doi : 10.17596/0002767

KAIREI Cruise Report

KR16-15

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

Protocol development for environmental assessment of hydrothermal vent area.

Nov 9, 2016 – Nov 16, 2016

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

Contents

1. Cruise Information

● **Cruise ID**

KR16-15

● **Name of vessel**

R/V Kairei

● **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.

● **Title of the proposal**

Monitoring the hydrothermal ecosystem and assessment of effects of drilling activity

● **Cruise period**

9 to 16 November 2016

● **Ports of call**

Departure : Naha, Okinawa

Arrival : Naha, Okinawa

● **Research area**

Okinawa Trough

Iheya North Knoll

27° 45.0’N、27° 54.0’N、126° 52.0’E、127° 10.0’E

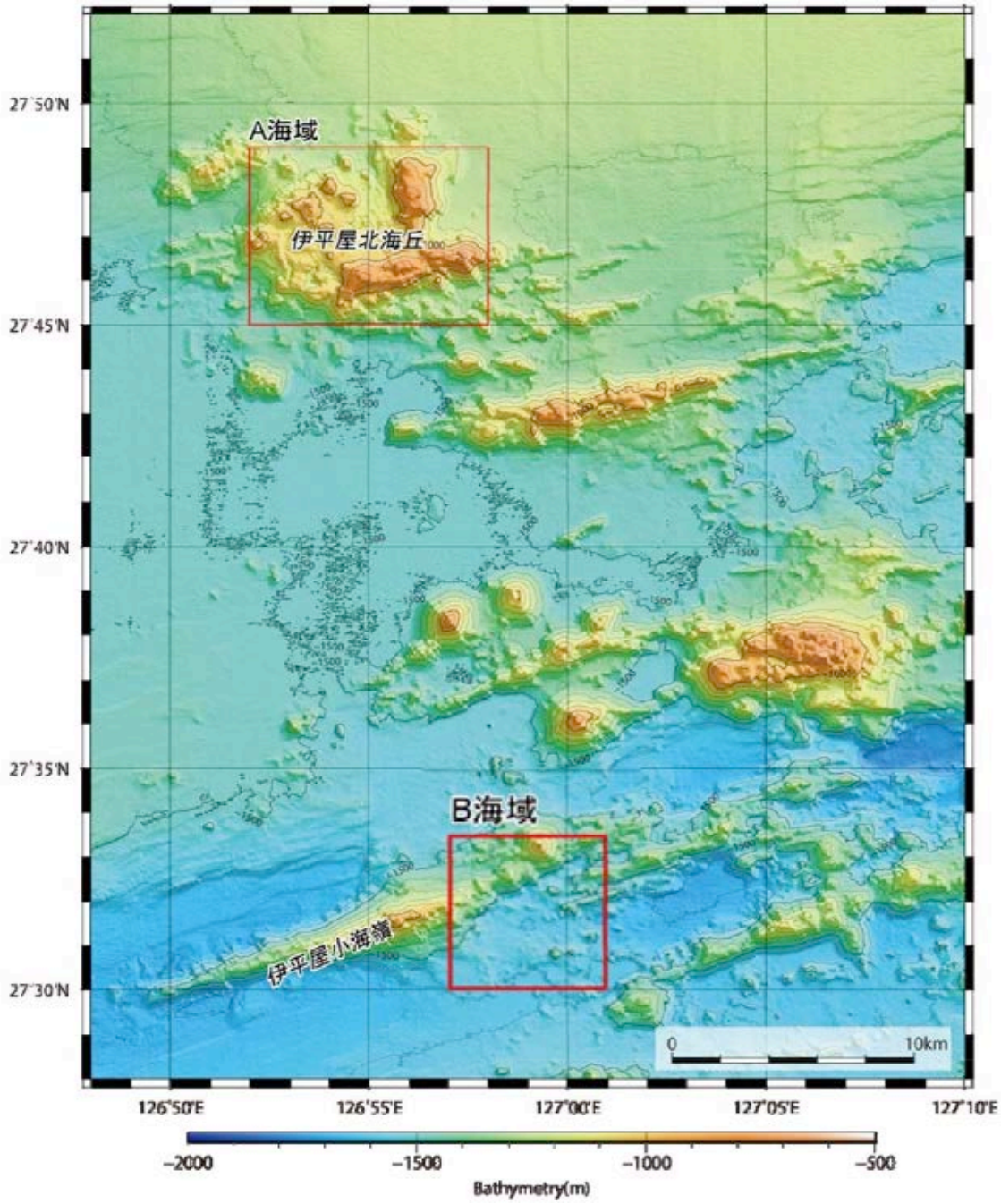
Water depth: 850-1500m

Iheya Ridge Noho site

27° 30.0’N、27° 33.5’N、126° 57.0’E、127° 01.0’E

Water depth: 1500-1600m

● **Research map**



Location of research area in Okinawa Trough

A: Iheya North Knoll, B: Iheya Ridge

2. Researchers

● Chief Scientist

Hiroyuki YAMAMOTO	JAMSTEC

● Representative of the science party

Eiichi Kikawa	JAMSTEC

● Science party

Yasuo FURUSHIMA	JAMSTEC
Tomo KITAHASHI	JAMSTEC
Masashi TSUCHIYA	JAMSTEC
Tetsuya MIWA	JAMSTEC
Tatsuhiro FUKUBA	JAMSTEC
Tatsuo FUKUHARA	JAMSTEC
Hiroyuki KASHIMA	JAMSTEC
Yoko UNOSAWA	JAMSTEC
Kyoka MAEDA	JAMSTEC
Motohiro SIMANAGA	Kumamoto University
Futa NAKASUGI	Kumamoto University

3. Observation

● Observation

This research cruise is planned for development of tools on environmental assessments using hydrothermal vent fields in Iheya North Knoll and Noho site of Iheya Ridge, Okinawa Trough. The Iheya North Knoll has been used for drilling expeditions, the IODP expedition Ex331 of 2010, the SIP project CK14-04 of 2014, and CK16-01 of 2016. The Noho site is an additional target area for 2016 drilling expedition by SIP project. The seafloor destruction by drilling expedition may impact a habitat condition of seafloor biome. The changing phenomena of seafloor communities have been studied in several cases of volcanic eruption and drilling expedition. The practical environmental assessment protocol for deep-sea ecosystems is yet an issue of development, even in scientific research field because of hard access zone. This cruise aims for collecting the data set of base-line condition in deep-sea hydrothermal vent field to examine the methods consists of environmental assessment protocol, and to study impact and disturbance of anthropogenic activities 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 a series of deep-sea expeditions by JAMSTEC. The video survey of seafloor using downward-facing camera induced for mapping is advantageous 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. Two approaches by morphological identification using image data and metagenomic analysis for mieofauna/microbial communities were carried out in post-cruise research for methodological study on marine EIA.

○ Research Schedule

Research schedule implemted on KR16-15 cruise

	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov
KAIKO Mk IV Dive #	**no dive**	**KAIKO 711**	**KAIKO 712**	**KAIKO 713**	**KAIKO 714**	**cancel**
site	Noho & Iheya North	Noho site	Iheya North	Noho site	Noho site	Iheya North
Deployment & Recovery						
Edokko Mark 1	deploy 2 at Iheya North	-	-	-	recovery 2	-
VMP-X	1 cast at Iheya North	1 cast	1 cast	1 cast	-	-
CTD-DO-water sampling	3 casts at Iheya North and Noho site	-	-	-	-	-
FRRF	1 cast at Iheya North	-	-	-	-	-
EMES	-	-	recovery & deploy	-	-	-
SHAF & POODLE	-	recovery	-	-	-	-
ROV payloard plan						
downward video camera	-	2	2	2	2	2
Hybrid-pH-CO2 (HCS)	-	+	+	+	+	+
ATP	-	+	+	+	-	-
5 L Niskin	-	2	2	2	2	2
vacum sampler	-	-	+	-	-	-
syringe sampler	-	+	+	+	-	-
ROV samplee basket setting						
push core sampler	-	6	-	6	6	3
RMT probe	-	1 (400C)	1 (150C)	1 (150C)	1 (150C)	1 (150C)
canister: 6 bottle, electric movemet	-	-	+	-	-	+
water sampler:syringe type	-	-	3	6	6	3

○ **Research information**

Habitat mapping

T. Fukuba, K. Maeda, T. Miwa

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 CO_2 Sensor (HCS), and *in situ* ATP sensor had installed on Kaiko Mk-IV. All sensors could determine biochemical signatures of physiological activity in hydrothermal vent fields.

Meiofauna

T. Kitahashi, M. Tsuchiya, K. Nakasugi, M. Shimanaga,

The H-type push core sampler was used in this cruise. The sediment core was collected at 3 sites located in the Noho site. At each site, the core sample was collected from three adjoining points of the drilling expedition by CK16-01. The core sample was divided at onboard laboratory, and preserved for examination of chemical properties, meiofauna, and microorganism. The specimens of epifauna on vent surface were collected by vacuum-sampler (electric slurp-gun type) installed in ROV.

Microbiome

Y. Tada, H. Kashima

The water samples were collected by CTD rosetta sampling system (12L x 12 Niskin bottles) from surface to bottom, and Niskin bottles installed in the ROV for the bottom water at hydrothermal vent sites of the Noho site and the Iheya North Knoll. The water samples were divided into each sample treatment and preserved for the studies on environmental parameters and microbial community.

Observatories

T. Miwa, T. Fukuhara, Y. Furushima

Free-fall and standalone platform for seafloor observation system, EDOKKO Mark-1,

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.

Recovery and deployment of in situ devices

H. Kashima, Y. Masaki (CK16-01), H. Yamamoto

The determination devices for subseafloor physical parameters, SAHF (Stand Alone Heat Flow) and POODLE (Pressure and "Ondo" On Deep-seafloorfor Long-term monitoring Equipment) which were deployed by ROV of CK16-01, were recovered at the site of Noho site. In situ device for microbial culture, EMES (Electrotrophic Microbes Enrichment System) which were deployed by Shinkai 6500 of YK16-11Dive#1470) was recovered and replaced new EMES at the NBC mound of Iheya North Knoll.

Information gathering for outreach

Y. Unosawa, Y. Furushima, H. Yamamoto

The SIP project and JAMSTEC would readily perform an outreach of research activity, especially on research cruise using deep-sea submersibles. In this cruise, information gathering has been carried out to make image materials for outreach.

4. Notice on Using

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.

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.

Appendix:

Shipboard Log of R/V Kairei

Date	Local Time	Note
09-Nov-16	08:00	Scientists onboard.
	09:00	Let go all shore lines & left NAHA for NAGO WAN due to rough sea
	10:00-10:30	Carried out education & traning for scientists.
	10:30-10:40	Ship tour for scientists.
	11:00-11:20	Carried out education(KAIKO) for scientists.
	13:00	Arrived at NAGO WAN.
	16:40-17:00	Konpira ceremony
	18:30-19:00	Scientist meeting.
10-Nov-16	03:00	Procceeded to Research area (OKINAWA Trough Noho Site)
	08:45	Arrived at Research area (OKINAWA Trough Noho Site)
	08:50	Released XBT at (27-30.9486N, 126-58.9530E)
	9:22-10:30	Carried out CTD operation
	10:35	Procceeded to Next research area (OKINAWA Trough Iheya North koll)
	11:50	Arrived at Research area (OKINAWA Trough Iheya North koll)
	12:21	Deployed EDOKKO No.1 (HSG-1)
	12:30	Deployed EDOKKO No.1 (HSG-2)
	12:46-13:42	Carried out VMP-X operation
	14:01-15:05	Carried out CTD-CMS operation (Deep bottom cast)
	15:23-16:02	Carried out FRRF operation
	16:15-17:01	Carried out CTD-CMS operation (Shallow cast, Depth=500m)
	17:25-18:10	Carried out calibration of EDOKKO (HSG-1 & HSG-2)
	18:30-19:00	Scientist meeting.
	19:20	Arrived at research area (OKINAWA Trough Noho Site)
	19:25-19:32	Carried out MBES mapping survey

11-Nov-16 06:00 Released XCTD at 27-30.8677N, 126-59.0978E

6:25-7:58 Carried out VMP-X operation

09:17 Hoisted up 'KAIKO Mk-IV'

09:23 Launched 'KAIKO Mk-IV' then it dove & Com'ced her operation #711(22)

11:08 KAIKO Mk-IV' landed on the sea bottom (D=1,544m)

14:12 KAIKO Mk-IV' left the sea bottom (D=1,556m)

15:30 Hoisted up 'KAIKO Mk-IV'

15:41 Recoverd 'KAIKO Mk-IV' & finished her operation

16:15 Proceeded to next research area (Iheya North knoll)

18:20 Arrived at research area (Iheya North knoll)

18:15-18:46 Carried out MBES mapping survey (Pre-dive survey)

18:30-19:00 Scientist meeting.

12-Nov-16 06:00 Released XCTD at 27-47.3902N, 126-53.8918E

6:22-6:39 Carried out VMP-X operation

08:07 Hoisted up 'KAIKO Mk-IV'

08:43 Launched 'KAIKO Mk-IV' then it dove & Com'ced her operation #712(23)

10:08 KAIKO Mk-IV' landed on the sea bottom (D=1,039m)

14:19 KAIKO Mk-IV' left the sea bottom (D=978m)

15:29 Hoisted up 'KAIKO Mk-IV'

15:39 Recoverd 'KAIKO Mk-IV' & finished her operation

16:15 Proceeded to next research area (Noho site)

18:00 Arrived at research area (Noho site)

18:30-19:00 Scientist meeting.

13-Nov-16 08:43 Hoisted up 'KAIKO Mk-IV'

08:49 Launched 'KAIKO Mk-IV' then it dove & Com'ced her operation #713(24)

10:27 KAIKO Mk-IV' landed on the sea bottom (D=1,575m)

14:47 KAIKO Mk-IV' left the sea bottom (D=1,546m)

16:08 Hoisted up 'KAIKO Mk-IV'

16:17 Recoverd 'KAIKO Mk-IV' & finished her operation

16:18 Released XCTD at 27-31.1624N, 126-58.9852E

17:08-18:30 Carried out VMP-X operation

18:35-20:30 Proceeded to Iheya Nroth knoll

19:00-19:30 Scientist meeting.

14-Nov-16 6:26-6:45 Lowered Transducer to release command

07:04 Recoverrd EDOKKO-1 (HSG-2)

07:15 Recoverrd EDOKKO-1 (HSG-1)

07:20 Com'ced proceeding to survey area (Noho site)

08:30 Arrived at surrvey area (Noho site)

10:01 Hoisted up 'KAIKO Mk-IV'

10:07 Launched 'KAIKO Mk-IV' then it dove & Com'ced her operation #714(25)

11:42 KAIKO Mk-IV' landed on the sea bottom (D=1,592m)

14:40 KAIKO Mk-IV' left the sea bottom (D=1,592m)

16:01 Hoisted up 'KAIKO Mk-IV'

16:09 Recoverd 'KAIKO Mk-IV' & finished her operation

17:15 Proceeded to Iheya Nroth knoll

18:00 Finished survey work this voyage due to "KAIKO Mk-IV"meckanical trouble

18:05 Suspended proceeding to Iheya North knoll

19:00-19:30 Scientist meeting.

23:00 Proceeded to NAHA ko M-1 ancorage

15-Nov-16 08:30 Arrived at NAHA ko

08:45 Let go Port side anchor in 20m of water at NAHA ko M-1 anchorage

13:30-14:00 Scientist meeting.

16-Nov-16 09:00 Arrived at NAHA shinko, then completed voy. No.KR16-15.

Onboard crew

R/V KAIREI CREW

Captain	Eiko UKEKURA
Chief Officer	Yasuhiko SAMMORI
2nd Officer	Hidehiko KONNO
3rd Officer	Keiji ITAHASHI
Chief Engineer	Eiji SAKAGUCHI
1st Engineer	Wataru KUROSE
2nd Engineer	Kenichi SHIRAKATA
3rd Engineer	Yoichi YASUE
Chief Electronics Operator	Masamoto TAKAHASHI
2nd Electronics Operator	Yuka MORIWAKI
3rd Electronics Operator	Ryosuke MATSUI
Boat Swain	Tadahiko TOGUCHI
Quarter Master	Kazumi OGASAWARA
Quarter Master	Minoru KISHI
Quarter Master	Nobuyuki ICHIKAWA
Quarter Master	Yoshiaki MATSUO
Quarter Master	Daisuke YANAGITANI
Sailor	Takumi MIURA
No.1 Oiler	Yukihiro YAMAGUCHI
Oiler	Eiji ARATAKE
Oiler	Yuji HIGASHIKAWA
Oiler	Masaki TANAKA
Assistant Oiler	Toru HIDAKA
Chief Steward	Toyonori SHIRAISHI
Steward	Toru MURAKAMI
Steward	Koichiro KASHIWAGI
Steward	Mao KIKUCHI

Kaiko Mk-VI Operation Team

Submersible Op. Manager	Homare WAKAMATSU
2/Submersible Tec. Officer	Ken YATSU
2/Submersible Tec. Officer	Kiyoshi TAKISHITA
2/Submersible Tec. Officer	Tetsuya ISHITSUKA
2/Submersible Tec. Officer	Junya NIIKURA
2/Submersible Tec. Officer	Shota IHARA
2/Submersible Tec. Officer	Atsushi TAKENOUCHI
2/Submersible Tec. Officer	Takuma GOTO

Marine Technician

Research Engineer	Yasushi HASHIMOTO
Research Engineer	Mitsuteru KUNO
Research Engineer	Hiroshi MATSUNAGA