Methane dynamics in Lake Biwa

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Introduction

Methane production and oxidation are important processes in carbon cycles of freshwater environments. Information on methane dynamics in oligo- to mesotrophic lakes is, however, still limitted. Spatial distribution and metabolism of methane in a mesotrophic lake were studied in Lake Biwa, the largest lake in Japan.

Sediment

Methane contents in sediment (0-10 cm) ranged from 1.0 to 54.0 $\mu l ml^{-1}$, and were weakly correlated with amounts of organic carbon in surface sediments (0-2 cm). Nitrogen stable isotopic composition of bulk sediment, which was used as an indicator of the origin of the organic matter (autochthonous vs. allochthonous), showed less correlation with methane content. $\delta^{13}C\text{-}CH_4$ values ranged from -61 to -79 ‰, and exhibited positive correlation with methane contents. $\delta^{13}C\text{-}CH_4$ values also showed a positive correlation with $\delta^{13}C\text{-}\sum CO_2$ and alomost of _c values between$\delta^{13}C\text{-}CH_4$ and $\delta^{13}C\text{-}\sum CO_2$ were within a range between 1.075 and 1.080. The results suggested that methane contents in sediments varied with in the lake depending on the quantity of deposited organic matter but the quality, and that methane production pathways were dominated by CO_2 reduction and similar over the lake (Murase and Sugimoto 2001). Methane produced in the sediment also showed low $\delta^{13}C\text{-}CH_4$ values ranging from –70 to –78 ‰ (Murase and Sugimoto 2002). Methane diffused to the surface layer of the sediment was mostly oxidized at the oxic layer resulting in increased $\delta^{13}C\text{-}CH_4$ values from –70 to –48 ‰.

Water

Epilimnion showed higher concentration of dissolved methane than hypolimnion in pelagic zone. Peaks of methane were observed at the thermocline. Transect observation of dissolved methane revealed three methane peaks at different water depths in the lake, and stream water and the sediments in littoral and sub-littoral zones were suggested to be the corresponding sources. Carbon stable isotope analysis indicated there were different sources of dissolved methane, although it was difficult to identify the origins due to high variation of the isotopic composition of methane from different sources. Seasonal increase in $\delta^{13}C$ value of methane was observed in hypolimnion, indicating methane oxidation during a stagnant period (Murase *et al*. 2003).

References

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Chemostratigraphy of the Middle Permian mid-oceanic limestone in Southwest Japan

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The Akiyoshi limestone represents an ancient organic reef complex on paleo-atoll in the mid-Panthalassa. It ranges from the Early Carboniferous to Middle Permian, and is biostratigraphically divided into 21 fusulinid/coral zones. We analysed forty-five samples of a drill-core Middle Permian limestone from the Kaerimizu section in Akiyoshi, Southwest Japan, in order to clarify the secular environmental change of the Permian superocean prior to the Permo-Triassic boundary mass extinction. The limestone is one of the most complete and continuous carbonate successions in this period. However, intensive geochemical study on the limestone is still limited. The currently analysed interval includes three fusulinid zones of the late Middle Permian; i.e., *Neoschwagerina craticulifera* Zone (25 meter thickness), *Verbeekina verbeeki* Zone (20 m), and *Colania douvillei* Zone (40 m) in ascending order. The major and trace elements were analysed by XRF and ICP-MS to check the limestone's quality and degree of alteration. A secular change in carbon isotope compositions of both carbonate and organic matter is reported and its geological implication is discussed.