

Cruise Report

KR15-20

R/V Kairei & AUV Jinbei
Sagami Bay, Suruga Bay, Izu-Ogasawara Archipelago

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

Protocol development for environmental assessment of hydrothermal vent
area.

13 to 22 December 2015

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1. Cruise Information

1.1. Cruise number

KR15-20

1.2. Name of vessel and submersible vehicle

R/V Kairei and AUV Jiinbei

1.3. Title of the proposal

SIP Project for Development of New-Generation Research Protocol for Submarine Resources: Protocol development for environmental assessment using autonomous underwater vehicle.

1.4. Cruise period

13 to 22 December 2015

1.5. Ports of call

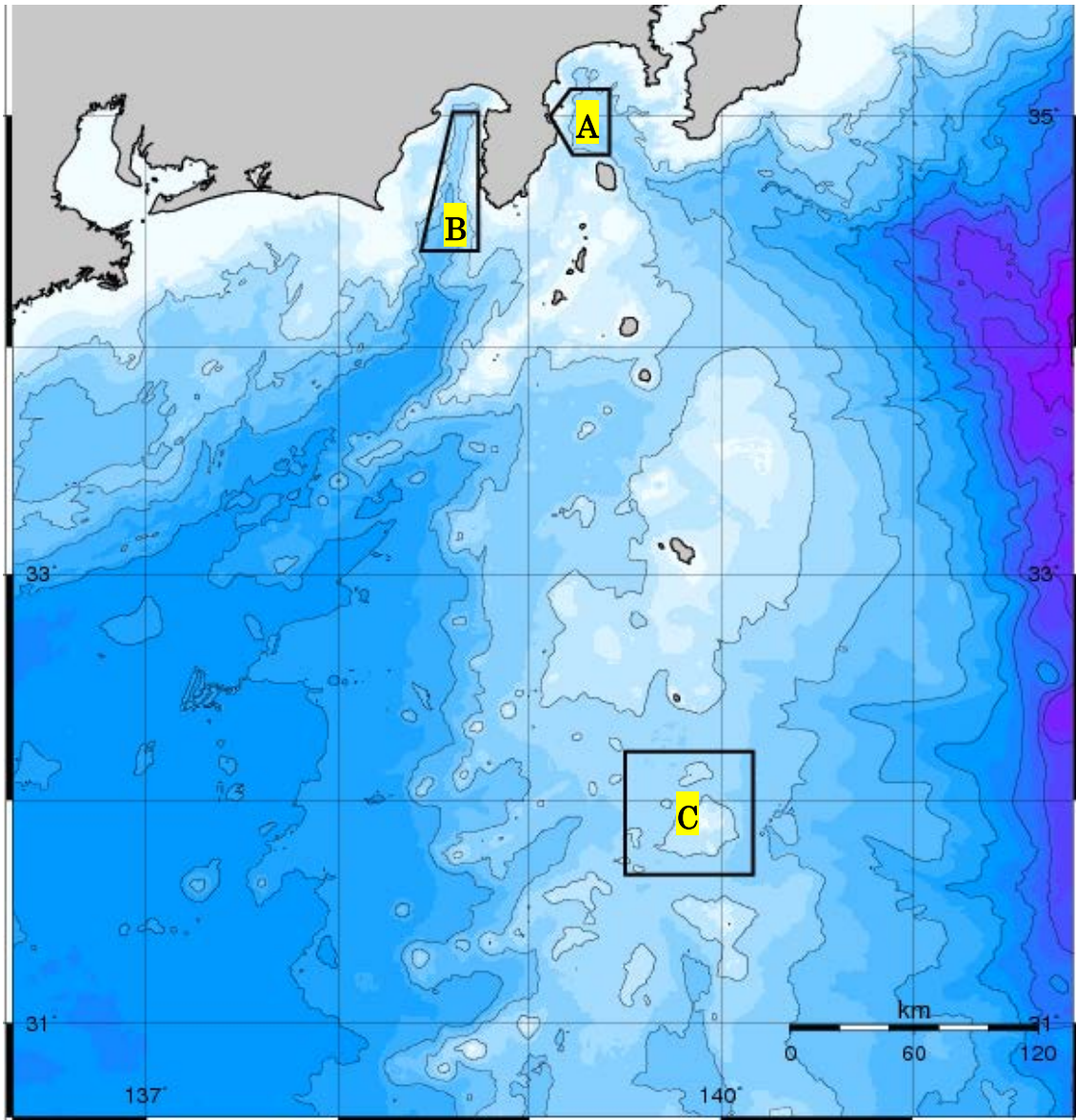
Departure : Yokosuka

Arrival : Yokosuka

1.6. Research area

Sagami Bay, Suruga Bay, Izu-Ogasawara Archipelago

2. Research map



A: Sagami Bay

[35°07.0'N,139°13.0'E]、[35°07.0'N,139°25.0'E]、[34°50.0'N,139°25.0'E]、
[34°50.0'N,139°13.5'E]、[35°00.0'N,139°06.5'E]

B: Suruga Bay

[35°01.0'N,138°36.0'E]、[35°01.0'N,138°44.0'E]、
[34°25.0'N,138°44.0'E]、[34°25.0'N,138°26.0'E]

C: Izu-Ogasawara Archipelago

[31°40.0'N、32°13.0'N]、[139°30.0'E、140°10.0'E]

3. Researchers

Chief Investigator / Representative of Science Party:

Hiroyuki YAMAMOTO	JAMSTEC
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Onboard Researchers:

Tetsuya MIWA	JAMSTEC
Tatsuo FUKUHARA	JAMSTEC
Junji KANEKO	JAMSTEC
Ayu TAKAHASHI	JAMSTEC
Shinichi TAKAGAWA	Office TAKAGAWA
Naoki FURUICHI	NIES
Shun TSUBOI	NIES
Shigeshi FUCHIDA	NIES
Hiroaki MABUCHI	JFE Advantech
Takeshi YOSHIUME	JAMSTEC
Yoshinobu NANBU	JAMSTEC
Shinobu OMIKA	JAMSTEC
Mitsuru TORIGOE	JAMSTEC
Hiroshi OCHI	JAMSTEC
Takeshi NAKATANI	JAMSTEC

Technical supporting stuff:

Hisanori IWAMOTO	Nippon Marine Engineering
Tatsuya TANAKA	Marine Works Japan

R/V KAIREI Crew

Captain	Eiko UKEKURA
Chief Officer	Takaaki SHISHIKURA
2nd Officer	Takeshi MURAMATSU
3rd Officer	Keiji ITAHASHI
Chief Engineer	Tadashi ABE
1st Engineer	Shinichi IKUTA
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	Masanori UEDA
Oiler	Kazuo SATO
Oiler	Masaki TANAKA
Oiler	Sota MISAGO
Assistant Oiler	Atsumu HARA
Chief Steward	Tatsunari ONOUE
Steward	Toru MURAKAMI
Steward	Masanao KUNITA
Steward	Kazuma SONODA
Steward	Mao KIKUCHI

4. Observation / Investigation

4.1 Overview

The practical environmental assessment protocol for marine ecosystems is yet an under-developing issue, even in scientific research field. While an environmental survey for seabed mining, monitoring of sub-seafloor CCS, and marine ecosystem management, are foci on the marine industries, the cost-performance of survey is recognized as serious issue to realize establishment of sustainable business. Autonomous underwater vehicle (AUV) has potential benefits to reduce the cost of deep-sea expeditions, and improves the observation protocols in marine science and business. This cruise aims for collecting the data set to develop the environmental assessment protocol combined with AUV and oceanographic observation.

5. Preliminary Research results

5.1. Survey of environmental condition and biological diversity

5.1.1. Oceanographic observations

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

Free-fall and standalone platform for seafloor observation system, EDOKKO, was deployed at Bayonnaise Knoll. During 24hr observation, time laps video record and physical properties of benthopelagic zone were recorded, 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 from surface to seafloor at Bayonnaise Knoll and Sagami Bay.

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 150m-depth layer at Bayonnaise Knoll.

The RINKO-Profiler is an *in situ* sensor to measure water temperature, salinity, dissolved oxygen, chlorophyll concentration, and turbidity etc. The RINKO measurement was performed by cable winch (together with FRRF) at Bayonnaise Knoll from surface to 200 m-depth. The measurement was also performed at Suruga Bay and Sagami Bay from surface to 20 m-depth by rope.

5.1.2. Water sampling

S. Tsuboi, S. Fuchida, N. Furuichi

The water samples were collected by CTD rosetta sampling system (12L x 12 Niskin bottles) for layers from 10 to 833 m depths at the site of the Bayonnaise Knoll, and by bucket sampling for surface waters at Suruga Bay, Sagami Bay, and Bayonnaise Knoll. In total, 11 water samples were collected. 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 at

Bayonnaise Knoll, and those from the surface water at Suruga Bay were used for the onboard incubation experiments.

5.1.3 Geographic and physicochemical survey by AUV Jinbei

*J. Kaneko, A. Takahashi, S. Takagawa
T. Yoshiume, Y. Nanbu, S. Omika, M. Torigoe, H. Ochi, T. Nakatani*

The AUV Jinbei is equipped with the following in situ sensors: CTD, DO, multi-beam echo sounder, hybrid CO₂-pH sensor, and magnetometer. The dive surveys were carried out at deep-sea valley of Suruga Bay (Dive 24), hydrothermal vent field of Bayonnaise Knoll (Dive 25, 26), and sea-mounds and seafloor of Sagami Bay (Dive 27, 28, 29, 30). The AUV has completed survey in 6 dives, and one dive has been cancelled by occurrence of mechanical malfunction. In 7 dives, we find several issues to be improved for routine operation. The sensor survey by AUV could collect the data on bathymetry, physicochemical conditions of water column, and geomagnetism of seafloor. The detail analysis of raw data will be performed on offshore laboratories.

6. Acknowledge

We are grateful thank to all crew of “R/V Kairei” for the safe navigation and support for the sampling and observation.

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

survey plan								
item/day	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
site	Suruga Bay	Bayonnaise	Bayonnaise	Sagami Bay	Sagami Bay	Sagami Bay	Sagami Bay	Sagami Bay
Edokko -platform		deploy	recovery	revovery				
Vertical Micro-Profiler		1	1		2			
FRRF			1 cast (0-150m)					
CTD-DO_water sampler,			1 casts (0-bottom)					
surface water sampling		+	+	+				
Towed proton magenetometer		night survey						
AUV JInbei:	DIVE 24	DIVE 25	DIVE 26	DIVE 27		DIVE 28	DIVE 29	DIVE 30
Multi beam echo sounder:	+	+	+	+		+	+	+
CTD sensor: Seabird SBE49	+	+	+	+		+	+	+
Dissolved oxygen sensor:	+	+	+	+		+	+	+
Fluoro-Turbidimeter:	+	+	+	+		+	+	+
Hybrid pH-CO2 sensor:	+	+	+	+		+	+	+
Magentometer	+	+	+	+		+	+	+

Specification of AUV Jinbei

Vehicle	
Size	4.0m(L)×1.1m(H)×1.1m(W)
Weight in the air	2 ton
Maximum depth	3,000 m
Speed	0.7 - 3 knots (2knots@cruising speed)
Minimum Altitude	30m
Duration	10 hours @cruising speed
Actuators	400W Thrusters × 4 400W Azimuth Thruster × 2 Rear X-Rudders Buoyancy Control System
Power	Lithium-ion Battery 115V, 120Ah
Communication	Wireless LAN, Acoustic comm., Optical Fiber comm., Satellite comm.
Control unit	Distributed CPU system
OS	Linux
Navigation devices	INS, DVL, GPS, Depth meter, Altimeter, Obstacle avoidance sonar, SSBL, LBL, VLBL
Observation payloads	
Multi beam echo sounder	Teledyne Reson SEABAT 7125
Side Scan Sonar	EdgeTech 2200-M
CTD sensor	Seabird SBE49
Dissolved oxygen sensor	JFE Advantech RINKO-III
Fluoro-Turbidimeter	WETLabs ECO FLNTU(RD)
Hybrid pH-CO2 sensor	JAMSTEC original

Shipboard Log

2015/12/13 southeast off HATSUSHIMA (34-58.7N, 139-16.1E)

Weather: Rain / Wind direction: North / Wind force: 6 / Wave scale: 3 /

Swell scale: 1 / Visibility: 5 miles (12:00 JST)

08:00	onboard
09:00	left JAMSTEC, proceeded to SURUGA bay
09:45-10:20	carried out education and training for scientist
15:00-15:20	scientists meeting
16:40-17:00	KONPIRA-SAN
17:30	arrived at SURUGA bay
17:31	released XBT

2015/12/14 west SHIMIZU port (35-00.1N, 138-39.5E)

Weather: Overcast / Wind direction: ENE / Wind force: 5 / Wave scale: 2 /

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

06:00	left SURUGA bay
07:00	arrived at off SHIMIZU port
08:00	one scientist embarked by boat
09:30	arrived at SURUGA bay
09:35-14:20	AUV JINBEI #24 dive
15:00	left SURUGA bay
16:00-16:10	scientists meeting

2015/12/15 south AOGASHIMA (31-57.3N, 139-43.7E)

Weather: Fine but cloudy / Wind direction: NE / Wind force: 1 / Wave scale: 1 /

Swell scale: 3 / Visibility: 8 miles (12:00 JST)

05:30	arrived at IZU-OGASAWARA
06:03	released XBT
06:06	deploy EDOKKO No.1
06:14-07:05	current profiler survey
09:38-14:52	AUV JINBEI #25 dive
15:23-15:49	position calibration for EDOKKO No.1

16:07-	start proton magnetometer survey
16:30-16:50	eight figure turns
17:18-	start MBES survey
18:00-18:10	scientists meeting

2015/12/16 south AOGASHIMA (31-58.1N, 139-43.8E)

Weather: Overcast / Wind direction: SW / Wind force: 6 / Wave scale: 3 /

Swell scale: 3 / Visibility: 8 miles (12:00 JST)

-03:40	finished MBES survey
-06:06	finished proton magnetometer survey
06:15-07:00	current profiler survey
07:06	recovered EDOKKO No.1
09:07-13:15	AUV JINBEI #26 dive
13:58-14:17	FRRF survey
14:54-16:20	CTD survey
17:00	left IZU-OGASAWARA

2015/12/17 southeast HATSUSHIMA (35-00.3N, 139-13.6E)

Weather: Fine but cloudy / Wind direction: WSW / Wind force: 6 / Wave scale: 3 /

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

06:30	arrived at SAGAMI bay
06:37	released XBT
09:52-14:43	AUV JINBEI #27 dive
15:45	arrived at off ITO port
18:00-18:20	scientists meeting

2015/12/18 southeast HATSUSHIMA (35-00.0N, 139-13.4E)

Weather: Fine but cloudy / Wind direction: South / Wind force: 1 / Wave scale: 1 /

Swell scale: 0 / Visibility: 8 mile (12:00 JST)

08:30	arrived at SAGAMI bay
08:50-10:09	current profiler survey
10:54-12:01	current profiler survey
13:00	arrived at off ITO port

18:00-18:10 scientists meeting

2015/12/19 east HATSUSHIMA (35-03.8N, 139-21.1E)

Weather: Blue sky / Wind direction: NE / Wind force: 5 / Wave scale: 2 /
Swell scale: 1 / Visibility: 8 mile (12:00 JST)

07:30 arrived at SAGAMI bay

08:55-12:01 AUV JINBEI #28 dive

18:00-18:05 scientists meeting

2015/12/20 south HATSUSHIMA (34-53.0N, 139-12.2E)

Weather: Fine but cloudy / Wind direction: ENE / Wind force: 3 / Wave scale: 2 /
Swell scale: 0 / Visibility: 8 mile (12:00 JST)

07:30 arrived at SAGAMI bay

08:43-14:54 AUV JINBEI #29 dive

18:00-18:05 scientists meeting

2015/12/21 southeast HATSUSHIMA (34-58.7N, 139-12.0E)

Weather: Cloudy / Wind direction: West / Wind force: 5 / Wave scale: 2 /
Swell scale: 0 / Visibility: 8 mile (12:00 JST)

07:02-12:20 AUV JINBEI #30 dive

15:45 arrived at off YOKOSUKA No.4

2015/12/22 JAMSTEC, YOKOSUKA

09:00 arrived at JAMSTEC

11:30 disembarked KAIREI

finished KR15-20 cruise