

Cruise Summary

1. Cruise Information

Cruise ID: YK12-05
Name of vessel: R/V Yokosuka
Title of the cruise: Submersible SHINKAI 6500 Dives (Okinawa Trough)
Chief scientist: Tada-nori Goto [Kyoto University]
Cruise period: April 23rd - May 8th, 2012
Ports of call: JAMSTEC Yokosuka pier – JAMSTEC Yokosuka pier
Research area: Okinawa Trough

i. Iheya North Area (Water Depth = 700m-1,700m)

Area surrounded by the following LAT/LON.

27°45.0'N 27°50.0'N

126°50.0'E 126°57.0'E

ii. Irabu knoll (Water Depth = 1,650m-2,000m)

Area surrounded by the following LAT/LON.

25°13.0'N 25°15.0'N

124°51.5'E 124°53.5'E

Purpose:

On the basis of project by MEXT, “Program of development of fundamental tools for advancing the availability of marine resources”, we conducted the research dive of submersible SHINKAI 6500. The main purposes of this cruise are summarized below:

Representative of the Science Party

Theme 1: Tatsuhiro Fukuba (University of Tokyo*) *current affiliation: MARITECH/JAMSTEC

Theme 2: Tada-nori Goto (Kyoto University)

Title of proposal

Theme 1: Research on exploration of seafloor hydrothermal activity by tracing the hot water plume with geochemical sensors

Theme 2: Geophysical exploration of seafloor massive sulfide off Okinawa area

2. Overview of the Observation

- 1) Research on exploration of seafloor hydrothermal activity by tracing the hot water plume with geochemical sensors

Geochemical survey operations had been conducted focusing on the hydrothermal activity in the Iheya-North Knoll and the Irabu Knoll area. For the dive 1299 and 1300, SHINKAI 6500 dived to the Iheya-North Knoll hydrothermal site for operational tests of chemical sensors, an in situ analyzers and water samplers mounted on the vehicle as a payload apparatus. As a result, all chemical sensors, in situ analyzers, and water samplers were worked correctly and geochemical anomalies on various chemical parameters such as pH, Mn, H₂S, ORP, CTD and turbidity were successfully observed in hydrothermal plumes. Hydrothermal site at the Irabu Knoll was explored using the SHINKAI 6500 with the payload sensors in detail during dive 1301 and 1302. Hydrothermal plume mapping was conducted during dive 1301 at the hydrothermal site that is located on the top of western knoll. At the northern caldera-like landform, we conducted hydrothermal site survey using 2 dives. As a result, hydrothermal active sites were successfully discovered based on a real-time data from pH sensor and Mn analyzer during the dives. Water samples were collected simultaneously during all survey operations.

- 2) Geophysical exploration of seafloor massive sulfide off Okinawa area

We have developed AUV-based controlled-source electromagnetic (CSEM) survey system which can be applied to exploration of seafloor massive sulfide. Our system can be attached to AUV “Urashima” and other various platforms, and allows us to image sub-seafloor resistivity structure with depth of several tens to hundreds meters. In this research cruise, we attached our CSEM instrument to the submersible SHINKAI 6500, and conducted the electromagnetic survey around the Iheya north knoll, located in the Okinawa Trough. In the Iheya north knoll, the hydrothermal activity is high at several mounds, and seafloor massive sulfide (SMS) deposits are observed on the seafloor. In addition, the borehole sampling and logging were carried out by D/V Chikyu, and the approximated geological structure (e.g., distribution of anhydrite and the underlying high-temperature fluid). In general, both the metallic deposits and high-temperature fluid indicate low resistivity. If the seafloor resistivity distribution derived by our survey system is obtained, we can discuss about the detailed distributions of SMS and subsurface fluid.

In this cruise, we carried out the experiment with two dive (#1297 and #1298) of SHINKAI 6500. We attached the transmitter for artificial electromagnetic signals to SHINKAI 6500. We also deployed and retrieved the six ocean-bottom electro-magnetometers (OBEM) as receivers. On the basis of preliminary analysis, the electromagnetic field transmitted from the submersible was successfully

received by the ocean bottom receivers in and around the hydrothermal area. Also, the receiver attached to the submersible itself found the low resistive seafloor near the hydrothermal mounds. The data will give us information about the mapping of seafloor and sub-seafloor resistivity distribution.