

## Conditions for photic zone euxinia deduced from ocean biogeochemical cycle model

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It is widely thought that atmospheric oxygen concentration has been kept in a level of the same order of magnitude as that of today over the Phanerozoic, based on both charcoal records and geochemical cycle modeling.

On the other hand, several lines of geological/geochemical evidence indicate that the oceans below photic zone were strongly de-oxygenated on a global scale at some geological intervals. Such oxygen deficient events are known as "Oceanic Anoxic Events (OAEs)."

In the anoxic water column, hydrogen sulfide is produced via bacterial sulfate reduction. Therefore, if sulfate and metabolizable organic matter are sufficient, hydrogen sulfide builds up in some cases, which is called "ocean euxinia."

Biomarkers derived from photosynthetic green sulfur bacteria have been discovered in the sedimentary rocks deposited during the Mesozoic OAEs(e.g., early-Triassic superanoxia and Cretaceous OAE2) indicating that hydrogen sulfide existed in the photic zone (~100m) at those intervals. However, the conditions required to generate the photic zone euxinia remains unrevealed.

Here we investigate the conditions required for occurrence of photic zone euxinia, using an ocean biogeochemical cycle model developed by Ozaki and Tajika (2013). We further improve the model to have the surface ocean with higher resolution to evaluate the vertical profiles of H<sub>2</sub>S, NO<sub>3</sub>, HPO<sub>4</sub>, and O<sub>2</sub>. We try to understand the changes of marine primary producer during photic zone euxinia quantitatively.

Keywords: oceanic anoxic events, biogeochemical cycles, phosphorus cycle, anoxia/euxinia, photic zone euxinia