

Preliminary report of AUV URASHIMA dives at Tarama and Irabu hydrothermal fields

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We conducted four AUV URASHIMA dives at Tarama and Irabu Knolls in the Okinawa Trough to reveal the origin and extent of these hydrothermal systems and their geological and geophysical background. The structure, fluid geochemistry and associated ecosystem of hydrothermal systems are highly diverse and the diversity is constrained by the surrounding geological setting. The Okinawa Trough is located at back arc area of the Ryukyu arc-trench system and is considered to be in transitional stage from continental rifting to oceanic crust formation. Many hydrothermal fields have been recently discovered in the area and they are characterized by the influence of rich sediment supply both from arc and continent. In August 2014, we carried out two dives at Tarama Knoll and other two dives at Irabu Knoll during YK14-16 cruise. The survey objectives are 1) to conduct high-resolution, three dimensional mapping of two sites using multiple sensors equipped on the AUV, 2) to compare two sites of different host rocks and tectonic settings, and 3) to identify an unknown high-temperature vent site at the Tarama Knoll. The AUV was generally operated at constant altitude mode (alt.=100m). We succeeded to cover whole area of these two knolls, using multi beam echo-sounder, side-scan sonar, sub-bottom profiler, three-component magnetometer, CTD, ADCP, pH/ORP/turbidity sensors, and water sampling using 24-channel MINIMONE sampler. The Irabu Knoll is located within the back arc rift axis and consists of three topographic highs. Three hydrothermal vents were reported on the knoll in previous surveys and all hydrothermal systems are hosted by basaltic basement. In dive 181 and 184, we confirmed three known hydrothermal vents and revealed the surrounding detailed geology. Magnetic anomaly is extremely high in general, supporting the idea that the hydrothermal fields are hosted by fresh basalt and maybe by active magmatism. The Tarama Knoll is located about 20 miles west of the Irabu Knoll, at the arc-side terrace of the back arc rift. Previous ROV survey reported a low temperature shimmering hosted by rhyolitic rocks at the top of the knoll and the extent of turbid seawater at the southern slope of the knoll that may indicate an existence of unknown high temperature hydrothermal vent site. We covered the whole knoll in Dive 182 and 183. We detected strong plume anomaly at the eastern slope of the knoll by geochemical sensors. We also detected the plume ejection form the seafloor in water column records of multi beam echo sounder and side-scan sonar, leading the identification of exact point of new vent site.

Keywords: hydrothermalism, AUV, Okinawa Trough, seafloor morphology, magneti anomaly, hydrothermal plume