NT14-21 Cruise summary

1. Cruise information

Cruise ID	NT14-21
Research vessel	R/V Natsushima
Title of the cruise	In situ chemical sensor and microbiological study of the Bayonnaise Knoll and Okinawa trough
Chief scientist	Blair Thornton (Institute of Industrial Science, The University of Tokyo)
Cruise period	11th December 2014 to 23rd December 2014 (Yokosuka Sumitomo ~ Naha)
Survey sites	Bayonnaise Knoll and Okinawa trough
Title of Proposals	
Proposal 1	Application of spectroscopic chemical sensors to survey hydrothermal vent deposits, *Blair Thornton (Institute of Industrial Science, The University of Tokyo)*
Proposal 2	Host-symbiont recognition mechanisms in the chemosynthetic ecosystem: functional analysis of abundantly expressed lectin-like protein in host animal, *Satoshi Nakagawa (Graduate School of Agriculture, Kyoto University)*
Proposal 3	Time-resolved in situ colonization experiments of basalt at seafloor to understand a deep biosphere ecosystem, *Satoshi Mitsunobu (Institute for Environmental Sciences, University of Shizuoka)*

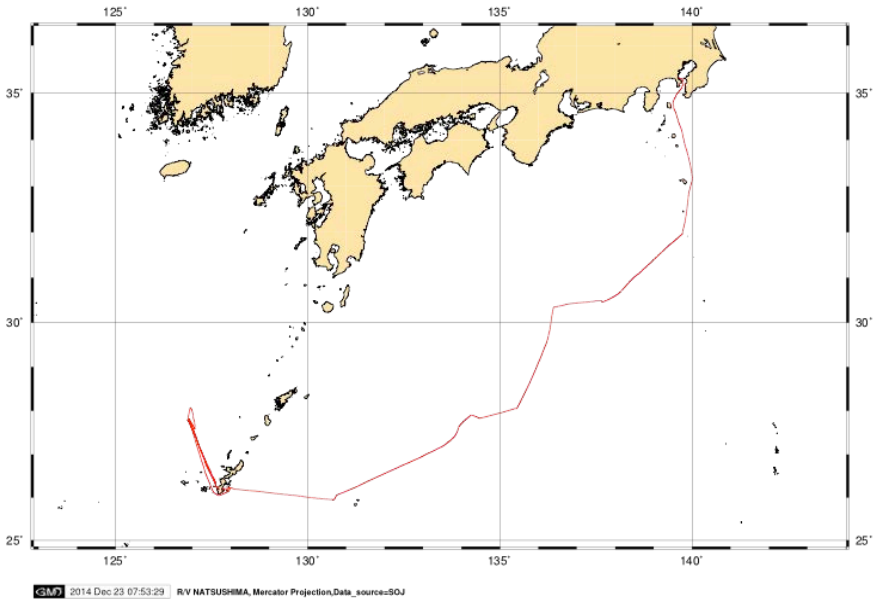

Figure 1 Ship's track during NT14-21

2. Overview of the observation

A total of 3 out of a planned 8 dives were performed during this cruise. The first dive (HPD#1757) was performed at the Bayonnaise Knoll in the Izu-Ogasawara arc under Proposal 3. After a failed dive attempt (HPD#1758), the second dive (HPD#1759) was performed at the Iheya North Field in the Okinawa Trough under Proposal 1. The third and final dive (HPD#1760) was performed in the same location, under Proposal 2. The remaining dives were cancelled due to bad weather conditions.

The main objective of proposal 1 is to investigate the application of laser-induced plasmas as a method to perform in situ, multi-element chemical analysis of the composition of liquids and solid deposits on the seafloor. During this cruise, we deployed an in situ sensor called the ChemiCam and performed multi-element chemical analysis of freshly exposed hydrothermal deposits after removal of the weathered layer using a deep-sea grinder. Well-resolved spectra were obtained from several locations around the base and the top of a hydrothermal mound during dive #1759 and sampling was performed. During #1760, measurements of seawater composition were successfully performed using ChemiCam with an integrated CT sensor to use when post-processing the data. In our future work, we will focus on further improving the operational efficiency of ChemiCam and will verify the results of in situ measurements with samples obtained during this cruise.

The major research focus of proposal 2 is the study of symbiosis in deep-sea vents. During this cruise, fluids, animals, and chimney structures were successfully collected, and we prepared samples for multi-omics analyses including glycomic analysis. For comparison, we will isolate and characterize free-living microorganisms from hydrothermal samples, i.e. fluids and chimney structures. During dive #1759 we collected hydrothermal samples, i.e. vent animals (mainly squat crabs), fluids (diluted vent fluids), and chimney structures. Samples were prepared for shore-based microbiological and biogeochemical analyses. During dive #1760 was done on December 22. Like dive #1759, we collected samples, i.e. vent animals (squat crabs and mussels), fluids, and chimney structures. Samples were prepared for shore-based microbiological and biogeochemical analyses. Future work using these samples will focus on culture–independent molecular ecological surveys and culture-dependent ecological surveys.

The main objective of proposal 3 is to understand a litho-biosphere ecosystem beneath sea-floor supported by oxidation of ferrous iron (Fe(II)) in ocean crust, basalt. Accordingly, we perform “time-resolved in situ colonization experiment with fresh basalt” to investigate biological alteration process of the basalt rock and microbial community related to the alteration. In this cruise, (i) we recovered the colonization samples set in hydrothermal area in Bayonnaise knoll in NT14-06 cruise, and (ii) we also collected seawater and sediment samples on the setting points. As the future works, we examine microbial community and chemical species of iron in the samples to reveal the mechanism on microbial basaltic iron oxidation.