# Extreme sulfur isotope fractionation in the seafloor hydrothermal deposit of the Okinawa Trough revealed by SIMS *in-situ* analysis

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Seafloor hydrothermal deposit is mainly composed of pyrite, sphalerite, galena and chalcopyrite with other sulfide/sulfate minerals. Sulfur in the main constituent sulfide minerals has been generally derived from mixture of magmatic and seawater sulfur [1,2]. Here, we report an extreme sulfur isotope fractionation in pyrite due to the bacterial sulfate reduction from the two modern seafloor hydrothermal deposits of the Iheya-North Knoll and Izena Hole in the Okinawa Trough revealed by the SIMS analysis.

We used drill core samples of the Iheya-North Knoll and Izena Hole obtained from the IODP Exp. 331 and cruise CK16-05. Based on the visual core descriptions, the sulfide-rich drill core sample beneath a sediment of the Izena Hole has a pyrite texture of framboid, colloform and euhedral along with maturation processes. Sulfur isotopes ($\delta^{34}$S) of the framboidal, colloform and euhedral pyrites are ranging from -38.91 to -2.84‰ (-17.28 ± 10.21‰), -13.63 to -2.96‰ (-7.36 ± 2.47‰) and -13.43 to -3.80‰ (-6.78 ± 2.69‰), respectively. The framboidal pyrite in the pumice above the subseafloor sulfide layer exhibits a narrow and light $\delta^{34}$S from -34.31 to -37.13‰. Moreover, the subseafloor sulfide layer was formed by replacement mineralization of a porous pumice layer based on the microscopic observations [3]. Similar sulfur isotope fractionation was observed at the flank of the mound in the Iheya-North Knoll whose framboidal and euhedral pyrite grains have $\delta^{34}$S ranging from -38.03 to -10.35‰ (-28.25 ± 9.84‰) and +0.36 to +3.86‰ (+2.85 ± 1.11‰). Combined with the recently reported extreme $\delta^{34}$S fractionation in the Spanish and American VMS deposits [4,5], replacement mineralization beneath a seafloor using framboidal pyrites derived from bacterial sulfate reduction plays a key role to form a large-scale seafloor hydrothermal deposit.

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