Mineralogical and Fe isotope correlations between Kuroko-type VMS deposits and a seafloor hydrothermal deposit in Okinawa Trough

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The CK16-05 cruise operated under SIP program drilled through a mound-type seafloor hydrothermal sulfide deposit in Izena Hole, Okinawa Trough down to 72.5 m below seafloor to understand internal structures of the deposit and evolution of ore mineralogy throughout hydrothermal activities. Petrographic investigation of the deposit has demonstrated that ore mineralogy changes from sphalerite and galena-rich in the shallow depth to pyrite and chalcopyrite-rich in the deep depth, similar to some volcanogenic massive sulphide (VMS) deposits, such as Matsumine deposit in the Hokuroku district, Japan [1]. In this study, we focused on variations in geochemical signatures of the seafloor hydrothermal deposit and their correlation with those in Kuroko-type VMS deposits.

The results of Fe isotope analysis show that the bulk sulfide samples at the shallow depth are slightly depleted in ^{56}Fe compared with those at the deep depth. The trend is also similar to that observed in Matsumine deposit, in which sphalerite and galena-rich ores are isotopically lighter than pyrite and chalcopyrite-rich ores. These results suggest that pyrite and chalcopyrite-rich ores at the deep depth were later formed near isotope equilibrium conditions with a high temperature hydrothermal fluid in both the seafloor hydrothermal deposit and Matsumine deposit. EPMA analysis showed that Fe content in sphalerite of the seafloor hydrothermal deposit was significantly different depending on depth, suggesting that hydrothermal fluids under different physiochemical conditions (e.g., fS_2, temperature) were involved in the formation of ores at the different depths.

[1] Otake *et al.*, *Goldschmidt 2018*.