

Sulphur compounds, methane, and phytoplankton: Interactions along a north-south transit in the western Pacific Ocean

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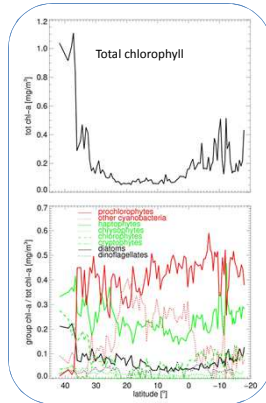
Introduction

- Dimethylsulfide (DMS) is the most important source of biogenic sulphur in the atmosphere and might have an impact on the climate
- Dimethylsulfoniopropionate (DMSP), the precursor of DMS, is produced by specialized phytoplanktons and serves as the most important single substrate for marine bacteria and phytoplankton
- Dimethylsulfoxide (DMSO), the oxidant of DMS, seems to present the biggest reservoir for DMS in the ocean and might also serve as a nutrient
- The western Pacific Ocean is widely undersampled for biogenic sulfur and its role for the marine sulfur cycle is poorly understood
- DMSP might be a precursor for methane (CH₄)

Conclusions

- The north-south transit was characterized as an oligotrophic region of low biomass, dominated mainly by prochlorophytes
- Same algae groups (haptophytes, chrysophytes and dinoflagellates) were identified as important DMSP and DMSO producers
- The surface water of the western Pacific Oceans seems to be enriched with DMSO
- DMSP_d and DMSO_{p/t} were positively correlated with CH₄ for the entire north-south transit
- DMSP could be considered as a potential precursor for CH₄ production
- For the first time we could show that DMSO might act as a precursor or substrate for CH₄ production as well

Phytoplankton composition determined by using measured marker pigments

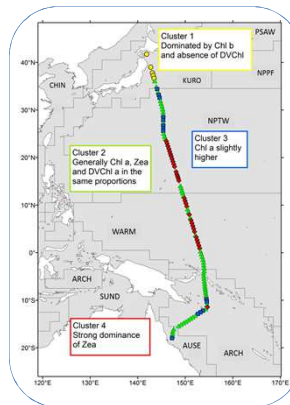


Dependent on the phytoplankton composition the sampling site could be separated into four different clusters

Cluster 1 and 3
 high phytoplankton biomass;
 dominance of eukaryotic algae in cluster 1 (chlorophytes, haptophytes, diatoms);
 dominance of cyanobacteria in cluster 3
 elevated concentration of sulphur species

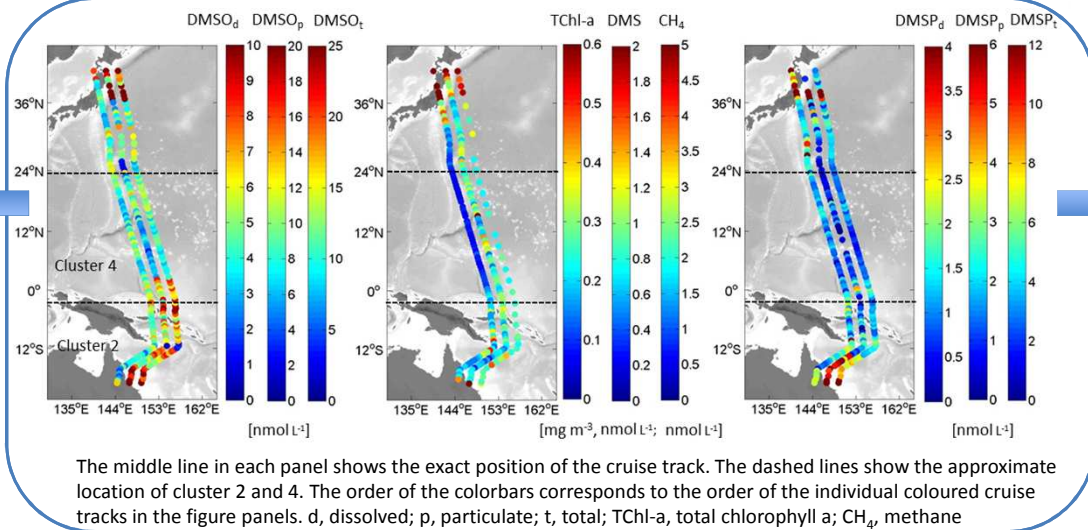
Cluster 2 and 4
 majority of the stations,
 low phytoplankton biomass;
 dominance of cyanobacteria,
 Low concentrations of sulphur

Cruise track of „TransBrom“ on R/V Sonne from 9th to 24th October 2009, colours indicating the distribution of the clusters

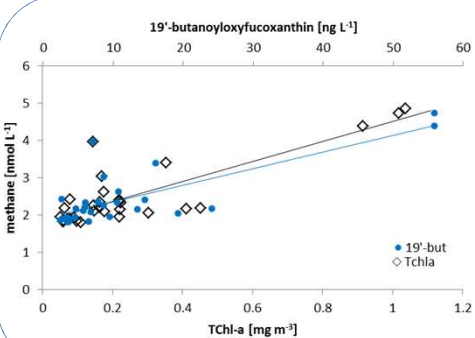


- Correlations between chlorophyll and DMSP/DMSO suggest the same source for both sulphur compounds in phytoplankton
- haptophytes, chrysophytes and dinoflagellates were identified as the main DMSP and DMSO producers
- DMSP producing algae might have the potential to synthesize DMSO
- No phytoplankton group were responsible for the production of DMS; bacteria seems to be the most important source for DMS

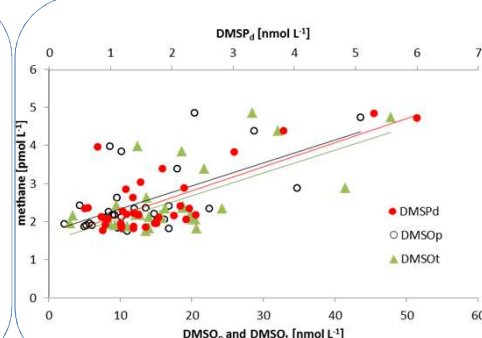
- First data presented about DMSO concentrations in surface seawater along a north-south transit in the Pacific Ocean
- The DMSO concentrations were elevated compared to other oceanic regions
- Oxidative stress and nutrient limitation might force the enhanced DMSO production by phytoplankton



- Lowest CH₄ concentrations in cluster 4
- The West Pacific was a weak net source of CH₄ to the atmosphere along the transit



- Chlorophyll correlates with CH₄ (R² = 0.69)
- A significant correlation between chrysophyceae and CH₄ (R² = 0.76)
- Chrysophyceae (indicated by 19'-but) is an important DMSP producing algae
- A direct production of CH₄ by algae is unlikely, however, bacteria attached to the algae might be responsible for CH₄ production



- DMSP dissolved correlates with CH₄ (R² = 0.57)
- a correlation was also found between DMSO particulate and CH₄ (R₂ = 0.37) and between DMSO total and CH₄ (R² = 0.42)
- we conclude that algae derived DMSP and DMSO might be considered as possible precursors for CH₄ production in the western Pacific Ocean