

Bathymetric survey and indicators of hydrothermal activity in the Amami Calderas using autonomous underwater vehicle

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1. Introduction

Amami Calderas are located on the volcanic front in the central Ryukyu Arc. Fe-Mn crusts of hydrothermal origin (Yokose et al., 2010, Gekkan Chikyu) and A Kuroko-type polymetallic sulfide ore enriched in Sb and Ag (Kumamoto University, 2012, Press Release) were dredged in the Amami Calderas. Although these dredged samples indicate the presence of hydrothermal activity, no direct evidence has not been obtained yet.

2. Method

Japan Coast Guard conducted high-resolution geophysical surveys with S/V *Takuyo* and AUV *Gondou* from 2013 to 2015 in the Amami Calderas. Large-scale bathymetry and water column data was acquired with hull-mounted EM710 and EM122 multibeam echo sounder (MBES) on S/V *Takuyo*. High-resolution bathymetry, sidescan sonar (SSS) imagery, and temperature data were obtained with Sonic2022 (400 kHz) MBES, EdgeTech2200M SSS (120 kHz) and SBE49 FastCAT CTD sensor on AUV *Gondou*, respectively. AUV was set to maintain a constant altitude of 50-70 m above the bottom.

3. Result

Plumes were detected as water column anomalies with MBES EM710 and EM122 at 4 sites in the Calderas at depths between 350 and 700 m. AUV survey were conducted at 3 sites and small depressions with width of several meters to dozens of meters were confirmed. Acoustic water column anomalies were also detected on SSS imagery in the 3 sites. Some plumes rises steeply from seafloor and others rises in smoke-shaped. Positive temperature anomalies were observed at plume-detected areas. Lineaments trending E-W or ENE-WSW are well-developed around these four sites and these north-facing and south-facing lineaments form graben structure.

4. Discussion

Plumes detected with ship MBES are considered to be bubble plumes associated with volcanic or hydrothermal activity, but some plumes in combination with positive temperature anomalies detected by AUV surveys can be interpreted as hydrothermal plumes. These hydrothermal systems in the Amami Calderas may be constrained by E-W or ENE-WSW trending faults which were probably formed by the rifting activity in the central Okinawa Trough, backarc basin of the Ryukyu Arc.

Keywords: high-resolution bathymetry, hydrothermal activity, autonomous underwater vehicle, Amami Calderas, central Ryukyu Arc