}C-labeled POC and led to the incorporation of ^{13}C into microbial cellular fatty acids, whose $\delta^{13}C$ values reached up to 266,785.9‰. (2) DOC was produced from POC, as suggested by significantly increased $\delta^{13}C$ values of DOC (up to 129,673.6‰). (3) No apparent difference was observed in microbial degradation of POC and DOC between the shallow and the deep-water microbes. Our results provide new insights on the mechanistic processes of the PAM and FLM assemblages in disintegration and transformation of POC, production of DOC and carbon flow from POC to DOC and the actively degrading microbes.