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Reevaluation of energy source of chemosynthesis-based animals in Okinawa Trough hydrothermal fields

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Hydrothermal activities in the Okinawa Trough maintain large biomass of chemosynthesis-based animals. Large part of such animals rely on thioautotrophic primary production, therefore, it is commonly believed that those animals are supported only by hydrogen sulfide provided from hydrothermal emission. However, the distribution of those animals are not limited nearby hydrothermal vents and are widely spreader around hydrothermal fields. We can not detect notable amount of hydrogen sulfide in the ambient seawater of those animal communities, it means that venting fluids are thoroughly diluted and possibly insufficient for sustaining those community.

The purpose of this study, therefore, is reevaluation of the energy source quantitatively for chemosynthetic primary production for understanding the extent of hydrothermal ecosystem in the Okinawa Trough.

We used isotope geochemical technique to achieve our goal. Seven animal species were collected at the two hydrothermal field, Iheya and Izena areas, using RV/Natsushima and ROV/HyperDolphin during NT10-17 cruise.

The isotopic signatures obtained from the soft body parts of the sample animals suggest that some animals (Solemyid clam, Alvinocaris shrimp, and galatheid crab) assimilate not only hydrothermal sulfide but also bacterial sulfide provided by sulfate-reducing activity. It may suggest importance of methane flux from the subsurface around the hydrothermal field because consortium of sulfate-reducing bacteria and methanotrophic archaea is potential source of hydrogen sulfide for thiotrophic animal community. On the other hand, methanotrophic *Bathymodiolus* mussel obtained from the Izena area have low sulfur isotopic signature, suggesting significant contribution of thioautotrophic production. It may imply that the mussel rely on not only symbiotic production but also suspended organic matter, which mainly produced by thioautotrophic bacteria.

Hydrothermal activity in the Okinawa Trough is characterized by high methane flux because thick sediment cover the area and interaction between the sediment and hydrothermal fluid generate significant amount of methane. The gaseous methane can spread widely rather than hydrogen sulfide dissolved in the hydrothermal fluid, therefore, large flux of methane may be a key factor for extent of chemosysthesis-based animal community in the Okinawa Trough.

Keywords: Okinawa Trough, hydrothermal system, chemosynthesis-based animal, energy source, stable isotope