Hydrothermal fluids of the Okinawa Trough: Sr isotopic composition

TOMOHIRO TOKI[1], RYUICHI SHINJO[2], JUN-ICHIRO ISHIBASHI[3]

[1] Department of Chemistry, Biology and Marine Science, Faculty of Science, University of the Ryukyus, 1, Senbaru, Nishihara, Okinawa 903-0213, Japan

[2] Department of Physics and Earth Sciences, Faculty of Science, University of the Ryukyus, 1 Senbaru, Nishihara, Okinawa 903-0213, Japan

[3] Department of Earth and Planetary Sciences, Graduate School of Sciences, Kyushu University, 6-10-1, Hakozaki, Fukuoka 812-8581, Japan

Hydrothermal systems play roles as natural equipment of concentrating metals around hydrothermal vents from rocks or sediments below the seafloor. To know pathways and scale of hydrothermal systems is very important information for effective exploration for mineral resources below the seafloor. Based on laboratory experiments, Sr isotope ratio in hydrothermal fluid gives us information of the solid phase that the hydrothermal fluid well reacts with below the seafloor prior to venting from the seafloor. In this study, we investigated Sr isotope ratios in hydrothermal fluids from 5 hydrothermal fields in the Okinawa Trough, and discuss diversity of the observed Sr ratios linking to styles of the hydrothermal fluid circulations controlled by the geologic setting.

The Sr isotope ratios in the hydrothermal fluids ranged from 0.7077 to 0.7121; Daiyon Yonaguni Knoll > Minami-Ensei Knoll > HAKUREI site (= seawater) > JADE site > Hatoma Knoll > Iheya North Knoll. The lowest Sr ratio in the Iheya North hydrothermal fluids is the closest to those of the volcanic rocks in the Okinawa Trough, which is slightly more radiogenic value than those of MORB. Most of the hydrothermal fluids showed much higher Sr ratios, and these high ratios would be attributed to interaction more significantly with sediments, since such high Sr ratio has been reported for the sediments in the Okinawa Trough (Asahara et al., 1995). The trend of the values may indicate distribution of the solid phase at high temperature that the hydrothermal fluids react with. This interpretation is consistent with the geochemical model proposed by Kawagucci (2015), which described distribution of organic matter in sediments around hydrothermal systems based on the carbon isotope ratio of methane in hydrothermal fluids. In this study, the model was also supported by Sr isotope ratio, not only by the carbon isotope ratio of methane.