Fluid geochemistry of high-temperature hydrothermal sites in the Okinawa Trough: A review

SHINSUKE KAWAGUCCI[1234]

[1]Department of Subsurface Geobiological Analysis and Research (D-SUGAR), Japan Agency for Marine-Earth Science and Technology (JAMSTEC) kawagucci@jamstec.go.jp
[2]Laboratory of Ocean-Earth life evolution research (OELE), JAMSTEC
[3]Research and development center for submarine resources, JAMSTEC
[4]Project team for development of new-generation research protocol for submarine resources, JAMSTEC

Fluid chemistries of the known high-temperature hydrothermal sites in the Okinawa trough are compiled to compare between them and with global representative sites with various tectonic/geologic backgrounds [1]. The comparisons indicate that the chemical characteristics of the Okinawa Trough hydrothermal fluids are explained by linkages between 1) shallow water depth that constrains the maximum fluid temperature, 2) back-arc tectonic setting that introduces magmatic volatiles into the fluid, 3) probable silicic rock-based fluid-mineral interaction at the hydrothermal reaction zone, and 4) seafloor sediment around the vents that provides both compounds derived from sedimentary organic matter and biogenic compounds, such as methane, produced by microbial ecosystems in the sedimentary environment.

To explain the highly diverse gas compositions and stable isotope ratios of methane among the OT hydrothermal sites, “fluid-sediment interaction” has been further classified into several types with respect to processes (microbial or chemical) and stages of subseafloor fluid circulation (recharge or discharge). This concept, originally called the Microbial Methanogenesis at Recharge stage (MMR) model, enables us not only to deduce the geochemical origins of methane in the hydrothermal fluid in each Okinawa Trough site but also to estimate the geographical distribution of hydrothermal fluid circulation via a two-dimension schematic illustration.

[1] Kawagucci, S. (2015) in *Subseafloor biosphere linked to global hydrothermal systems; TAIGA Concept*, Edited by J. Ishibashi, K. Okino, and M Sunamura, Springer Japan, Tokyo, pp 387-403. DOI: 10.1007/978-4-431-54865-2_30