

Photic Zone Anoxia/Euxinia and Marine Biogeochemical Cycles Deduced from a One-Dimensional Marine Biogeochemical Cycle Model

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It has been revealed that the redox boundary was within the photic zone of the surface ocean, which is inferred from the biomarker derived from obligatory anaerobic green-sulfur bacteria, and the bloom of nitrogen-fixing cyanobacteria occurred, which is inferred from the biomarker and nitrogen isotopic composition of organic matters deposited during Ocean Anoxic Events (OAEs) at Cenomanian/Turonian boundary, about 95 million years ago. In order to understand characteristic features of marine biogeochemical environment and ecosystem during OAEs, we investigate the marine biogeochemical cycles under the anoxic/euxinic ocean conditions.

We developed a vertical one-dimensional marine biogeochemical cycle model which involves various biochemical processes in the oxic-anoxic water column. According to recent phosphorus speciation analyses, the P burial efficiency declines under the anoxic condition, and intense positive feedback loop between anoxia, redox-dependent P burial process, and primary productivity in the surface ocean ("anoxia-productivity feedback") may work during OAEs. We examined the roles of anoxia-productivity feedback in occurrences of global anoxia/euxinia.

Based on sensitivity analyses, we revealed that OAEs tend to occur under warmer and wetter climatic conditions like those during the mid-Cretaceous. The conditions called "photic zone anoxia/euxinia (PZA/PZE)" will be discussed. We will also discuss the changes of ecosystem and geochemical structures within the water column when PZA/PZE occurs in the ocean.