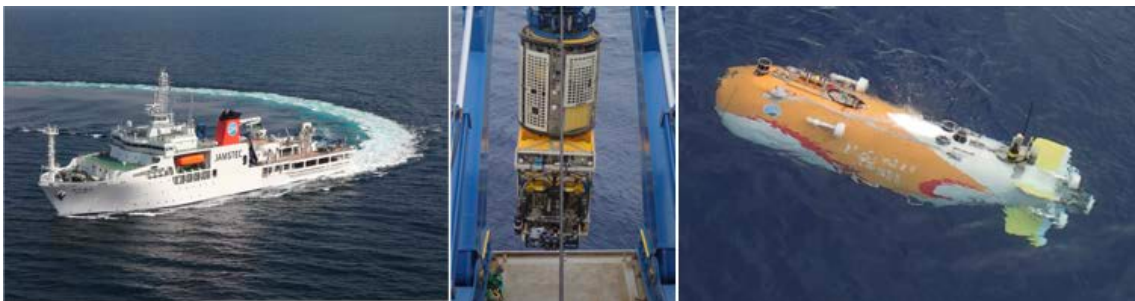


R/V Kaimei Cruise Report KM17-12C

SIP Project for Development of New-Generation Research Protocol
for Submarine Resources: survey for baseline condition of hydrothermal
vent area and in situ examination of observation tools.

Okinawa Trough

November 13 to 29, 2017



Japan Agency for Marine-Earth Science and Technology
(JAMSTEC)

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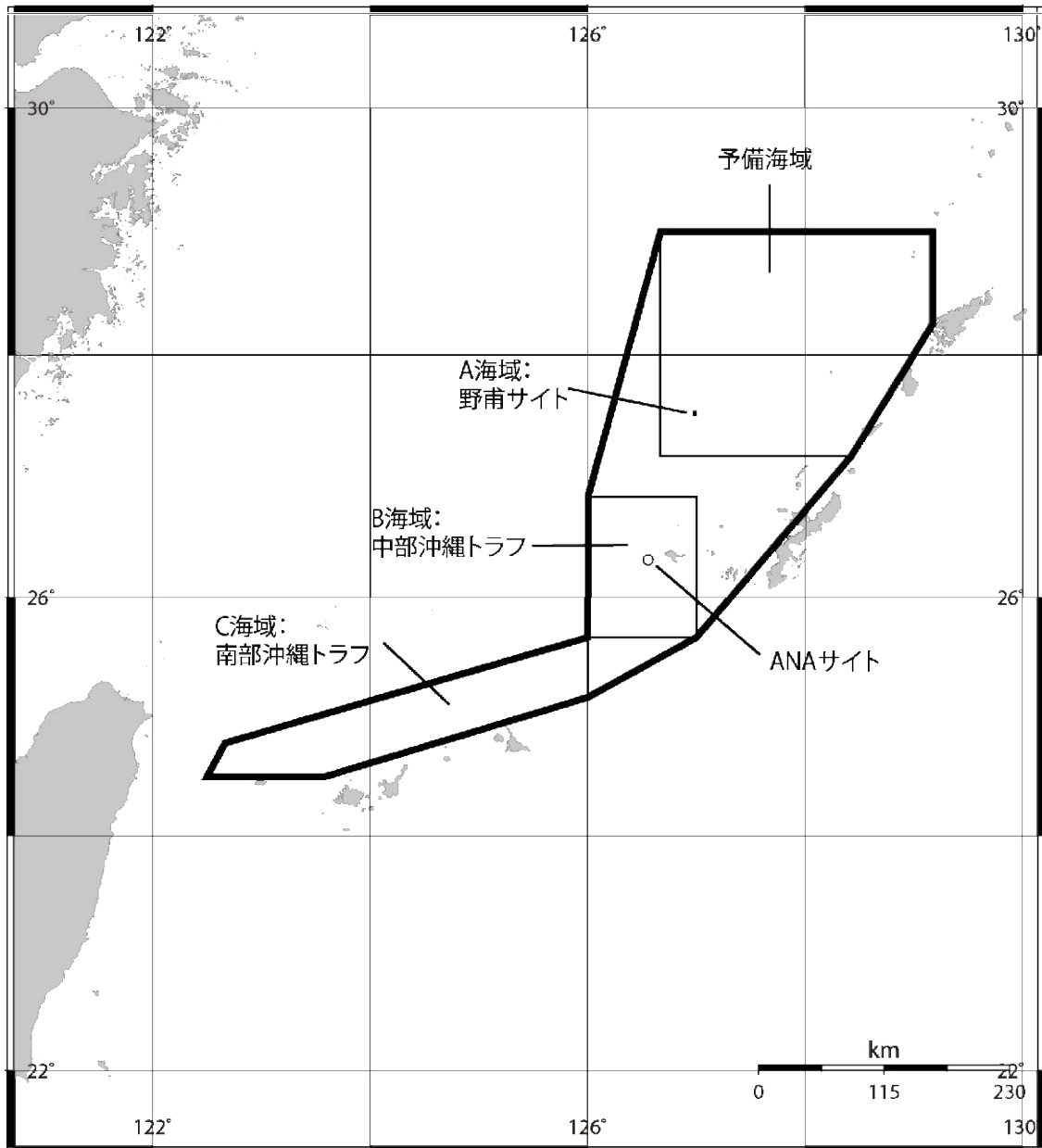
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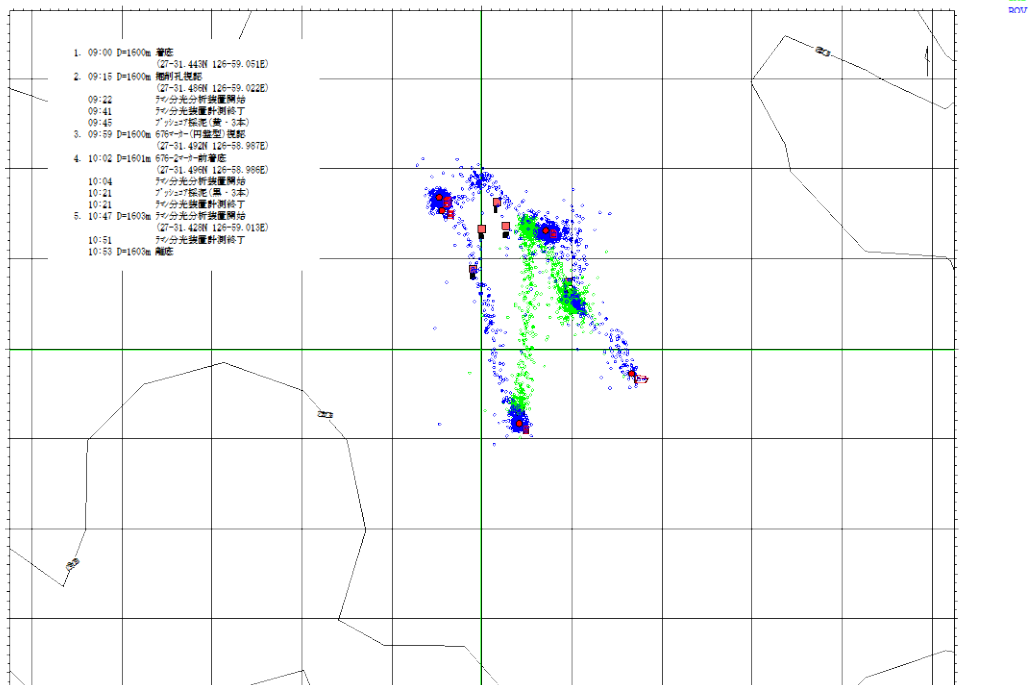
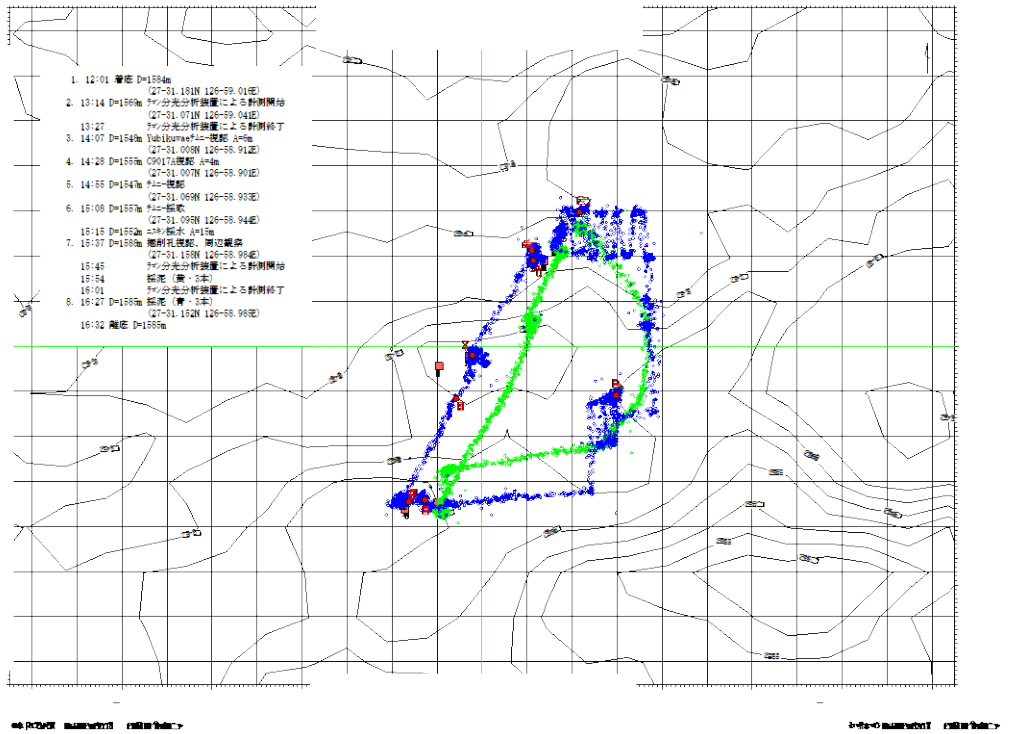
1. Cruise Information

- Cruise ID KM17-12C
- Name of vessel R/V Kaimei
- Title of the cruise
SIP Project for Development of New-Generation Research Protocol for Submarine Resources: survey for baseline condition of hydrothermal vent area and in situ examination of observation tools.
- Title of proposal Survey and monitoring the environments of hydrothermal vent area
- Cruise period November 13 to 29, 2017
- Ports of departure / call / arrival JAMSTEC Yokosuka / JAMSTEC Yokosuka
- Research area Okinawa Trough area
- Research Map

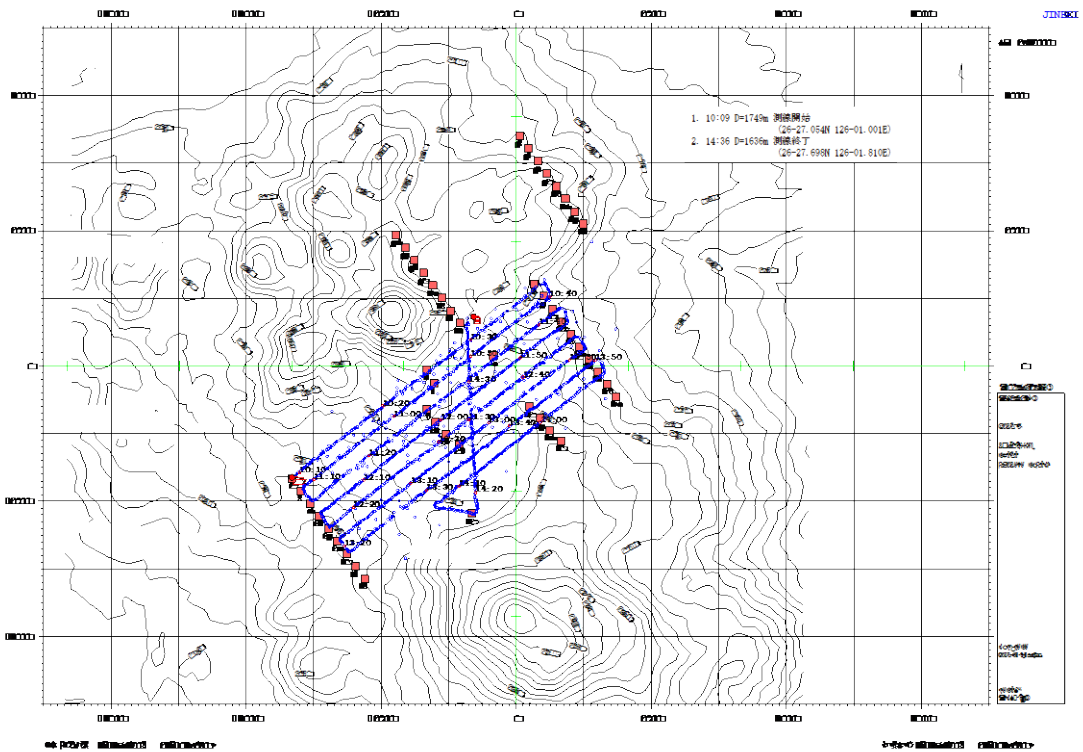
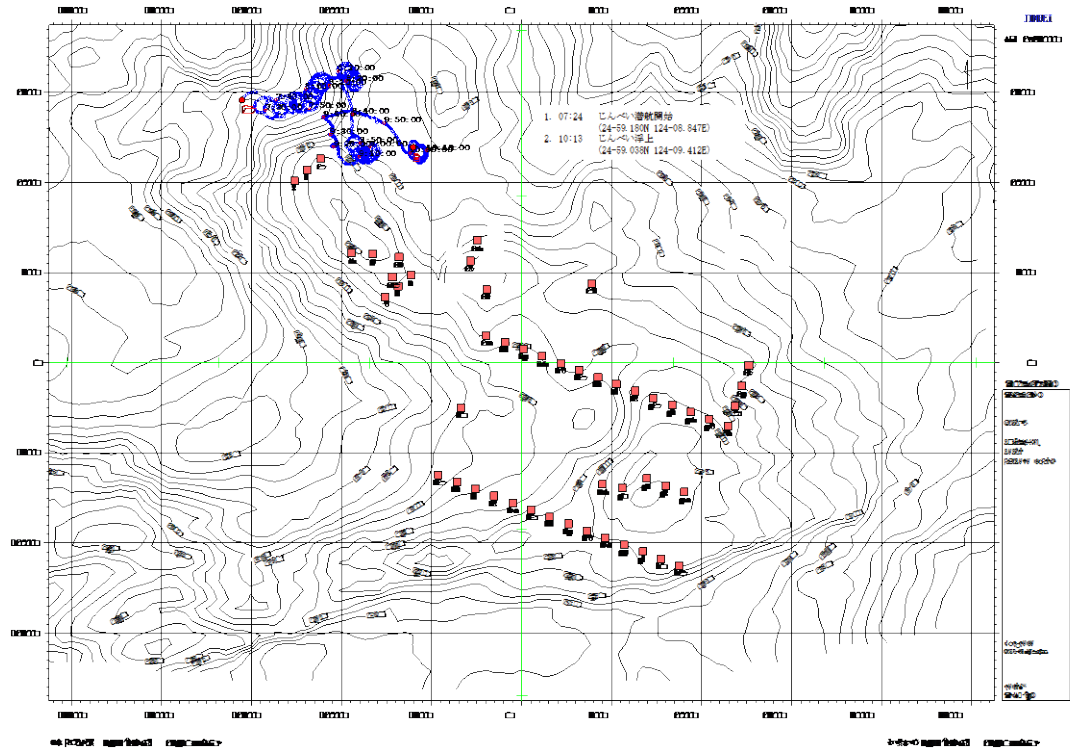
Research area



Dive map KM-ROV



AUV Jinbei



2. Research party

- Chief Scientist and Representative of the science party:
YAMAMOTO Hiroyuki JAMSTEC
- Science party
KUMAGAI Hidenori JAMSTEC
KITAHASHI Tomo JAMSTEC
TSUCHIYA Masashi JAMSTEC
MIWA Tetsuya JAMSTEC
FUKUBA Tatsuhiro JAMSTEC
WATANABE Hiromi JAMSTEC
KONDO Shunsuke JAMSTEC
KITADA Kazuya JAMSTEC
TAKAHASHI Ayu JAMSTEC
NITTA Suehiro JAMSTEC
AOYAMA Chiharu Tokyo University for Marine Science and Technology
NODA Kanami Tokyo University for Marine Science and Technology
KONDO Mantaro Tokyo University for Marine Science and Technology
KAWACHI Masanobu National Institute of Environmental Studies
KOSHIKAWA Hiroshi National Institute of Environmental Studies
FUCHIDA Shigeshi National Institute of Environmental Studies
OHTA Shuhei National Institute of Environmental Studies
TAKAHASHI Tomoko University of Tokyo
YOSHINO Souichi University of Tokyo
OHNO Atsuo JAMSA
HARADA Koji JAMSA
OHTA Kento JAMSA
YONEZAWA Taichi JAMSA

R/V KAIMEI CREW

Captain	YOSHIDA Rikita
Chief Officer	SAMMORI Yasuhiko
2nd Officer	MIYAKE Kazuki
3rd Officer	SUZUKI Akira
Jr.3rd Officer	YAMAMOTO Kazuma
Chief Engineer	KANEDA Kazuhiko
1st Engineer	KATO Kenzo
2nd Engineer	HANAWA Akira
3rd Engineer	FUJII Kota
Chief Electronic Operator	ISHIWATA Hiroki
2nd Electronic Operator	SHIROZUME Takatomo
3rd Electronic Operator	ONIKUBO Ryuji
Boat Swain	OHATA Masanori
Able Seaman	IWASAKI Naoki
Able Seaman	MIYASHITA Takuya
Able Seaman	ITO Hideo
Able Seaman	NAKANISHI TORU
Sailor	OHJIRI Yuta
Sailor	KOJIMA Shinya
No.1 Oiler	ISHI Hiroyuki
Oiler	UEDA Masanori
Oiler	AIZAWA Kota
Oiler	SHIMOHATA Shota
Chief Steward	CHIKUBA Yukihide

Steward

Steward

Steward

KM-ROV Operation Team

Operation Manager

2nd ROV Operator

2nd ROV Operator

2nd ROV Operator

3rd ROV Operator

3rd ROV Operator

AUV-JINBEI Operation Team

Operation Manager

1st ROV Operator

2nd ROV Operator

2nd ROV Operator

2nd ROV Operator

3rd ROV Operator

Marine Technician

Research Engineer

Research Engineer

SONODA Kazuma

KUBOTA Ryu

KASHIWAGI Koichiro

MIURA Atsumori

ISHITSUKA Tetsuya

TAKENOUCHI Atsushi

SAKAKIBARA Yudai

KUMAGAI Shinosuke

SUGIURA Shuya

SAITO Fumitaka

MATSUMOTO Keita

SAIGO Ryo

KURAMOTO Yoshikazu

TORIGOE Mitsuru

MINAMINO Naoto

MINAMIZAWA Satomi

HASHIMOTO Yasushi

3. Research/Development Activities

● Research overview

This cruise has been planned in a series of research to collect the baseline data of environments on Okinawa Trough, and to advance the development of observation tools and operation techniques. The baseline data of environment, e.g. oceanographic structure, seafloor condition, biodiversity and distribution, were collected within Okinawa Trough and adjacent sea areas using KM-ROV. A systematic plume mapping rounding them up by a-ship-hull-mounted MBES is planned as the starting point of the campaign to evaluate the resource potentials on polymetallic sulfides. As the plume-geological survey, both ship-hull-mounted and AUV *Jinbei* equipped multi-beam echo sounder were utilized in order to reveal numbers and distribution of seafloor hydrothermal vent sites in the mid- and southern- Okinawa Trough. In this cruise, we conducted a suitable operation protocol of environmental baseline survey and binary scale multi-beam echo sounder (MBES) plume and geological survey.

● Survey of benthic fauna

Tomo Kitahashi, Masashi Tsuchiya, Hiromi Watanabe, Atsuo Ohno, Kento Ohta, Koji Harada, Taichi Yonezawa

The sediment core samples were collected by push core sampler for meiobenthos. The sediment core was collected at 4 sites located in Noho of the Iheya Minor Ridge. At each site, the core sample was collected from three adjoining points of the drilling expedition by CK16-01, where the core samples were collected during R/V Kairei KR 15-17 and 16-17 cruises in 2015 and 2016, respectively. The core sample was divided at onboard laboratory, and determined chemical properties and composition of meiofauna using onboard FlowCAM. The sample collection of epifauna was planned by suction-sampler (electric slurp-gun type) and multi-compartment canister installed in ROV.

● Onboard bioassay and monitoring of photosynthetic activity

Masanobu Kawachi, Shuhei Ota, Shigeshi Fuchida, Hiroshi Koshikawa, Atsuo Ohno, Kento Ohta, Koji Harada, Taichi Yonezawa

The onboard bioassay technique using test organism (*Cyanobium* sp. NIES-981) was tested for evaluation of two different samples, a mixed metal solution resembling the eluate composition obtained from a whole round core sample (C9027B 1X-CC) and the eluate prepared from a part of newly collected chimney (KM17 A3) by ROV operation (Dive 41 on 17 November). The latter new eluate was preliminary analyzed the major metal composition by ASV (Anodic Stripping Voltammetry). During three trials of the onboard bioassay, we could estimate the toxicities of both eluates. We revised our technical protocol and created a new video manual for more practical field-use through the collaborative work between NIES and JAMSA teams. In addition, using a portable flow cytometer “On-chip Sort”, we monitored effects of metals on microbial community especially targeting pico-nano size phytoplankton which is major component in this cruise survey region. We used surface seawater from both tap seawater and seawater collected with bucket from ship deck (17, 22 and 25 November) for the experimental monitoring. At the same time, temperature and salinity of the surface seawater were measured with a handy CTD sensor (RINKO profiler). Two different metal solutions above mentioned were used again for the evaluation of the impact on the natural microbial communities. We demonstrated usefulness of cell staining technique using SYBR Green I and propidium iodide to demonstrate accurate cell counting method and microbial viability test onboard.

● Development and test operation of onboard pollution alert system for surface environment

Hiroshi Koshikawa, Tstsuya Miwa, Shunsuke Kondo

NIES and JAMSTEC are collaborating to develop an onboard pollution alert system for the surface environment around seafloor mining activities. As one of promised toxicant sensing parameters, we focused on the rapid and prompt change of the photosynthetic fluorescence yield (F_v/F_m and/or F_v'/F_m') of natural phytoplankton assemblages which are exposed to toxic substances such as heavy metals. During this cruise, we performed trial operations of our real-time F_v/F_m monitoring system which is composed of a dark – light adaptation controller with a set of three 5 L tanks (hand-made), three

Fv/Fm measuring instruments equipped flow-through modules (FRRF (Kimoto Electronics, Japan), Water-PAM (Walz, Germany), PhytoFlash (Turner Desgins, USA)) and seawater pumps. Our system worked well and collected continuous Fv/Fm data on the R/V trail. The data brought out that the natural variation of Fv/Fm (probably induced by a regular change of sunlight intensity) could not be compensated adequately even if the phytoplankton was acclimated to the dark environment for 15 – 30 minutes using the dark – light adaptation controller before the subsequent Fv/Fm measurement. This result suggests that some prediction scheme of diurnal natural variation of Fv/Fm must be established and implemented it to our onboard pollution alert system to improve the sensitivity and the reliability.

- **In situ operation of integrated Laser Raman spectroscopy**

Tomoko Takahashi, Souichi Yoshino

Compounds of porewater and seawater were measured using the in-situ Laser Raman spectrometer. The ROV manipulator was used to hold the Raman spectrometer's probe unit. Porewater measurements were performed at several locations where sediment core samples were recovered. The probe penetrated sediments and porewater in the depth of 15 and 30 cm from the seafloor was measured. The differences of sulfate peak heights between penetration depths were successfully detected.

- **Hydrothermal plume survey by ship-hull-mounted MBES**

Kazuya Kitada, Chiharu Aoyama, Ayu Takahashi, Hidenori Kumagai

We conducted an acoustic survey using MultiBeam Echosounder System (MBES) equipped on board R/V Kaimei (EM122, Kongsberg Maritime, Inc.) to reveal numbers and distribution of seafloor hydrothermal vent sites in the southern and the middle Okinawa Trough. The total coverage of approx. 340 km² was attained using ~1.1 km (~0.6 NM) track spacing and ~5 kt ship speed for the purpose of hydrothermal plume survey: 65km² in the area of Iheya Minor Ridge, 100 km² in the area of Ishigaki Knolls, 28 km² in the area of a small hill at 26°05'N, and 147km² in the area of Nakadomari Hill. Dense bathymetry and water column image data were obtained for each area and the water column backscattering strength was analyzed by using Echo View8 (Echoview Software Pty Ltd) and SoundingDiver5 (Ocean High Technology Institute, Inc). During the survey, we successfully detected plume signals (acoustic water column anomaly) rising as continuous streams in water columns.

- **Hydrothermal-field survey by AUV-MBES with chemical and physical sensors**

Hidenori Kumagai, Kazuya Kitada, Ayu Takahashi

Two AUV Jinbei dives (Dives #57 and #58) were conducted over the survey area at a volcanic field of Ishigaki Knolls and at Nakadomari Hill near back-arc rifting axis in the middle Okinawa Trough. At the first dive at the Ishigaki Knolls volcanic field (Dive#57), we tested the operational function of AUV Jinbei; but the dive eventually aborted by malfunction of maneuver system. At the second dive at the Nakadomari Hill (Dive#58), the dive started at 09:24 and survey started at 10:09. The survey successfully proceeded to 7th track; however, wave height were seriously increased at 14:00. Then, at the middle of the 8th track, the scenario was intermitted and adjusted to perform just a cross-line trending approx. N-S. Here, the spacing of survey lines were set approx. 120m during the dive.

Acoustic data were collected by the high frequency MBES (SEABAT7125, Teledyne RESON) with 400 kHz projector array mounted on AUV Jinbei in order to investigate hydrothermal plume signals, such as acoustic water column anomaly besides the detailed topographical and geological information. Magnetic field data were collected by the fluxgate magnetometer mounted in the port side of the payload space. The electric field was continuously measured using an electrode array mounted at the top of AUV Jinbei. Chemical sensors (stand-alone ORP and turbidity meters) were used to detect hydrothermal plume signals.

- **Surface geophysical survey: magnetic and gravity field**

Kazuya Kitada

We conducted the dense magnetic and gravity surveys aboard the R/V Kaimei to characterize the sub-seafloor structures and the spatial distribution of the magmatic activity around the hydrothermal site. Magnetic field data were collected by two equipments; a shipboard three-component magnetometer (STCM SFG-2015, Tierra Tecnica) and a ship-towed cesium magnetometer (G-882, Geometrics Inc.). The STCM data contain the effects of ship's magnetic field, which is required to be corrected in order to derive the real geomagnetic field. The 360° rotation data of both clockwise and counter-clockwise, called figure-eight turns, were conducted for the calibration and the twelve constants (B(1,1)-B(3,4)) related to

the ship's permanent and induced magnetic field were estimated using the calibration data. During this cruise, figure-eight turns were conducted three times. Total geomagnetic field were measured by using a cesium marine magnetometer. The length of the towed cable was ~400m to reduce the ship's magnetic effect. Geomagnetic total intensity anomaly is obtained by subtracting the International Geomagnetic Reference Field from the cesium magnetometer data. Due to the relatively rough sea-state, towing of cesium-magnetometer was quite limited, only the area of the middle Okinawa Trough near 126°E area. During transit, three-component magnetic field data were also acquired. Gravity field data were obtained from a shipboard gravimeter (MGS-6, Micro-g LaCoste) during the cruise from 13 to 29 November 2017. Free-air gravity anomaly was calculated with subtracting the normal gravity field and the correction of the Eotvos effect using the GNSS data. The gravity field data measured by the portable gravimeter (CG-5 AUTOGRAV, SCINTREX limited) at the pier of the JAMSTEC Yokosuka HQ were used to correct the data drift.

- **Shallow sub-seafloor structure using Sub-Bottom Profiler**

Hidenori Kumagai

In the vicinity of the Iheya-Minor Ridge, shallow subseafloor structure were surveyed by using TOPAS PS18 Sub Bottom Profiler equipped to R/V Kaimei; respective beam frequency and width formed is 0.5 – 6 kHz and 4.5°. Thus, typical foot-print of SBP beam is approx. 100m in 1500m WD. SBP focused survey was carried out along two ridge-perpendicular lines. Beside these two tracks, along-ridge SBP survey was also carried out simultaneous with plume survey. It is noteworthy that acoustic wave emission of SBP is seriously interfere the received signals of MBES, such simultaneous operation has not been conducted for the rest of this cruise.

Further across trough survey along longitudinal line 126°2'E was conducted. This line passes on the Nakadomari-Hill at 26°27' that is similar tectonic situation to Iheya-North Knoll: on the southern flank of the trough axis. Although the severe sea state at the survey, considerable reflection images were successfully obtained most part of the lines.

- **In situ measurement of physicochemical properties**

Tatsuhiko Fukuba, Tetsuya Miwa

Concentration of ATP (adenosine triphosphate) as a proxy of microbial biomass was measured using the *in situ* ATP analyzer (JAMSTEC/IIS-UT). The analyzer was mounted on the backside of KM-ROV and connected to the ROV for electrical power supply and RS-232 communication. As a result of deployments, ATP concentration profiles were successfully obtained during the dive #41 and 42. ATP concentration anomaly was widely distributed at the bottom of the studied site.

An ISFET (Ion Sensitive Field Effect Transistor) –based pH sensor was mounted on KM-ROV for *in situ* pH measurement. The sensor was operated with a battery and measured data was stored on a sensor every 10 sec. During the dive #42, apparent pH anomaly due to hydrothermal fluid was observed.

- **Recovery of in situ observation devices**

Tetsuya Miwa, Shunsuke Kondo

Free-fall and standalone platform for seafloor observation system, EDOKKO Mark-1, was deployed at ANA site by MR17-03C cruise. Time laps video record and physical properties of benthopleagic zone were recoded. At 4:00, 12:00 and 20:00, the video camera acquired a one-minute movie file. It was recovered from the seafloor on this cruise.

- **Information gathering for outreach**

Suehiro Nitta, Hiroyuki 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 by video and photograph has been carried out to make image materials for outreach product and manual making.

4. Cruise Log

日付 Date	時間 Local Time	内容 Note	本船位置/気象/海象 Position/Weather/Wind/Sea condition
13-Nov-17	8:00	Scientists onboard.	12:00 (UTC+9h)
	9:00	Let go all shore lines & left YOKOSUKA for research area.	North off IZU-OSHIMA
	10:00-10:40	Carried out education & training for scientists.	34-57.2N, 139-26.5E
	10:40-11:00	Shipboard tour for scientists.	Fine but Cloudy
	11:00-11:30	ROV "KM-ROV" briefing.	NE-3 (Gentle breeze)
	13:00-13:10	Scientist meeting.	2 (Sea Smooth)
	13:10-13:45	AUV "JINBEI" briefing.	2 (Low Swell Long)
	16:40	Konpira ceremony.	Visibly: 8'
14-Nov-17	all day	Proceeding to research area.	12:00 (UTC+9h)
	9:00	Scientist meeting.	South off SHIKOKU
	16:06-16:26	Carried out eight figure turn.	31-19.2N, 134-45.4E
			Rain
			WSW-3 (Gentle breeze)
			2 (Sea Smooth)
			2 (Low Swell Long)
			Visibly: 6'
15-Nov-17	all day	Proceeding to research area.	12:00 (UTC+9h)
	9:00	Scientist meeting.	East off AMAMI-OSHIMA
	16:00	Scientist meeting.	28-10.5N, 130-07.3E
			Fine but Cloudy
			N-5 (Fresh breeze)
			4 (Sea Moderate)
			4 (Moderate Average)
			Visibly: 8'
16-Nov-17	2:00	Arrived at research area (Okinawa Trough "Iheya Ridge").	12:00 (UTC+9h)
	4:49	Released XBT at 27-30.5374N, 127-00.7325E.	Iheya Ridge
	5:19-5:31	Carried out MBES mapping survey (Pre dive survey).	27-31.1N, 126-59.0E
	8:45-9:00	Carried out sampling of surface water by bucket.	Cloudy
	11:07	Hoisted up "KM-ROV".	E-6 (Strong breeze)
	11:12	Launched "KM-ROV", it dove & com'ced her operation #41.	4 (Sea Moderate)
	12:01	"KM-ROV" landed on the sea bottom (D=1,584m).	3 (Moderate Short)
	16:32	"KM-ROV" left the sea bottom (D=1,585m).	Visibly: 8'
	17:41	Hoisted up "KM-ROV".	
	17:46	Recovered "KM-ROV" & finished the operation.	
	21:47	Com'ced MBES mapping survey.	
17-Nov-17	3:46	Finished MBES mapping survey.	12:00 (UTC+9h)
	8:05	Hoisted up "KM-ROV".	Iheya Ridge
	8:13	Launched "KM-ROV", it dove & com'ced her operation #42.	27-31.4N, 126-59.0E
	9:00	"KM-ROV" landed on the sea bottom (D=1,600m).	Rain
	10:53	"KM-ROV" left the sea bottom (D=1,603m).	SE-6 (Strong breeze)
	11:49	Hoisted up "KM-ROV".	4 (Sea Moderate)
	11:56	Recovered "KM-ROV" & finished the operation.	3 (Moderate Short)
	13:49-14:02	Carried out sampling of surface water by bucket.	Visibly: 7'
	14:00	Suspended "KM-ROV" dive due to rough sea.	
	15:16-16:34	Carried out MBES mapping survey.	
	18:19-19:37	Carried out MBES mapping survey.	
	19:00	Scientist meeting.	
	20:30	Proceeded to NAGO-WAN due to rough sea.	
18-Nov-17	1:30	Arrived at off NAGO-WAN.	12:00 (UTC+9h)
	9:00-9:30	Carried out boat station drill for all crew & scientist.	NAGO-WAN
			26-34.0N, 127-56.8E
			Cloudy
			NNE-6 (Strong breeze)
			4 (Sea Moderate)
			2 (Low Swell Long)
			Visibly: 7'

日付 Date	時間 Local Time	内容 Note	本船位置/気象/海象 Position/Weather/Wind/Sea condition
19-Nov-17	13:00	Left off NAGO-WAN & proceeded to research area(ANA site).	12:00 (UTC+9h)
	19:00	Scientist meeting.	NAGO-WAN
			26-34.0N, 127-54.2E
			Fine but Cloudy
			NNE-6 (Strong breeze)
			4 (Sea Moderate)
			3 (Moderate Short) Visibly: 8'
20-Nov-17	9:00	Arrived at ANA site.	12:00 (UTC+9h)
	10:08	Recovered "Edokko Mark-1".	West off KUME-JIMA
	14:08	Com'ced SBP & MBES mapping survey.	26-31.0N, 126-17.3E
	19:00	Scientist meeting.	Fine but Cloudy
			NE-6 (Strong breeze)
			4 (Sea Moderate)
			3 (Moderate Short) Visibly: 8'
21-Nov-17	2:04	Finished SBP & MBES mapping survey.	12:00 (UTC+9h)
	6:45	Com'ced proceeding to MBES mapping survey area.	North off MIYAKO-JIMA
	17:30	Arrived at MBES mapping survey area.	25-32.8N, 124-53.2E
	17:32	Released XBT at 25-00.3420N, 124-20.0102E	Overcast
	18:04	Com'ced SBP & MBES mapping survey.	ENE-6 (Strong breeze)
	19:00	Scientist meeting.	4 (Sea Moderate)
	23:28-23:50	Carried out eight figure turn.	3 (Moderate Short) Visibly: 7'
22-Nov-17	4:05	Finished SBP & MBES mapping survey. Then proceeded to "JINBEI" dive point.	12:00 (UTC+9h)
	4:30	Arrived at "JINBEI" dive point.	North of ISHIGAKI-JIMA
	7:17	Hoisted up "JINBEI".	24-57.6N, 124-11.5E
	7:24	Launched "JINBEI", it dove & com'ced her operation #57.	Cloudy
	8:30-8:45	Carried out sampling of surface water by bucket.	NW-6 (Strong breeze)
	9:40	"JINBEI" com'ced refloating.	4 (Sea Moderate)
	10:13	Refloated "JINBEI".	3 (Moderate Short)
	10:35	Hoisted up "JINBEI".	Visibly: 8'
	10:47	Recovered "JINBEI" & finished the operation.	
	11:30	Proceeded to MBES mapping survey point.	
	12:01-15:41	Carried out MBES mapping survey.	
	16:00	Proceeded to off KUME-JIMA due to rough sea.	
	19:00	Scientist meeting.	
23-Nov-17	4:30	Arrived at off KUME-JIMA.	12:00 (UTC+9h)
	19:00	Scientist meeting.	South off KUME-JIMA
			26-16.6N, 126-45.4E
			Overcast
			N-6 (Strong breeze)
			4 (Sea Moderate)
			3 (Moderate Short) Visibly: 7'
24-Nov-17	10:00	Proceeded to MBES mapping survey area.	12:00 (UTC+9h)
	12:37	Released XBT at 26-02.1675N, 126-05.5556E.	West off KUME-JIMA
	13:02	Com'ced towing to cesium magnetometer.	26-05.0N, 126-12.7E
	13:40-18:02	Carried out MBES mapping survey.	Cloudy
	19:00	Scientist meeting.	NNE-5 (Fresh breeze)
	19:34	Com'ced MBES mapping survey.	4 (Sea Moderate)
			3 (Moderate Short) Visibly: 8'

日付 Date	時間 Local Time	内容 Note	本船位置/気象/海象 Position/Weather/Wind/Sea condition
25-Nov-17	5:57	Finished MBES mapping survey.	12:00 (UTC+9h)
	6:35	Finished towing to cesium magnetometer.	West off KUME-JIMA
	7:00	Arrived at "JINBEI" dive point.	26-27.2N, 126-01.3E
	9:16	Hoisted up "JINBEI".	Rain
	9:24	Launched "JINBEI", it dove & com'ced her operation #58.	E-6 (Strong breeze)
	9:45-10:00	Carried out sampling of surface water by bucket.	3 (Sea Slight)
	14:38	"JINBEI" com'ced refloating.	3 (Moderate Short)
	15:24	Refloated "JINBEI".	Visibly: 7'
	15:51	Hoisted up "JINBEI".	
	15:57	Recovered "JINBEI" & finished the operation.	
	16:30	Proceeded to MBES mapping survey area.	
	17:12-22:06	Carried out MBES mapping survey.	
	19:00	Scientist meeting.	
	26-Nov-17	2:30	Proceeded to YOKOSUKA.
19:00		Scientist meeting.	West off AMAMI-OSHIMA
			28-31.3N, 128-47.3E
			Rain
			NNE-7 (Near gale)
			5 (Sea Rough)
			4 (Moderate Average) Visibly: 4'
27-Nov-17	all day	Proceeding to YOKOSUKA.	12:00 (UTC+9h)
	13:15-14:25	Shipboard seminar.	South off SHIKOKU
			32-30.3N, 134-14.3E
			Fine but Cloudy
			ENE-6 (Strong breeze)
			4 (Sea Moderate) 4 (Moderate Average) Visibly: 8'
28-Nov-17	all day	Proceeding to YOKOSUKA.	12:00 (UTC+9h)
	19:00	Scientist meeting.	Off TATEYAMA
			35-00.4N, 139-48.4E
			Overcast
			NNW-5 (Fresh breeze)
			3 (Sea Slight) 2 (Low Swell Long) Visibly: 7'
29-Nov-17	9:00	Arrived at YOKOSUKA, then completed voy. No.KM17-12C.	

5. Notice on Using

This cruise report is a preliminary documentation as of the end of cruise.
This report is not necessarily corrected even if there is any inaccurate description (i.e. taxonomic classifications). This report is subject to be revised without notice. Some data on this report may be raw or unprocessed. If you are going to use or refer the data on this report, it is recommended to ask the Chief Scientist for latest status.
Users of information on this report are requested to submit Publication Report to JAMSTEC.

<http://www.godac.jamstec.go.jp/darwin/explain/1/e#report>
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