Microbiological Investigation of the Iron-Containing Floculent Mats in Various Deep Sea Environments

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It is believed that most important energy source in ocean crust or subseafloor is vastly abundant iron. Therefore, it is suggested that the iron-oxidizing chemolithoautotrophic microbe is a key player for the microbial ecosystem. However, there were no direct evidences because cultivation of iron oxidizer was difficult. Recently, "Mariprofundus ferrooxidans" belong to the ζ (zeta)-proteobacteria was isolated. This microbe can oxidize ferrous iron as the elctron donor and can be widely observed in various deep-sea low-temperature hydrothermal fields. However, the diversity, distribution and role of these iron-oxidizing ζ-proteobacteria are still unknown. In addition, it is still unclear how these microbes cope with iron predominantly from oceanic basalts. Therefore, to clarify these questions, we have investigated several iron-containing flocculent mats from deep-sea hydrothermal fields in the Mariana Vocanic Arc and the Okinawa Trough. Culture independent analysis of these mats demostrated that ζ-proteobacteria was the most dominant phylotypes. The X-ray analysis revealed that the abundance of potentially biogenic Fe-oxides-species would be relevant with the abundance of ζ-proteobacteria population in the iron-containing flocculent mats. These results strongly supported that iron-oxidizing chemolithoautotrophs have significant ecological roles for iron and carbon cycles in deep-sea low-temperature hydrothermal systems.