

Cruise Report

KR15-17
R/V Kairei & ROV Kaiko Mrk IV

SIP Project for Development of New-Generation Research Protocol
for Submarine Resources:

Protocol development for environmental assessment of hydrothermal vent
area.

Noho site & Iheya North Ridge
Okinawa Through

November 9 to 15, 2015

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1. Cruise Information

1.1. Title of the cruise

SIP Project for Development of New-Generation Research Protocol for Submarine Resources: Protocol development for environmental assessment of hydrothermal vent area.

1.2. Cruise number

KR15-17

1.3. Name of vessel and submersible vehicle

R/V Kairei and ROV Kaiko Mk IV

1.4. Title of the proposal

Monitoring the hydrothermal ecosystem and assessment of effects of drilling activity

1.5. Cruise period

9 to 15 November 2015

1.6. Ports of call

Departure : Naha, Okinawa

Arrival : Naha, Okinawa

1.7. Research area

Okinawa Trough

Iheya North Ridge

27° 45.0'N, 27° 54.0'N, 126° 52.0'E, 127° 10.0'E

Water depth: 850-1500m

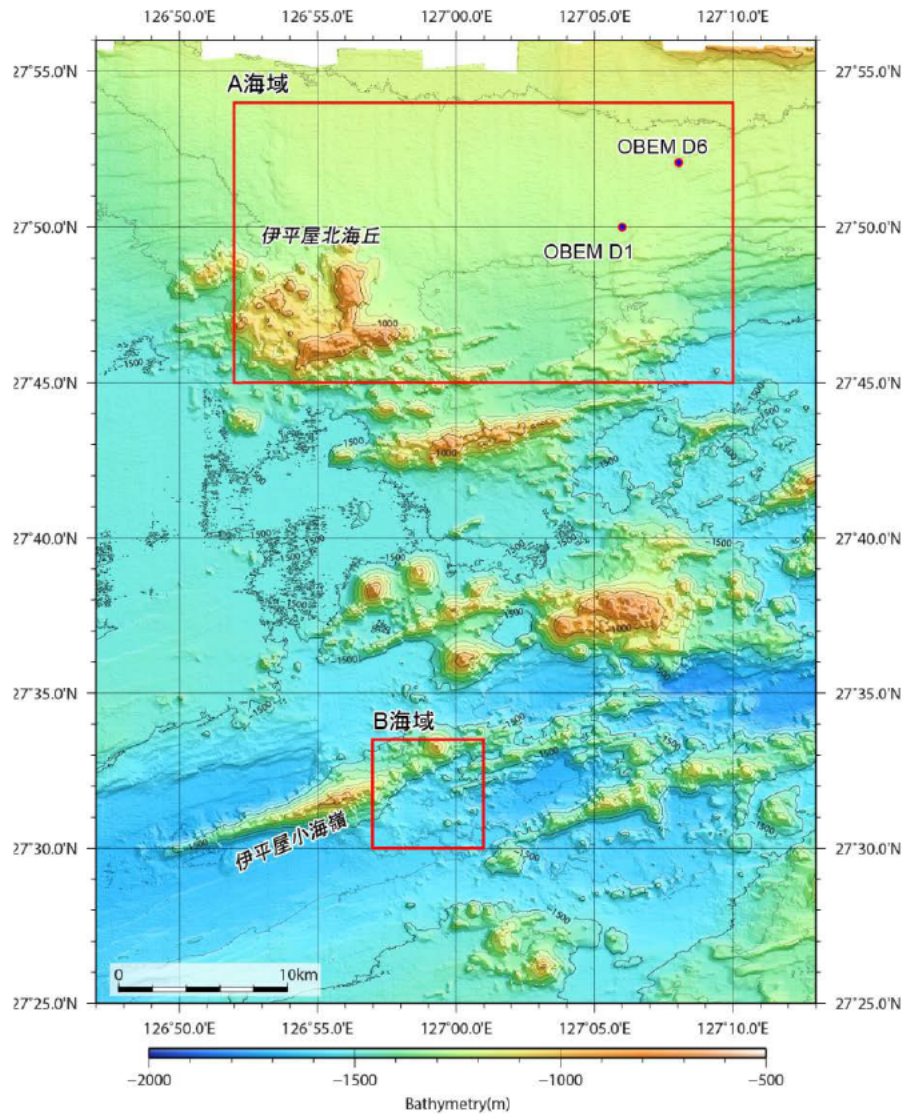
Noho site

27° 30.0'N, 27° 33.5'N, 126° 57.0'E, 127° 01.0'E

Water depth: 1500-1600m

2. Research map

Location of research area in Okinawa Trough



3. Researchers

Chief Scientist / RePresentative of Science Party:

Hiroyuki YAMAMOTO JAMSTEC

Onboard Researchers:

Takuro NUNOURA JAMSTEC

Tomo KITAHASHI JAMSTEC

Masashi TSUCHIYA JAMSTEC

Tetsuya MIWA JAMSTEC

Tatsuhiko FUKUBA JAMSTEC

Tatsuo FUKUHARA JAMSTEC

Hirokazu ITOU JAMSTEC

Chong CHEN JAMSTEC

Jin SUN Hong Kong University of Science and Technology

Masanobu KAWACHI NIES

Hiroshi KOSHIKAWA NIES

Naoki FURUICHI NIES

Shun Tsuboi NIES

Shigeshi FUCHIDA NIES

Kiminori SHITASHIMA Kyushu University

Yukako YAMADA Kyushu University

Naoya EBINA Kyushu University

Technical supporting staff:

Hisanori Iwamoto Nippon Marine Engineering

Shinsuke Toyoda Marine Works Japan

4. Observation / Investigation

4.1 Overview

This research cruise is planned for environmental assessments of hydrothermal vent field in Iheya North Knoll and Noho site of Okinawa Trough. The Iheya North Knoll has been used for drilling expeditions, the IODP expedition Ex331 in 2010, the SIP project CK14-04 in 2014, and next expedition will be planed in 2016. The Noho site is a new target area for 2016 drilling expedition by SIP project. The seafloor destruction by drilling expedition may impact a habitat condition of seafloor biome. The community changing process has been studied in several cases of volcanic eruption and drilling expedition. The practical environmental assessment protocol for deep-sea ecosystems including hydrothermal vent field is yet an under-developing issue, even in scientific research field. This cruise aims for collecting the data set of base-line condition in deep-sea hydrothermal vent field to examine the environmental assessment protocol, and to study the disturbance of drilling campaign for seafloor biome.

Habitat mapping is a basic approach to understand a situation of community and a linkage between habitat condition and distribution pattern of organisms. The data on seafloor bathymetry, seabed classification, benthic fauna, physicochemical conditions have been collected in this deep-sea expedition. The video survey of seafloor using downward-facing video camera was conducted to analyze the animal distribution and population density. Physical and chemical properties in surrounding area of hydrothermal system are data to determine the extent of chemosynthesis-based ecosystem. In this cruise, several types of physicochemical sensors were examined. In this cruise two approaches by morphological identification using image data and metagenomic analysis for meiofauna/microbial communities. Furthermore, the studies on assessment method of photosynthetic community using indigenous phytoplankton species, and the life cycle observation of benthic animals for galatheid *Shinkaia crosnieri* and *Bathymodiolus* mussels were conducted.

5. Preliminary Research results

5.1. Survey of environmental condition and biological diversity

5.1.1. Video mapping and chemical sensors

T. Fukuba, T. Miwa, Y. Yamamda, K. Shitashima, H. Yamamoto

The video mapping was conducted in the belt transect located at the Noho site, using a downward camera system installed with digital hi-vision video camera which mounted on the ROV. The videos image will be analyzed at the laboratory of JAMSTEC.

In order to investigate the biogeochemical condition in benthopelagic zone of hydrothermal environments, Hybrid CO₂ Sensor (HCS), IFET-pH sensor, and *in situ* ATP sensor had installed on Kaiko Mk-IV. All sensors detected biochemical signature of hydrothermal activity within the dives.

5.1.2. Free-fall observatory

T. Miwa, H. Itou, T. Fukuhara, N. Furuichi

Free-fall and standalone platform for seafloor observation system, EDOKKO, was deployed at Noho site. During 48hr observation, time laps video record and physical properties of benthopleagic zone were recoded, and then recovered from the seafloor by acoustic release system.

Vertical Microstructure Profiler (VMP-X) is a full-depth profiling system to measure the turbulent microstructure. In this cruise, VMP-X could measure the turbulent structure, but accidentally ballast release was triggered in mid-water depth and only measured within the surface zone.

The Fast Repetition Rate Fluorometer (FRRF) is an *in situ* sensor for determination of potential activity of photosynthesis. In this cruise, FRRF was operated by the cable winch, and determined from surface to 200m-depth layer at Iheya North Knoll.

5.1.3. Sediment core

T. Kitahashi, M. Tsuchiya, T. Nunoura, M. Hirai, N. Ebina, S. Fuchida

The H-type push core sampler was used in this cruise. The sediment core was collected at 3 sites of the transect line located in the Noho site. At each site, the core sample was collected from three adjoining points. The core sample was divided in

onboard laboratory, and preserved for examination of chemical properties, meiofauna, and microorganism. The chimney sample was collected at Noho site.

5.1.4. Water sampling

M. Kawachi, H. Koshikawa, S. Tsuboi, S. Fuchida, N. Furuichi

The water samples were collected by operation of CTD rosetta sampling system (12L x 12 Niskin bottles) from 10 to 1,150m depths, bucket sampling for the surface water at the Iheya North Knoll, and Niskin bottles equipped on the ROV for the bottom water at the Noho site in November 12, 2015. In total, 17 depth layers of water samples were collected. In the Noho site, the surface water samples were collected with bucket sampling, and the bottom water samples were collected with Niskin bottles equipped on the ROV in November 13, 2015. The water samples were divided into each sample treatment and preserved for the studies on environmental parameters and phytoplankton community. Water samples from chlorophyll maximum depth in Iheya North Knoll and the surface water samples from Noho site were used for the onboard incubation experiment.

5.1.5. Benthos

C. Chen, J. Sun

During this cruise, representative benthic megafauna species of the Okinawa Trough vent fields including the galatheid squat lobster *Shinkaia crosnieri* and the deep-sea mussel *Bathymodiolus platifrons* were collected from hydrothermal venting sites at the Noho site using a slurp gun. Specimens were successfully recovered in living state, and then immediately transferred to cold condition (4 °C) for long-term rearing. These specimens will be transferred to JAMSTEC alive for further study on their life cycle.

6. Acknowledgement

We are grateful thank to all crew of “R/V Kairei” for the safe navigation, and great thanks are due to the “ROV Kaiko Mrk IV” operation team for the sampling and observation of deep-sea hydrothermal field.

7. Notice on Using

Notice on using: Insert the following notice to users regarding the data and samples obtained.

This cruise report is a preliminary documentation as of the end of the cruise. This report may not be corrected even if changes on contents (i.e. taxonomic classifications) may be found after its publication. This report may also be changed without notice. Data on this cruise report may be raw or unprocessed. If you are going to use or refer to the data written on this report, please ask the Chief Scientist for latest information. Users of data or results on this cruise report are requested to submit their results to the Data Management Group of JAMSTEC.

Appendix:

Research log

ROV payload and deployment

Dive #	-	KAIKO 675	KAIKO676	KAIKO677
site	Iheya North	Noho site	Noho site	Noho site
	-	ROV	ROV	ROV
Deployment:				
Edokko		AM: deploy		AM: recovery
VMP-X	1 cast			
CTD-DO-water sampling	2 casts (0-200m, 200-bottom)			
FRRF	1 cast (0-200m)			
ROV: payload				
downward camera		+	+	+
Hybrid-pH-CO2 (HCS)		+	+	+
ATP		+	+	+
ISFET pH/pCO2/ORP		+	+	+
radon		+	+	+
5 L Niskin		2	2	2
vacum sampler		1	1	1
syringe sampler		1	1	1
ROV: basket				
push core		9	9	9
sample box		1	1	1
scoop		1	1	1

Member of Research vessel and Deep-submersible

R/V KAIREI Crew

Captain	TAKAFUMI AOKI
Chief Officer	TAKAAKI SHISHIKURA
2nd Officer	TAKESHI MURAMATSU
3rd Officer	KEIJI ITAHASHI
Chief Engineer	TADASHI ABE
1st Engineer	TAKASHI OTA
2nd Engineer	NAOHITO TADOOKA
3rd Engineer	KATSUTO YAMAGUCHI
Chief Electronics Operator	TAKEHITO HATTORI
2nd Electronics Operator	YUKA MORIWAKI
3rd Electronics Operator	EMI SAWAYANAGI
Boat Swain	KAZUO ABE
Able Seaman	YUKITO ISHII
Able Seaman	NAOKI IWASAKI
Able Seaman	HIDEAKI NAKATA
Sailor	SHO SUZUKI
Sailor	TOSHIYA SAGA
Sailor	KOHEI SATO
No.1 Oiler	TOSHIKAZU IKEDA
Oiler	SOTA MISAGO
Oiler	KEIYA TANIGUCHI
Assistant Oiler	DAIKI SATO
Assistant Oiler	HIROMU FUKUDA
Chief Steward	TOYONORI SHIRAIISHI
Steward	MASAO HOSOYA
Steward	MASANAO KUNITA
Steward	KAZUMA SONODA
Steward	MAO KIKUCHI

KAIKO Mk-IV operating team

Operation Manager

ATSUMORI MIURA

1st ROV Operator

HOMARE WAKAMATSU

2nd ROV Operator

JUNYA NIIKURA

2nd ROV Operator

KIYOSHI TAKISHITA

2nd ROV Operator

TETSUYA ISHITSUKA

2nd ROV Operator

SHOTA IHARA

3rd ROV Operator

TAKUMA GOTO

3rd ROV Operator

KENTARO MURASAKI

Shipboard Log of R/V Kairei

Date and time log

2015/11/9 TOMARI FUTO No.8 berth (26-13.5N, 127-40.4E)

Weather: Fine but cloudy / Wind direction: West / Wind force: 3 / Wave scale: 1 /
Swell scale: 0 / Visibility: 8 miles (12:00 JST)

08:00 onboard
09:00-09:10 scientists, crew, and KAIKO team meeting
09:10-09:50 carried out education and training for scientist
09:55-10:20 KAIKO Mk-IV briefing
15:00 left NAHA, proceeded to NAGO BAY
18:00 arrived at NAGO BAY

2015/11/10 NAGO BAY (26-34.7N, 127-54.9E)

Weather: Overcast / Wind direction: NNE / Wind force: 5 / Wave scale: 2 /
Swell scale: 1 / Visibility: 5 miles (12:00 JST)

15:00-15:15 scientists meeting
17:30 transit to research area (OBEM site D6)

2015/11/11 northwest off OKINAWA (27-48.5N, 126-54.4E)

Weather: Fine but cloudy / Wind direction: NNE / Wind force: 4 / Wave scale: 3 /
Swell scale: 3 / Visibility: 8 miles (12:00 JST)

06:38-09:10 OBEM recovery (site D6, D1)
05:07 released XBT
10:30-10:45 CTD survey
11:04-12:05 FRRF survey
13:05-13:29 CTD survey
14:02-15:28 CTD survey
15:36-16:08 current profiler survey
18:14 released XBT
19:00-19:25 pre-dive MBES survey

2015/11/12 northwest off OKINAWA (27-31.0N, 126-59.0E)

Weather: Overcast / Wind direction: ENE / Wind force: 3 / Wave scale: 2 /

Swell scale: 1 / Visibility: 8 miles (12:00 JST)

06:24 deploy EDOKKO No.1
08:33 launching KAIKO (KAIKO#675Dive)
10:09 KAIKO landing (1,562m)
14:50 KAIKO leave the bottom (1,593m)
16:07 KAIKO come up to the surface
16:59-17:57 position calibration for EDOKKO No.1

2015/11/13 northwest off OKINAWA (27-31.5N, 126-59.0E)

Weather: Cloudy / Wind direction: SE / Wind force: 4 / Wave scale: 2 /

Swell scale: 1 / Visibility: 8 miles (12:00 JST)

08:33 launching KAIKO (KAIKO#676Dive)
10:08 KAIKO landing (1,590m)
14:54 KAIKO leave the bottom (1,555m)
16:16 KAIKO come up to the surface

2015/11/14 northwest off OKINAWA (27-30.9N, 126-58.9E)

Weather: Cloudy / Wind direction: NNW / Wind force: 4 / Wave scale: 2 /

Swell scale: 1 / Visibility: 8 mile (12:00 JST)

05:53-06:49 recover EDOKKO No.1
09:03 launching KAIKO (KAIKO#677Dive)
10:44 KAIKO landing (1,562m)
13:11 KAIKO leave the bottom (1,559m)
14:28 KAIKO come up to the surface

2015/11/15 Arrive at TOMARI FUTO, OKINAWA

09:00 arrived at TOMARI FUTO No.8 berth
11:30 disembarked KAIREI
 finished KR15-17 cruise