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Enhancement of dimethylsulfide production by anoxic stress in natural seawater

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Dimethylsulfide (DMS) is the dominant reduced sulfur species in the ocean and an important source of aerosols particles and clouds in the marine atmosphere. Marine DMS plays a key role in the climate system of the Earth. A better knowledge of the distribution of marine DMS and its controlling factors is required. Previous field studies have reported the formation of DMS peak upper anoxic layer though the governing processes have not been clearly understood yet. Here we show the first direct evidence for the enhancement of DMS production caused by anoxic stress.

Isotope tracer experiments were made using the oxic and anoxic coastal seawater to quantitatively evaluate DMS production rates in three processes; cleavage of dimethylsulfoniopropionate (DMSP), dimethylsulfoxide reduction and phytoplankton release.

Under the anoxic condition, DMS production was considerably enhanced and DMS consumption was inhibited, resulting in an 8-fold higher rate of gross DMS production than that under the oxic condition. While almost all DMS was derived from DMSP cleavage (99%) under the oxic condition, the DMS production under the anoxic condition was mainly due to direct release of DMS from phytoplankton (63%). These results demonstrate that phytoplankton suffered from anoxic stress emits DMS into the seawater, resulting in a rise in DMS levels. Anoxic stress is indicated to be one of important environmental factors in the dynamics of marine DMS, suggesting the possible global importance due to a ubiquity of anoxic conditions in the coastal oceans.

Keywords: dimethylsulfide, dimethylsulfoniopropionate, dissolved oxygen