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Diversity of seafloor massive sulfide ores in the Okinawa Trough

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The Okinawa Trough is one of exploration target areas for seafloor mineral resources around Japan, where eight active hydrothermal fields have been discovered. Since the Okinawa Trough is located in the continental margin, these hydrothermal systems develop within sediment layer. Subseafloor hydrothermal fluid flow within sediment layer may enhance accumulation of hydrothermal precipitates and preservation of hydrothermal ores, therefore large size sulfide ore deposits are expected to be discovered in the Okinawa Trough.

In 2011, two dive expeditions were conducted under framework of Taiga project, focusing on studies of seafloor hydrothermal ore deposits in the Okinawa Trough. NT11-15 expedition conducted in Augsut investigated Jade and Hakurei sites in the Izena Cauldron, and active sites in the Iheya North Knoll. NT11-20 expedition condcuted from September to October visited Minami-Ensei Knoll, Yoron Knoll, Izena Cauldron, Irabu Knoll and Hatoma Knoll. In this presentation, we will discuss diversity and commonality of mineralogy and geochemistry among hydrothermal ores collected from these active hydrothermal fields.

In some active hydrothermal fields in the Okinawa Trough, occurrrence of sulfide and sulfate deposits is seprately observed. Only sulfate precipitates were observed in chimney structures above the seafloor, while sulfide deposits were observed in mound structures buried in the seafloor. This signature could be attributed to phase separation of hydrothermal fluid just beneath the seafloor. Phase sepration generates two different types of (vapor-rich and brine-rich) hydrothermal fluid, which could be related with sulfate and sulfide mineralization.

Hydrothermal ore deposits in the Okinawa Trough are characterized as enrichment in Zn and Pb, which corresponds to dominant occurrence of sphalerite, wurtzite and galena. Among trace elements, enrichment in Ag is notable. Ag is mainly included in tetrahedrite being associated with replacement of As by Sb. These chemical signatures could be attributed to formation of hydrothermal ores at rather low temperature.

Keywords: hydrothermal activity, volcanic massive sulfide, seafloor hydrothermal ore, back-arc basin