Particle production and transformation in the eastern tropical North Pacific oxygen-deficient zone (ETNP-ODZ) revealed by $\delta^{15}$N-amino acids

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Introduction

The ETNP region offers a unique opportunity to study particle export due to its high productivity and the presence of an ODZ. It has been suggested that the efficiency of the biological pump in regions with ODZs may be higher as compared to oxic water columns. This may result from additional flux sources such as the primary producers at the secondary chlorophyll maximum (SCM) found in the upper ODZ. Reduced particle attenuation is another possible explanation as zooplankton abundance is very low within the ODZ. Additionally, a secondary zooplankton biomass maximum is present at the lower oxycline that could interact with particles below the ODZ.

In this study, we analyzed the $\delta^{15}$N of nitrate, phenylalanine (Phe), and glutamic acid (Glu) in particles and zooplankton. The results were compared to those in oxic waters to investigate the sources of particles and the subsequent transformation processes in the ETNP-ODZ.

Sample Collection and Analysis

- **200 - 800L** of water was filtered in situ using McLane Pump:
  - GF75 Filter: 0.3 - 53 μm → Suspended particles
  - Nitex mesh: > 53 μm → Sinking particles

The vertical distribution of $\delta^{15}$N of bulk particles is shown in Figure 1.

Particle production at PCM and SCM

- Bulk $\delta^{15}$N and $\delta^{15}$N of suspended particles reflect that phytoplankton communities at PCM were supported by both NO$_3^-$ and recycled N
- SCM materials contributed to sinking particles at Station 5

Particle alteration by microbes and zooplankton

- Heterotrophic microbial remineralization may exert a smaller N fractionation effect on suspended particles in the ODZ compared to oxic water column over the upper 300 m (Fig. 6).

- Zooplankton likely avoids feeding in the ODZ core at Sta 3

- Potential feeding at the upper oxycline (LO)/ODZ interface at Sta 8

Chemoautotrophic production at the lower oxycline (LO) may produce low $\delta^{15}$N$_{\text{Naa}}$ signals in suspended particles

- Increase in zooplankton activities and microbial remineralization at the LO elevates $\delta^{15}$N$_{\text{Naa}}$ and TP$_{\text{Glu-Phe}}$ of sinking particles

References:

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