Physical properties of rock samples of seafloor massive sulfide

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Geophysical surveys around submarine hydrothermal areas are conducted to investigate new seafloor mineral resources. However, the information related to the volume of metallic material cannot be directly obtained from the geophysical surveys. As one of ways to solve this problem, construction of an appropriate rock-physical model of target area is helpful to interpret the geophysical results. For development of a rock model in a submarine hydrothermal area, we carried out the fundamental research about various physical properties and mineral component of rock samples collected from two hydrothermal areas; the Izena hole and the Noho site at the Okinawa Trough, Japan. We discussed the correlation between physical and chemical parameters.
In this research, we measured electrical conductivity, porosity, density, natural remanent magnetization (NRM), and metal element content of rock samples. The electrical conductivity, with measurement under the various conductivity of pore water, was interpreted using the modified Archie's law (the parallel circuit model), and the surface conductivity and formation factor were determined. For porosity and density measurement, we used the buoyancy method. For NRM, we used the superconducting quantum interference device (SQUID) magnetometer. The metal composition ratio was measured with the X-ray fluorescence (XRF) analysis.

The rock samples including relatively large amount of conductive (> 25 wt. %) could not be explained by the simple parallel circuit model since the formation factor was unrealistic. We corrected the parallel circuit model in which the surface conductivity is a function of the pore-water conductivity. As a result, a positive correlation was found between the surface conductivity and Iron abundance ratio. Positive correlation was also observed between NRM and Iron. In conclusion, the rock model can include the metal abundance as a function of excess conductivity and NRM.

Keywords: seafloor massive sulfide ; Archie's law; electrical conductivity; models

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