Mineralogical and geochemical study of hydrothermal ores collected from the Hatoma Knoll in the southern Okinawa Trough

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Hydrothermal activity was located within the summit crater at the water depth of ~1500 m of the Hatoma Knoll in the southern Okinawa Trough. The activity is characterized by abundant sulfate (anhydrite and barite) mineralization associated with active venting of substantial Cl-depleted hydrothermal fluid up to 300 ºC, which strongly suggests extensive subseafloor phase separation. We collected hydrothermal sulfide/sulfate ores during dive expeditions employing manned submersible or ROV, and studied their mineralogical and geochemical features using XRD and EPMA. Based on the mineral assemblage and its texture, the hydrothermal ores can be classified into three types. Type I is fine-grained sulfide ore including active chimneys, that is characterized by dendritic texture of sulfides probably caused by quenching precipitation. Type II is sulfide dominant ore typically composed of abundant sulfide minerals of sphalerite, galena, and tetrahedrite. Some of Type II ores showed high Sb content in the tetrahedrite. Type III is barite dominant chimney, often associated with arsenic sulfide minerals. ESR (electron spin resonance) ages were determined for barite crystals in Type II and Type III ores. The ages of both ore types showed a similar range from almost zero to 7,000 yrs. On the other hand, we notice geographical distribution specific to the ore types. Whereas Type I and Type III ores and chimneys were distributed in the north and west sides of the central cone, Type II ores were mainly found as mound breccia or half-buried blocks in sediment in the south and east sides. These results suggest that diversity of ore types is attributed not to mineralization in different stages but to precipitation from different fluids which chemical composition is controlled by the subseafloor phase separation.