

The effect of methane concentration on methanotrophic bathymodiolid mussels in the Okinawa Trough hydrothermal fields

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As methane (CH₄) is a greenhouse effect gas, the emergence and activity of CH₄-oxidizing organisms is suggested to have triggered global glaciation. Although the threshold concentrations of CH₄ for the growth of CH₄-oxidizing microorganisms under laboratory conditions are well known, CH₄-oxidizing organisms in the field is poorly constrained for the threshold concentration of CH₄ for growth. This information is critical to reconstruct atmospheric and oceanic CH₄ levels when the activities of methanotrophic organisms are indicated from geologic records with ¹²C-enriched organic matter. We investigated sediment-hosted deep-sea hydrothermal fields in the Okinawa Trough where abundantly emitted CH₄ is known to support methanotrophic ecosystem represented by Bathymodiolid mussels. The distribution of Bathymodiolid mussels and the CH₄ concentrations of their habitats were determined in five hydrothermal fields throughout the Okinawa Trough, and it is suggested that approximately 10 μM is a threshold CH₄ concentration for the methanotrophic organism in the deep-sea ecosystem.

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