

Cruise Summary

1. Cruise Information

- Cruise number: NT09-17, Leg 1
- Name of Vessel: R/V Natsushima; ROV Hyper-Dolphin
- Title of the cruise: Okinawa Trough
- Chief Scientist: Shigeki Matsunaga (The University of Tokyo)
- Representatives of the science party: Hidenori Kumagai (JAMSTEC), who could not attend the cruise; Kousaku Arai (National Institute of Advanced Industrial Science and Technology, AIST)
- Cruise period: September 26, 2009-October 3, 2009
- Ports of call: Hakata (departure) - Naha (arrival)
- Research area: Central part of Tokara Archipelago and Miyako Sea-knoll

2. Overview of the Observation

(1) Analysis of invertebrates including sponges inhabiting on the sea knoll around Tokara Archipelago as the cell-biological and biochemical resources

Marine invertebrates as represented by sponges, which inhabit at depths where collection by scuba diving is impossible was collected by Hyper dolphin.

The collected specimens were used to isolate symbiotic and associated microorganisms. They were used to establish metagenomic library as well as culture cell lines. In Oshima-shinsono and Miyakonone, the benthic invertebrates were observed using high-vision camera and representative specimens were collected by the vessel. The samples were processed on board for isolation of microorganisms. Sponge cells were dissociated and fractionated for the establishment of metagenomic library. Also sponges were preserved to study the taxonomy and the remaining portions were frozen and brought to the library for chemical study.

(2) Ultra-high resolution bathymetric and volcanic-activity mapping on gigantic seafloor caldera

Distribution of gigantic calderas on the Japan Arc is limited in its both ends. The southern sequence may extend from Aso volcano to the area western off Amami-Oshima; the potential caldera is centered as 28°30'N, 128°38'E: hereafter Amami-caldera. The caldera volcano is long-lived, up to a few tens of million years, which infers that the hydrothermal activity has also long lives in such volcanoes. Recent development of acoustic imaging enables us to detect hydrothermal plumes. In this study, acoustic hydrothermal mapping coupled with geochemical and microbiological sensors was carried out in and around Takarajima caldera where some caldera associated hydrothermal activities are inferred. High-resolution bathymetric survey was also carried out along the volcanic front down to the potential Amami-caldera.

Two dive surveys of Hyper-Dolphin were carried out; one was done on the post-caldera cone within the Takarajima caldera (1.5 hours), the other was on the southern flank of Takarajima-caldera (2.5 hours). In the dives, sea-bed observation and sensor mapping were tried. On the both sites, the seafloor were covered by the poorly-sorted, light colored, cemented sediments. One push-core was sampled at one of the peaks on the post-caldera cone inside of the caldera. No active hydrothermal activities were visually found in and around Takarajima caldera during the dives. The fairly cemented gravels

indicate inactive conditions of the volcano at least near the landing points. Although no significant anomalies were recorded either by chemical or by microbiological sensors, very weak reflection was occasionally recorded above the post-caldera cone during the survey. Detailed analyses of bathymetry, sensor and acoustic data will be done later.

(3) Marine geology and tectonics in the area between the Okinawa and Miyako Islands

The Ryukyu Island Arc extends from Kyushu to Taiwan, a distance of 1200 km, along the Ryukyu Trench where the Philippine Sea Plate is subducting beneath the Eurasian Plate. The Okinawa Trough, a back arc basin, formed behind the Ryukyu Island Arc in the late Pliocene to early Pleistocene. The formation of the Okinawa Trough is strongly related with tectonics of the Ryukyu Island Arc and assigns to the complicate uplift and/or subsidence on the Islands.

Bathymetric surveys and Hyper-dolphin submersible observation studies were carried out on NT09-17 cruise to clarify the detailed geology and tectonics of the Miyako-Sone area. The ROV track starting from cliff of Miyako Saddle about 520 m in water depth and up to the flat floor of Miyako-Sone about 121 m in water depth.

We found the carbonate outcrops that have formed steep cliffs and relatively flat sea floor was covered by sandy sediment. The mudstone correlated with such as the Pliocene Shimajiri Formation (and other oldest Formation) is not found in Dive #1060 (above 500 m in water depth). Top of the Miyako-Sone possibly shallower than 140 m in water depth cropped out at last inter-glacial stage and karstified the carbonate rocks should be occur in this stage. The results of submersible surveys show the possibility of subsidence on the study area. Detailed sample analyses include dating are let us know the geological subsidence history on the Miyako-Sone area.