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R/V KAIMEI Cruise Report

KM24-03 leg. 1

Understanding the actual condition of marine pollutants and their impact on marine ecosystems

Suruga bay, Sagami bay, Izu-Ogasawara area

April 16, 2024 – April 26, 2024

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

KANSO Technos

Waseda University

Kitazato University

Tokyo University

Shibaura Institute of Technology

Tokyo University of Marine Science and Technology

Acknowledgements

We thank the captain Naoto Kimura and crew of the R/V KAIMEI for organizing the cruise and sampling. We also thank marine technicians from Nippon Marine Enterprises and Marine Work Japan for research support and ground stuff from Japan Agency for Marine-Earth Science and Technology for all the procedures to establish this cruise.

Contents

Abstract

KM24-03 leg. 1 cruise was conducted from April 16, 2024 to April 26, 2024 in the areas including Suruga Bay, Sagami bay, and Izu-Ogasawara area to understand the current situations of marine pollution and the deep-sea biodiversity, and their possible interferences by conductin ROV dives, CTD water sampling, CTD shadowgraph monitoring, plankton net sampling and acquisition of physical oceanographic data.

Total four ROV dives were conducted off Aogashima island and off Hatsushima island. Through the dives, many deep-sea organisms, sediments and chimneys were obtained. Twelve CTD casts were conducted: shadowgraph camera, LISST, RONKO profiler and LADCP were additionally introduced onto the CTD fame for data acquisition. The deep-sea water obtained in each CTD cast was filtrated through sterivex filters onboard and the environmental DNA will be extracted from the filters for the monitoring of deep-sea biodiversity.The deep-sea organisms collected by small plankton net will be also subjected for obtaining the reference and barcode sequence data and some of the individuals were immediately analyzed onboard by using newly advanced techniques. Further, we also conducted 3D mapping video capturing and physical oceanographic observation by utilizing Hydrophone and chemical sensor. As all of those data are jointly analyzed and discussed, the current situations of marine pollutants and the deep-sea biodiversity will be depicted more clearly.

Cruise information

Cruise ID: KM24-03 leg. 1

Vessel: KAIMEI

Title of the cruise: Understanding the actual condition of marine pollutants and their impact on marine ecosystems

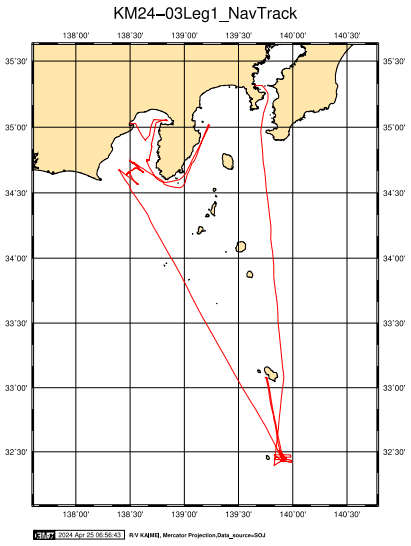
Chief Scientist: Akinori Yabuki, JAMSTEC

Cruise period: April 16, 2024 – April 26, 2024

Port of call: Yokosuka (Yokosuka, Kanagawa, Japan) – Shimizu (Shizuoka, Shizuoka, Japan)

Research Area: Suruga bay, Sagami bay, Izu-Ogasawara area

Research map:



1. Participants aboard

Chief Scientist	Akinori Yabuki
	Japan Agency for Marine-Earth Science and Technology
Vice-Chief Scientist	Yasuo Furushima
	Japan Agency for Marine-Earth Science and Technology
2nd vice-Chief Scientist	Takao Yoshida
	Japan Agency for Marine-Earth Science and Technology
Scientist	Masaru Kawato
	Japan Agency for Marine-Earth Science and Technology
Scientist	Tetsuro Ikuta
	Japan Agency for Marine-Earth Science and Technology
Scientist	Tomoko Takahashi
	Japan Agency for Marine-Earth Science and Technology
Scientist	Dhugal Lindsay
	Japan Agency for Marine-Earth Science and Technology
Scientist	Sangekar Mehul Naresh
	Japan Agency for Marine-Earth Science and Technology
Scientist	Tatsuo Fukuhara
	KANSO Technos
Scientist	Kodai Kato
	KANSO Technos
Scientist	Kiminori Shitashima
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	Graduated School of Waseda University
Graduated Student	Mutsumi Ohhama
	Graduated School of Waseda University
Graduated Student	Tatsuya Tokutake
	Graduated School of Kitazato University
Graduated Student	Ayuu Yuasa
	Japan Agency for Marine-Earth Science and Technology
Graduated Student	Jacob Kleboe
	Japan Agency for Marine-Earth Science and Technology
Undergraduate student	China Miyazaki
	Tokyo University of Marine Science and Technology
Undergraduate student	Mineo Saito

	Tokyo University of Marine Science and Technology
Marine Technician	Wataru Tokunaga
	Nippon Marine Enterprises, Ltd.
Marine Technician	Seika Takai
	Nippon Marine Enterprises, Ltd.
Chief Marine Technician	Aine Yoda
	Marine Works Japan, Ltd.
Marine Technician	Rei Ito
	Marine Works Japan, Ltd.
Marine Technician	Yuta Shinomiya
	Marine Works Japan, Ltd.
Marine Technician	Ko Arihara
	Marine Works Japan, Ltd.
Marine Technician	Misato Kuwahara
	Marine Works Japan, Ltd.
Marine Technician	Yuko Miyoshi
	Marine Works Japan, Ltd.
Marine Technician	Takuya Izutsu
	Marine Works Japan, Ltd.
Marine Technician	Zu Paing
	Marine Works Japan, Ltd.

2. Purposes

KM24-03 leg. 1 cruise was conducted under the following research subjects:

- Understanding the current situations of marine pollutants, especially plastics and assessing their impact on marine ecosystems
- Understanding the biodiversity in deep sea using environmental DNAs and obtaining reference data on the diversity by ROV, baited camera system and shadowgraph camera observation
- Test for novel annotation system on the ROV videos and novel event detection system
- Obtaining physical oceanographic information as the reference data on the exchanges of deep-sea biodiversity and their monitoring

3. Results

3-1. KM-ROV dives

3-1-1. Dive lists

Date	Dive#	Site	Landing Leaving	Lat (N)	Lon (E)	Depth (m)	Short description
Apr. 18. 2024	262	Off Aogashima	8:42	32-25.92120	139-53.90150	806	Collection of RamaCam data and video images,
			10:01	32-25.80580	139-53.88570	809	Deployment of several research stuffs.
Apr. 20 2024	263	Off Aogashima	8:14	32-26.20470	139-54.69380	763	Collection of RamaCam data and video images,
			10:11	32-26.16740	139-54.70210	747	Deployment of several research stuffs.
Apr. 20 2024	264	Off Aogashima	13:35	32-26.12410	139-54.64930	775	Collection of RamaCam data and video images,
			16:14	32-26.19540	139-54.65640	763	Deployment and recovery of several research stuffs.
Apr. 23 2024	265	Off Hatsushima	11:53	35-00.93110	139-13.40900	927	Collection of deep-sea animals. Sediment
			15:01	35-00.95340	139-13.36600	856	samples, RamaCam data and video images

3-1-2 Dive reports (KM-ROV #262–265)

KM-ROV #262

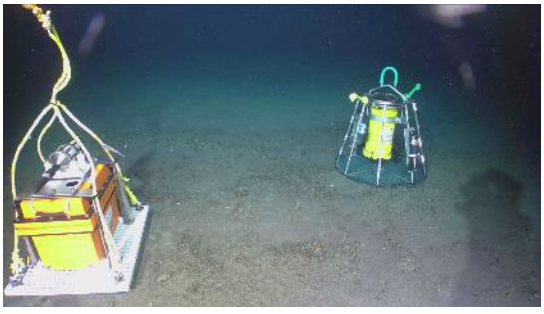
Date: April 18, 2024
Site: Higashi Aogashima knoll, Depth: 806 m
Landing (Lat., Lon., Time, Depth): 32°25.9220'N 139°53.9176'E, 08:42, 806 m
Leaving (Lat., Lon., Time, Depth): 32°25.8067'N 139°53.8980'E, 10:01, 809 m
Observer: FURUSHIMA, Yasuo

Theme: Prediction of marine biodiversity fluctuations and understanding the dynamics of pollutants

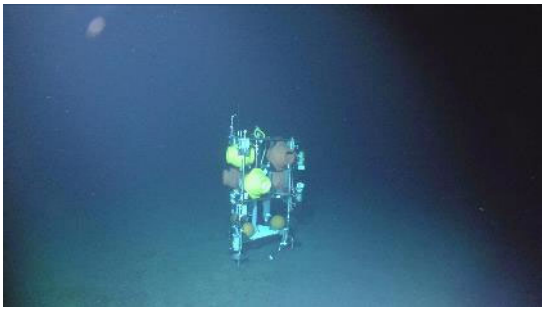
Purpose of dive:
1. Installation of ADCP (Acoustic Doppler Current Profiler).
2. Installation of underwater sound recorder (KANSO & AIST).
3. Confirmation of the installation status of the free-fall lander.
4. Measurement of suspended particles by RamaCam.
5. Seabed mapping by stereo camera.

Dive Summary

In this KM-ROV dive, we installed an ADCP and an underwater sound recorder for long-term measurements. This location is a relatively flat seabed about 1 km south of the Central Cone site (CC), where test drilling is planned. We also installed a free-fall lander at this location the day before, and we confirmed its installation status with the KM-ROV and conducted seabed mapping. Due to concerns about deteriorating sea conditions, we ended the dive after only installing the equipment and conducting a short period of seabed mapping.



Installation of ADCP and underwater sound recorder



Confirmation of the lander's installation status

Payload Equipment:

1. ADCP (Front)
2. Underwater sound recorder (Front)
3. Stereo camera (Front)
4. RamaCam (Rear)
6. Slurp gun (single caniste (Rear)

Front payload

Rear Payload

Sampling Points and Events:

Time	Position	Depth (m)	Events
08:42	32-25.9220N 139-53.9176E	806	Landing
09:06	32-25.8602N 139-53.9064E	809	Installation of ADCP (HOMER ID:99)
09:17	32-25.8602N 139-53.9064E	809	Installation of underwater sound recorder
09:33	32-25.8100N 139-53.9004E	807	Observation of the lander and mapping
10:01	32-25.8067N 139-53.8980E	809	Leaving

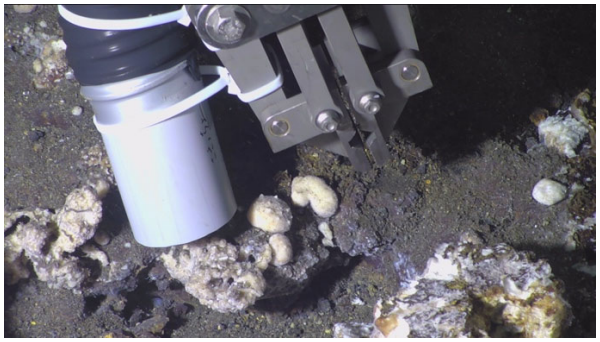
KM-ROV #263

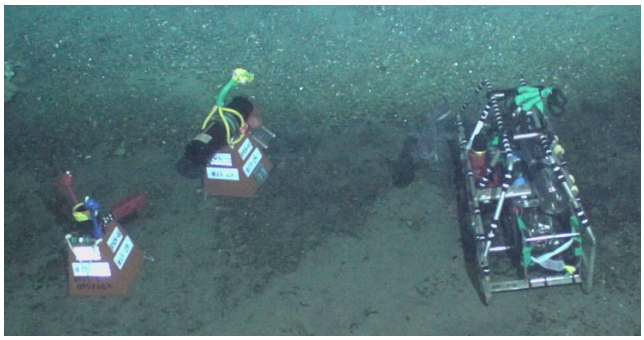
Date: April 20, 2024
Site: Izu-Ogasawara Arc, Higashi-Aogashima Vent Field (Southeast), Depth: 743–765 m
Landing (Lat., Lon., Time, Depth): 32°26.1898'N 139°54.7017'E, 08:14, 763 m
Leaving (Lat., Lon., Time, Depth): 32°26.1546'N 139°54.7394'E, 10:11, 747 m
Observer: Ayu Yuasa

Theme: Predicting changes in marine biodiversity and understanding the dynamics of pollutants

Purpose of dive:
1. Installation of chemical sensor/recorder system.
2. Installation of submarine cameras.
3. Installation of a sediment trap.
4. Biological sampling with a suction sampler.
5. Perimeter observation and seafloor mapping.
6. Observation of suspended particles by RamaCam.

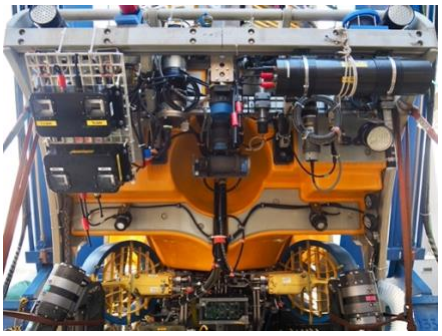
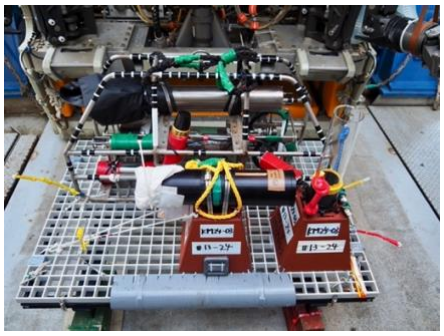
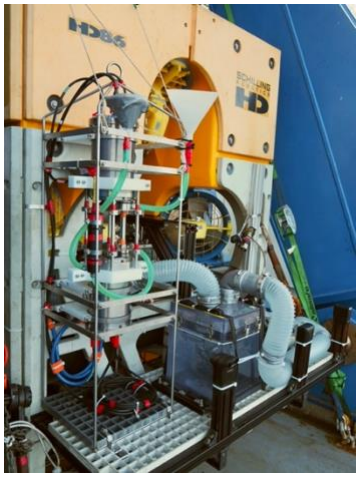
Dive Summary
After landing, submarine cameras, a sediment trap, and a chemical sensor/recording system were installed. After that, biological sampling using a suction sampler was conducted as necessary while observing the surrounding area. Subsequently, seafloor mapping was conducted using a 3D camera system. During the dive, observation of particles using RamaCam was performed.


Biological sampling


Installed equipment

Payload Equipment:
1. Suction sampler with a single bottled canister x1 (Rear)
2. Sediment trap x1 (Front)
3. Rama Cam (Rear)

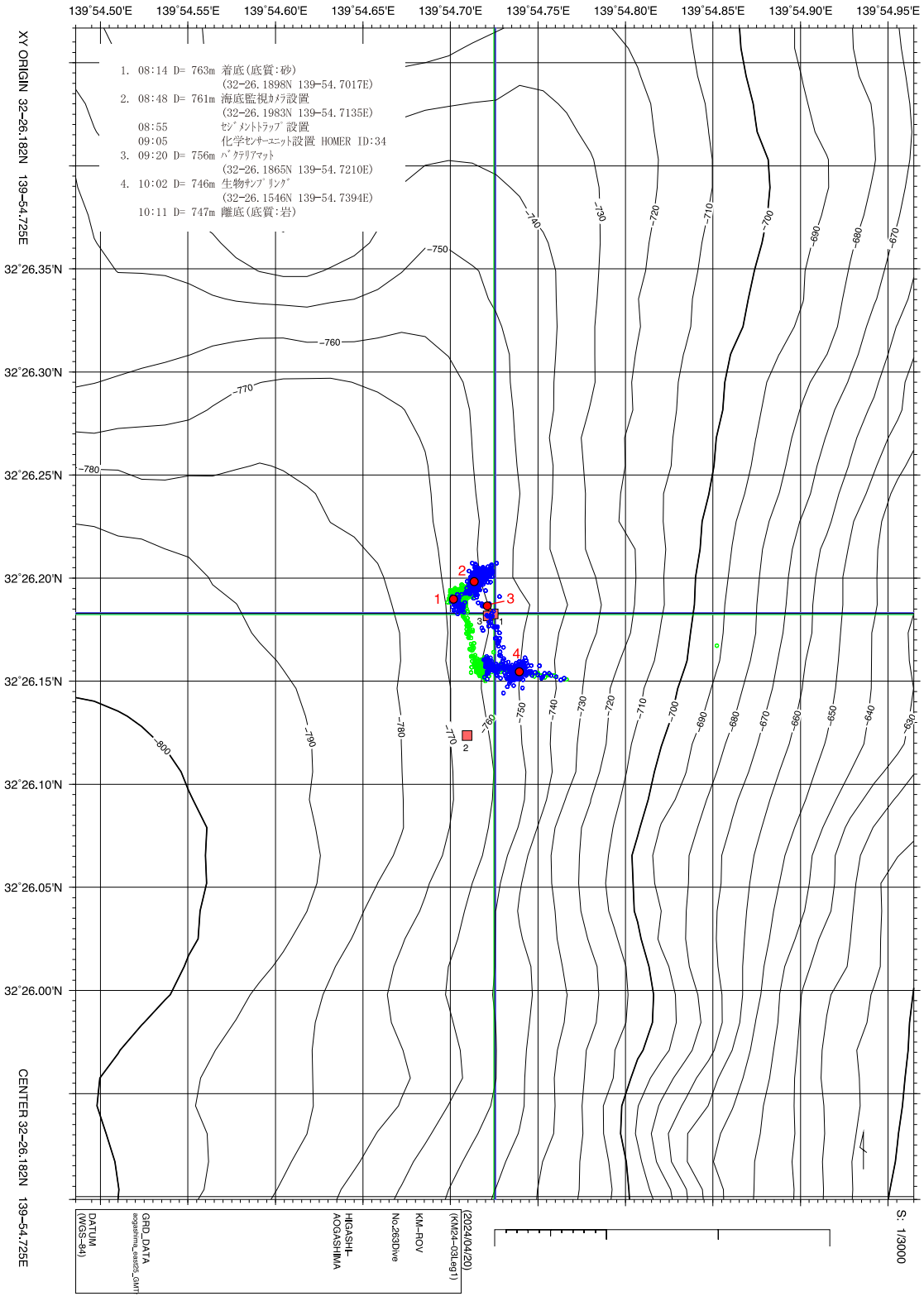
4. 3D mapping system (Front)
5. Submarine cameras (Front)
6. Chemical sensor/recording system (Front)

Sampling Points and Events

Time	Position	Depth (m)	Events
0814:	32-26.1898 N 139-54.7017 E	763	Landing
08:48	32-26.1983N 139-54.7135E	761	Instalation submarine camera
08:55	32-26.1983N 139-54.7135E	761	Installation a sediment trap
09:05	32-26.1983N 139-54.7135E	761	Installtaion chemical sensor/recording system
09:20	32-26.1865N 139-54.7210E	756	Bacteria mat
10:02	32-26.1546N 139-54.7394E	746	Biological sampling
10:11	32-26.1546N 139-54.7394E	747	Leaving

Dive track KM-ROV#263



KM-ROV #264

Date: April 20, 2024
Site: Izu-Ogasawara Arc, Higashi-Aogashima Vent Field (Southeast), Depth: 747–782 m
Landing (Lat., Lon., Time, Depth): 32°26.1176'N 139°54.6709'E, 13:35, 772 m
Leaving (Lat., Lon., Time, Depth): 32°26.2081'N 139°54.7131'E, 16:14, 763 m
Observer: Tetsuro Ikuta

Theme: Prediction of changes in marine biodiversity and understanding of pollutant dynamics

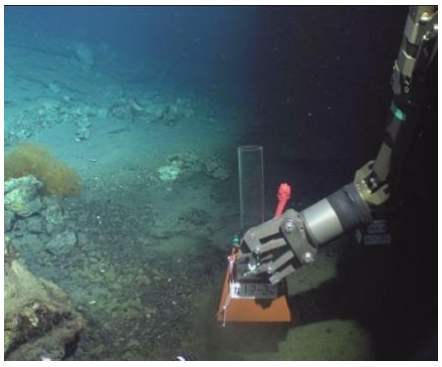
Purpose of dive:

7. Recovery of chemical sensor/recorder (CS/R) system.
8. Installation of a sediment trap.
9. Biological sampling with a suction sampler.
10. Sampling of chimneys in a box.
11. Perimeter observation and seafloor mapping.
12. Observation of suspended particles by RamaCam.

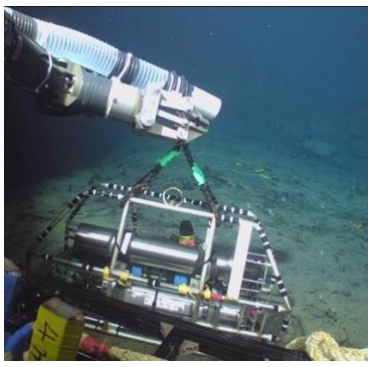
Dive Summary

After landing, biological samples were collected using a suction sampler and chimney samples were collected in a sample box. Subsequently, seafloor mapping was conducted using a 3D camera system and a sediment trap was installed. Finally, the chemical sensor/recording system installed at Dive 263 was recovered, and the ROV left the bottom. During the dive, observation of suspended particles using RamaCam was performed.

Biological sampling



Installation of a sediment trap

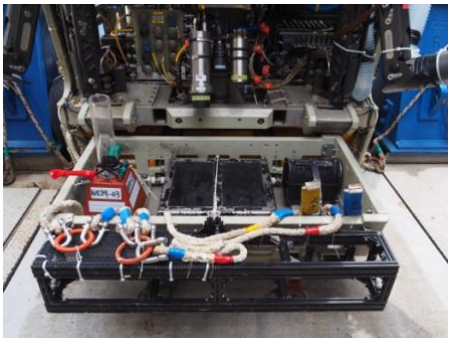


Recovery of CS/R system

Payload Equipment:

7. Suction sampler with a single bottled canister x1 (Rear)
8. Sample box x1 (Front)

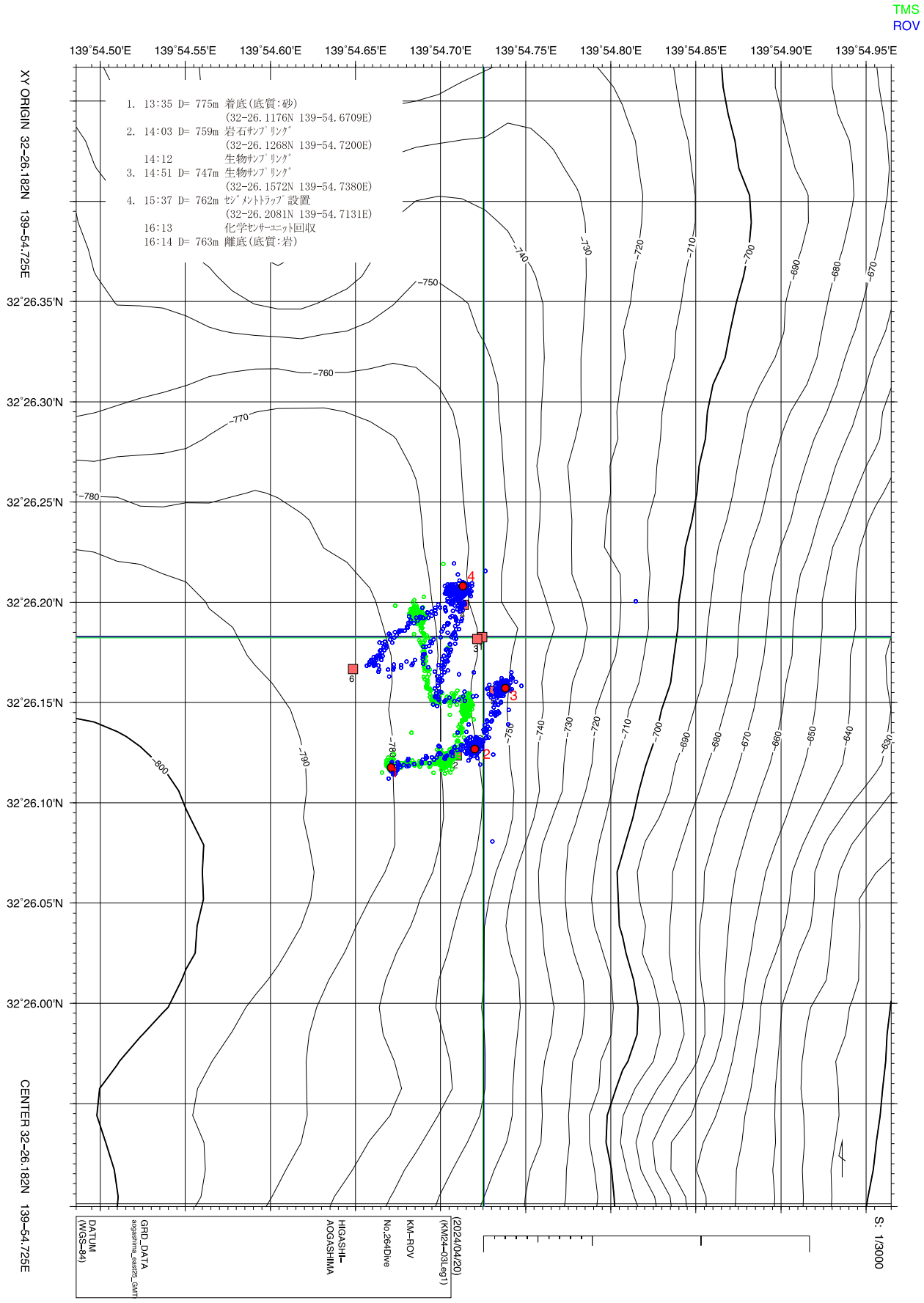
9. Kumade sampler x1 (Front)
10. Sediment trap x1 (Front)
11. RamaCam (Rear)
12. 3D mapping camera (Front)



Sampling Points and Events

Time	Position	Depth (m)	Events
13:35	32-26.1176N 139-54.6709E	775	Landing
14:03	32-26.1268N 139-54.7200E	759	Chimney sampling
14:12	32-26.1268N 139-54.7200E	759	Biological sampling
14:51	32-26.1572N 139-54.7380E	747	Biological sampling
15:37	32-26.2081N 139-54.7131E	762	Installation of a sediment trap
16:13	32-26.2081N 139-54.7131E	762	Recovery of chemical sensor/recorder system
16:14	32-26.2081N 139-54.7131E	763	Leaving

Dive track KM-ROV#264



KM-ROV #265

Date: April 23, 2024
Site: Off Hatsushima, Sagami Bay, Depth: 856–927 m
Landing Point: 35°00.9307'N, 139°13.3945'E, D=927m
Leaving Point: 35°00.9552'N, 139°13.3162'E, D=856m
Observer: Takao Yoshida (JAMSTEC)

Theme: Prediction of changes in marine biodiversity and understanding of pollutant dynamics

Purpose of dive:

13. Biological sampling with a suction sampler and a scup samplers.
14. Core sampling with MBARI-push core.
15. Perimeter observation and seafloor mapping.
16. Observation of suspended particles by RamaCam.

Dive Summary

After landing, biological samples were collected using a suction sampler at a depth of 906m. We moved to the *Calyptogena* clam colony at 857m. Five core samples were collected by MBARI push corers and biological samples were collected in a box. Then, we left the bottom as scheduled. During the dives, seafloor mapping was conducted using a 3D camera system and observation of suspended particles using RamaCam was performed.

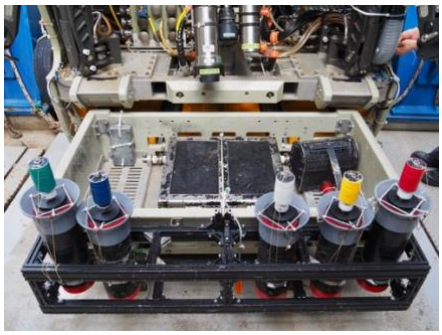
Biological sampling using a suction sampler

Core sampling

Payload Equipment:

13. Suction sampler with a single bottled canister x1 (Rear)
14. Sample box x1 (Front)
15. Kumade sampler x1 (Front)

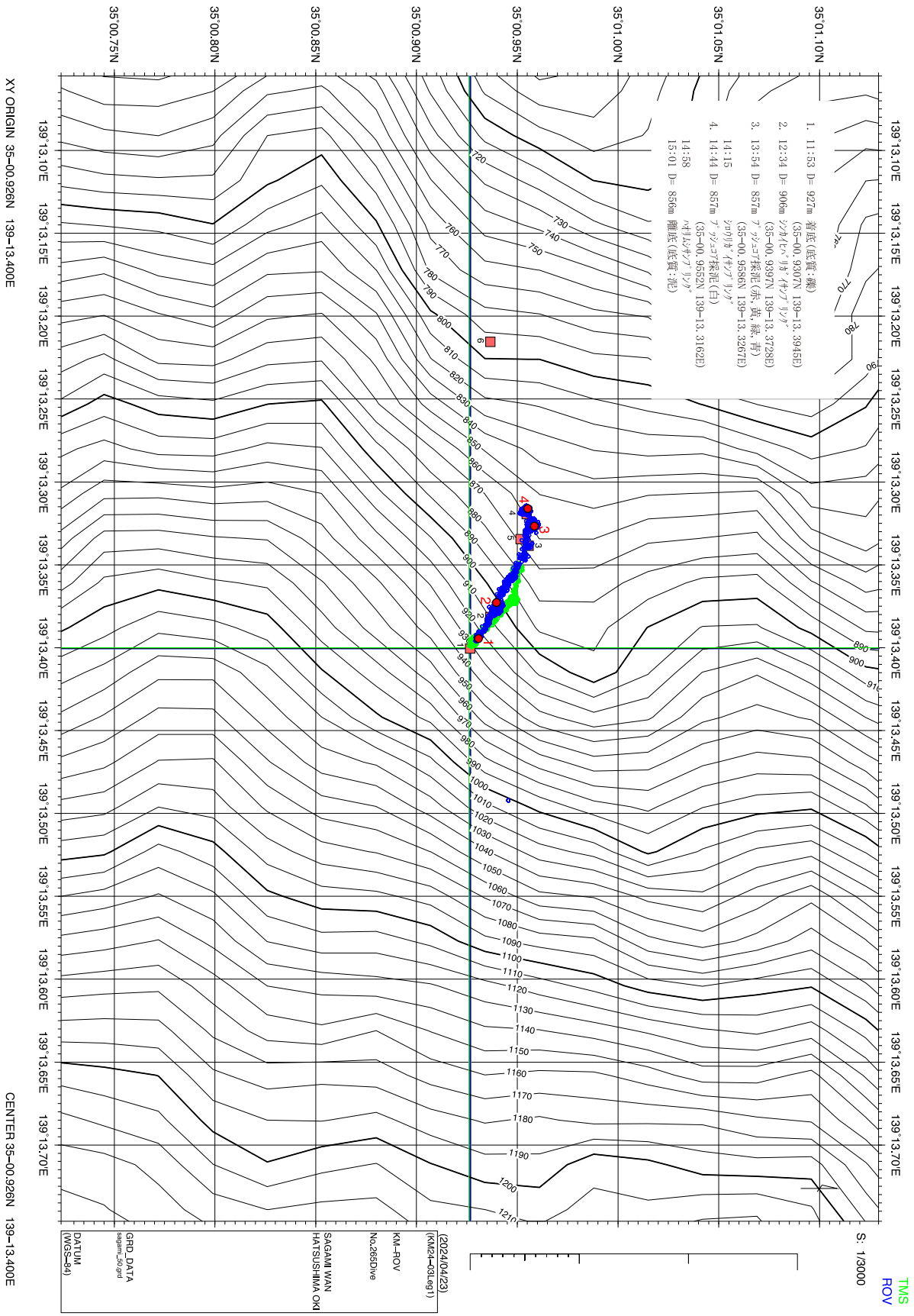
16. MBARI push corer x5 (Front)
17. RamaCam (Rear)
18. 3D mapping camera (Front)



Sampling Points and Events

Time	Position	Depth (m)	Events
11:53	35-00.9307N 139-13.3945E	927	Landing
12:34	35-00.9397N 139-13.3728E	906	Biological sampling
13:54	35-00.9586N 139-13.3267E	857	Core sampling
14:15	35-00.9586N 139-13.3267E	857	Biological sampling
14:44	35-00.9552N 139-13.3162E	857	Core sampling
14:58	35-00.9552N 139-13.3162E	857	Biological sampling
15:01	35-00.9552N 139-13.3162E	856	Leaving

Dive track KM-ROV#265



3-2. CTD water samplings

Environmental DNA (eDNA) metabarcoding analysis provides a useful method for estimating the biodiversity in aquatic ecosystems. Thus, water samplings for eDNA analysis using Niskin bottles with CTD (Fig. 1) were conducted for monitoring of deep-sea biodiversity. During this cruise, water samplings were collected at Aogashima and Sagami Bay. Collected waters were immediately filtrated with Sterivex filters (listed in table 1). After filtration, approximately 2.0 mL of RNAlater was immediately filled into the Sterivex filter. Sterivex filters were refrigerated at 4°C for overnight and were stored at -80°C. After the cruise, eDNA analysis for metabarcoding of marine organisms will be conducted for understanding of deep sea biodiversity.

Fig. 3.2 CTD with Niskin bottles

Date（JST)	CTD ID.	Time (JST)	Latitude	Longitude	Depth (m)	Site No	Niskin No.	Filter Name
2024/4/19	013M001	10:11	32-26.14N	139-54.45E	786	13-#24, South East	5,6,7	KM24-03C1N1
2024/4/19	013M002	12:25	32-26.24N	139-53.92E	777	13-#26, Center Corn	33,34,35	KM24-03C2N1
2024/4/19	013M003	16:41	32-27.61N	139-55.06E	746	13-#25, East	33,34,35	KM24-03C3N1
2024/4/21	009M001	8:36	34-40.56N	138-23.77E	0	#9, Suruga Bay	bucket	KM24-03_S1
2024/4/21	009M001	8:36	34-40.56N	138-23.77E	486	#9, Suruga Bay	1～12	KM24-03_C4N1～12
2024/4/21	009M001	8:36	34-40.56N	138-23.77E	440	#9, Suruga Bay	13～24	KM24-03_C4N13～24
2024/4/21	009M001	8:36	34-40.56N	138-23.77E	100	#9, Suruga Bay	25～36	KM24-03_C4N25～36
2024/4/21	003M001	11:59	34-33.86N	138-34.49E	0	#3, Suruga Bay	bucket	KM24-03_S2
2024/4/21	003M001	11:59	34-33.86N	138-34.49E	2530	#3, Suruga Bay	1～9	KM24-03_C5N1～9
2024/4/21	003M001	11:59	34-33.86N	138-34.49E	1000	#3, Suruga Bay	10～18	KM24-03_C5N10～18
2024/4/21	003M001	11:59	34-33.86N	138-34.49E	440	#3, Suruga Bay	19～27	KM24-03_C5N19～27
2024/4/21	003M001	11:59	34-33.86N	138-34.49E	100	#3, Suruga Bay	28～36	KM24-03_C5N28～36
2024/4/22	007M001	8:43	34-41.41N	138-33.00E	0	#7, Suruga Bay	bucket	KM24-03_S3
2024/4/22	007M001	8:43	34-41.41N	138-33.00E	1466	#7, Suruga Bay	1～9	KM24-03_C6N1～9
2024/4/22	007M001	8:43	34-41.41N	138-33.00E	1000	#7, Suruga Bay	10～18	KM24-03_C6N10～18
2024/4/22	007M001	8:43	34-41.41N	138-33.00E	440	#7, Suruga Bay	19～27	KM24-03_C6N19～27
2024/4/22	007M001	8:43	34-41.41N	138-33.00E	100	#7, Suruga Bay	28～36	KM24-03_C6N28～36
2024/4/22	004M001	16:58	34-39.41N	138-37.40E	0	#4, Suruga Bay	bucket	KM24-03_S4
2024/4/22	004M001	16:58	34-39.41N	138-37.40E	1000	#4, Suruga Bay	1～12	KM24-03_C7N1～12
2024/4/22	004M001	16:58	34-39.41N	138-37.40E	440	#4, Suruga Bay	13～24	KM24-03_C7N13～24
2024/4/22	004M001	16:58	34-39.41N	138-37.40E	100	#4, Suruga Bay	25～36	KM24-03_C7N25～36
2024/4/23	006M001	5:01	34-41.97N	138-35.03E	0	#6, Suruga Bay	bucket	KM24-03_S5
2024/4/23	006M001	5:01	34-41.97N	138-35.03E	2043	#6, Suruga Bay	1～9	KM24-03_C8N1～9
2024/4/23	006M001	5:01	34-41.97N	138-35.03E	1000	#6, Suruga Bay	10～18	KM24-03_C8N10～18
2024/4/23	006M001	5:01	34-41.97N	138-35.03E	440	#6, Suruga Bay	19～27	KM24-03_C8N19～27
2024/4/23	006M001	5:01	34-41.97N	138-35.03E	100	#6, Suruga Bay	28～36	KM24-03_C8N28～36
2024/4/24	005M001	8:33	34-44.93N	138-40.41E	0	#5, Suruga Bay	bucket	KM24-03_S6
2024/4/24	005M001	8:33	34-44.93N	138-40.41E	496	#5, Suruga Bay	1～12	KM24-03_C9N1～12
2024/4/24	005M001	8:33	34-44.93N	138-40.41E	440	#5, Suruga Bay	13～24	KM24-03_C9N13～24
2024/4/24	005M001	8:33	34-44.93N	138-40.41E	100	#5, Suruga Bay	25～36	KM24-03_C9N25～36
2024/4/24	010M001	13:30	34-51.05N	138-42.07E	0	#10, Suruga Bay	bucket	KM24-03_S7
2024/4/24	010M001	13:30	34-51.05N	138-42.07E	488	#10, Suruga Bay	1～12	KM24-03_C10N1～12
2024/4/24	010M001	13:30	34-51.05N	138-42.07E	440	#10, Suruga Bay	13～24	KM24-03_C10N13～24
2024/4/24	010M001	13:30	34-51.05N	138-42.07E	100	#10, Suruga Bay	25～36	KM24-03_C10N25～36
2024/4/25	012M001	7:48	35-03.42N	138-43.50E	0	#12, Suruga Bay	bucket	KM24-03_S8
2024/4/25	012M001	7:48	35-03.42N	138-43.50E	988	#12, Suruga Bay	1～12	KM24-03_C11N1～12
2024/4/25	012M001	7:48	35-03.42N	138-43.50E	440	#12, Suruga Bay	13～24	KM24-03_C11N13～24
2024/4/25	012M001	7:48	35-03.42N	138-43.50E	100	#12, Suruga Bay	25～36	KM24-03_C11N25～36
2024/4/25	011M001	11:57	34-53.97N	138-38.50E	0	#11, Suruga Bay	bucket	KM24-03_S9
2024/4/25	011M001	11:57	34-53.97N	138-38.50E	1572	#11, Suruga Bay	1～9	KM24-03_C12N1～9
2024/4/25	011M001	11:57	34-53.97N	138-38.50E	1000	#11, Suruga Bay	10～18	KM24-03_C12N10～18
2024/4/25	011M001	11:57	34-53.97N	138-38.50E	440	#11, Suruga Bay	19～27	KM24-03_C12N19～27
2024/4/25	011M001	11:57	34-53.97N	138-38.50E	100	#11, Suruga Bay	28～36	KM24-03_C12N28～36

Table 3.2. Summary of the CTD water sampling measurement.

3-3. Acquisition of Baseline Data Necessary for Verification and Development of Environmental Impact Assessment Technology

During this voyage, we conducted investigations for the development of survey techniques for creating a comprehensive environmental impact assessment package and for acquiring baseline data at the Higashi-Aogashima Seamount, where BMS drilling is planned for August this year. When conducting seabed drilling, it is necessary to conduct environmental impact assessment surveys before, during, and after drilling. In this voyage, we conducted environmental surveys assuming pre-drilling surveys.

3-3-1. Environmental Measurement by Free-Fall Lander

We installed a free-fall lander (Fig.3-3-1) at a point south of the planned drilling point and collected environmental data for about three days (Table 3-3-1). The free-fall lander is equipped with a camera system to capture the seabed environment (Fig.3-3-2), a shadowgraph camera that can photograph plankton (suspended particles) in high resolution and identify the number and species, a RINKO Profiler (CTD) that measures water temperature, salinity, turbidity, and dissolved oxygen, and high-accuracy single-point acoustic current meter (ADV) that can estimate deep-sea turbulence, each of which collected environmental data. In addition, we simultaneously conducted water sampling with a water sampler attached to the lander and mud sampling with core sampler attached to each leg.

Fig.3-3-1 Free-fall lander

Observation Point	Higashi Aogashima knoll	
Location (Lat. and Long.)	32-25.8099 N	139-53.8962 E
Depth (m)	814.5m	
Lander input time	2024/4/17 08:39	
Installation time	2024/4/27 09:00	
Descent speed(m/min)	39.4m/min (814.5m/21min)	
Start time of surfacing	2024/4/20 11:06	
Lander unfacing time	2024/4/20 11:20	
Surfacing speed (m/min)	54.7m/min (814.5m/14min)	
Installation period (hour)	74	

Table.3-3-1 Information on the lander installation

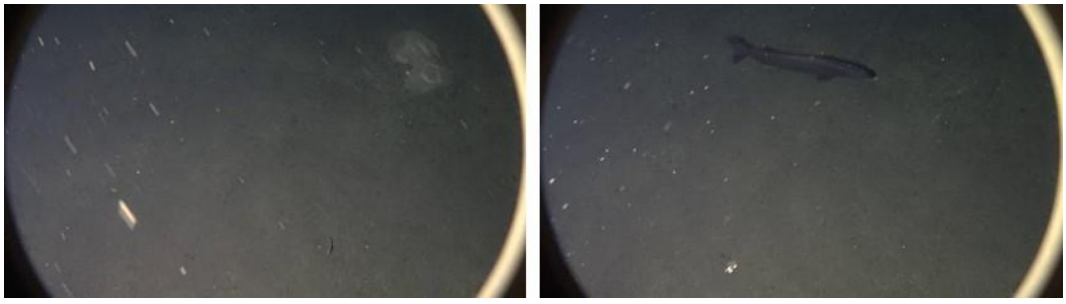


Fig.3-3-2 Capture image of Lander camera system

3-3-2. Turbulence Measurement by Expendable Vertical Microstructure Profiler (VMP-X)

Near the installation point of the free-fall lander, we conducted a turbulence measurement using VMP-X to understand the mixed environment from the ocean surface to just above the seabed. Although it is a preliminary value, the value of the turbulence kinetic energy dissipation rate (ε), an indicator of deep-sea turbulence intensity near the seabed, was large at $10^{-7.5}$ (W/kg) (Fig.3). This is presumed to be due to the complex seabed topography and the influence of hydrothermal venting, which are characteristic of hydrothermal areas. In addition, the actual measured value of turbulence intensity obtained with VMP-X is compared with the estimated value of turbulence intensity that can be calculated from the ultrasonic flowmeter attached to the free-fall lander, and is used to verify the estimated value of turbulence intensity that can be obtained over time.

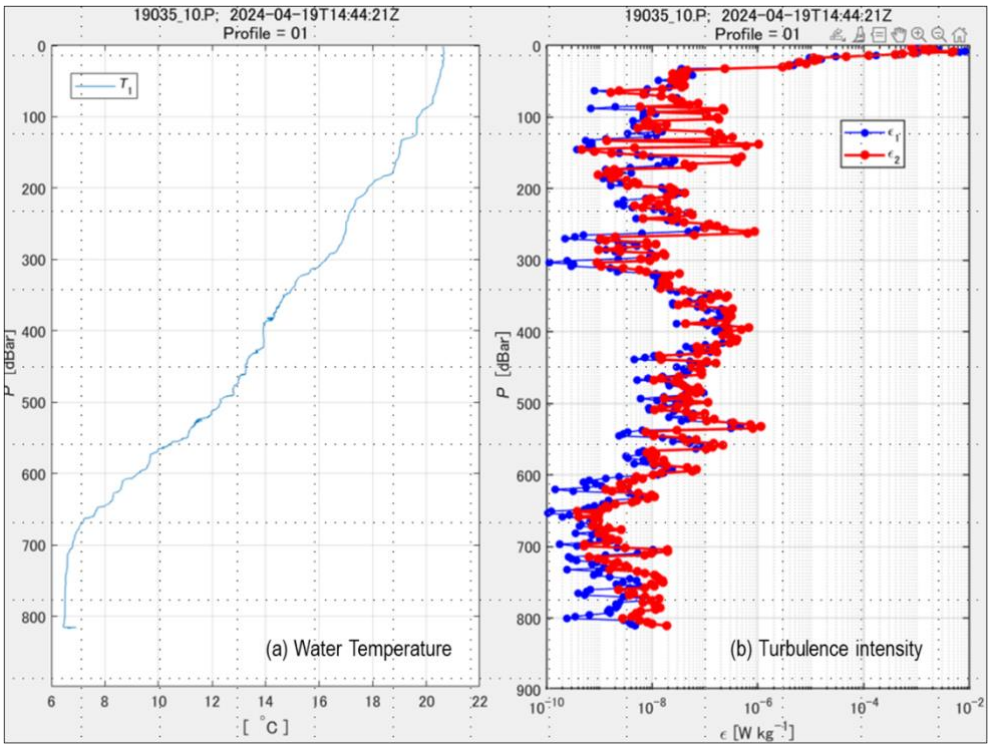


Fig. 3-3-3 Vertical fluctuation of water temperature and turbulence intensity using VMP-X.

3-3-3. CTD, Water Sampling, XCTD Observation

At the BMS drilling planned point of Higashi-Aogashima Seamount (3 points: East Site, Southeast Site, Central Corn Site), we conducted CTD and water sampling surveys (Fig.4). In the CTD observation, in addition to water sampling for extracting environmental DNA, we also conducted flow measurement by LADCP, particle size and particle diameter measurement of suspended matter by LISST, and image acquisition of suspended matter by shadowgraph camera. In addition, we conducted east-west cross-sectional observation (3 east-west survey lines) by XCTD and obtained water temperature and salinity data to capture the marine environment around the seamount in three dimensions.

Fig. 3-3-4 CTD system with LADCP, LISST, shadowgraph camera

3-3-4. Installation of ADCP, Seabed Observation Camera, Simple Sediment Trap

In order to monitor long-term environmental changes from before to after BMS drilling, we installed an Acoustic Doppler Current Profiler (ADCP) capable of measuring flow direction and speed in multiple layers and an underwater recorder (AIST, KANSO jurisdiction) near the installation point of the free-fall lander (south side of the planned drilling point) (Fig.5). In addition, we installed a seabed observation camera and a simple sediment trap near the Southeast Site where drilling is planned, and started monitoring the seabed environment (Fig.6). These are planned to be collected in the next fiscal year's voyage.

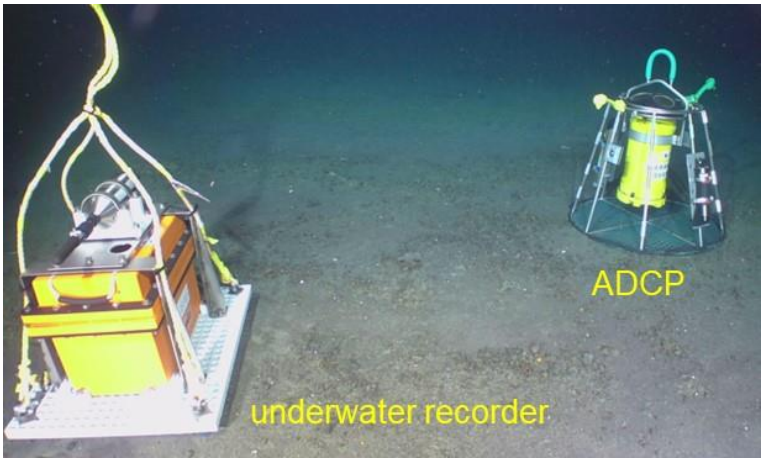


Fig. 3-3-5 ADCP and underwater recorder installed on the seabed of Higashi Aogashima Knoll.

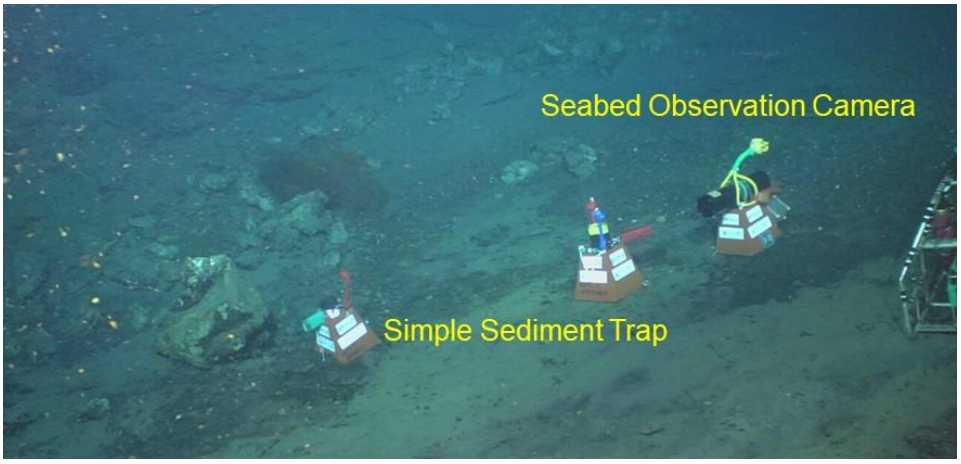


Fig. 3-3-6 Seabed observation camera and simple sediment trap installed at the South East site of Higashi Aogashima Knoll.

From these survey results, it is expected that the dynamics of suspended matter in the mixed environment near the seabed can be comprehensively evaluated. In addition, it is also expected that the verification of environmental impact assessment technology will be possible by conducting similar surveys even after the test drilling.

3-4. Imaging Survey

3-4-1. Stereo Mapping with KMROV

Two stereo camera units (URDeep01 & URDeep02) were mounted on a grate on the front, starboard side of the KMROV and were powered by a battery unit (Li-Po 6S, 22.2V, 28Ah, 621Wh) mounted on the front port side of the ROV. The battery unit is 140 mm in diameter and 584.3 mm long (weight in air 16.7 kg, weight in water 7.5 kg) and has two eight pin Subconn mini connectors (MCBH8F), each providing DC24V power on pin 1 and ground on pin 2, with the connector opposite the vent plug also providing power on pin 3 with ground on pin 4. A third MCBH8F connector (labelled BC) is for the battery cell monitoring Balance Charger system. The internal battery is charged through the power connector opposite the vent plug (with four connected pins) and the monitoring BC connector using a Blue Robotics H6 PRO Battery Charger with in-house cables. Powering the two cameras the battery should last for more than twelve hours and possibly up to twenty-four hours (but still unchecked!)

Fig. 3-4-1Stero Mapping camera introduced on the upper frame of KM-ROV

URDeep01 recorded at 2.7K resolution with a 50 degree opening angle, while URDeep02 recorded in 4K resolution with a 130 degree opening angle. Each URDeep camera has the following physical specifications: W280 mm × D170 mm × H110 mm, weight in air: 10kg, weight in water: 9kg. Each camera has two bulkhead connectors, with the eight pin Subconn mini connector

(MCBH8M) being for power supply from the battery and a four pin Subconn mini connector with a guiding pin currently unused. When power is supplied, the Jetson Nano PC inside the camera housing starts and its web server can be accessed via a web browser over the WiFi network it provides (URDeep01: 192.168.77.77:5500, URDeep02: 192.168.77.80:5500). Recording start, stop, file copying/downloading and deleting, set camera time to current PC time and other functions can be accessed in this way.

3-4-2. Shadowgraph camera imaging

Shadowgraph cameras developed in house at JAMSTEC were deployed on the CTD rosette and one system was also deployed on the Lander System. The shadowgraph camera deployed on the Lander System had a circular imaged area of 100 mm. Both this system and one with a circular imaged area of 60 mm were deployed on the CTD rosette. Both of these systems are rated to 1500 m depth and the imaging devices record at 4096 X 3042 pixel resolution.

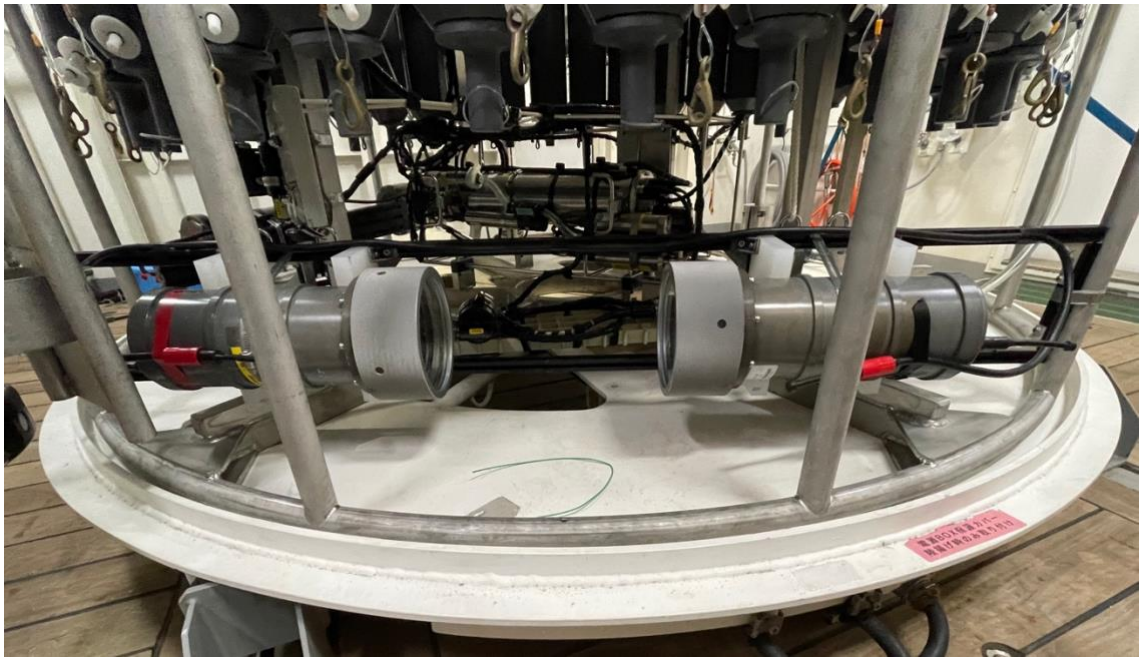


Fig. 3-4-1 Shadow graph camera introduced on the CTD frame

3-5. RamaCam observation

The RamaCam, an integrated system of holographic camera and Raman spectroscopy for particle identification/classification, was deployed four times during the cruise. The RamaCam is the second generation and was developed at JAMSTEC in 2024, as shown in Fig. 3-4. We tested the real-time automated particle detection and measurement program; 1.detection of a particle in a holographic image, 2. pump off to trap the particles by stopping flow in a flow cell, 3. Raman measurement of the particle, 4. pump on to release the particle and wait for a new particle (holography is always on).

Fig. 3-4 RamaCam on the KM-ROV.

First three dives were performed at Higashi-Aogashima, and the last dive was performed at off Hatsushima, Sagami Bay. We observed particles regularly in the holographic images at the seafloor. The parameters and codes were adjusted and improved to detect particles reliably using the obtained holographic images, and we succeeded in stopping the flow immediately for Raman measurements in the last two dives. Some particles stayed in the chamber and Raman measurements were performed onto them, however, some escaped from the chamber before starting Raman measurements. It is assumed to be because the capturing frame rate of camera slowed down due to overheat then the flow became too fast to keep particles in the chamber. Further improvement is necessary to increase the particle detection algorithm and to reduce flow speeds so that particles are reliably trapped in the chamber by adding valves.

3-6. Plankton net sampling.

The small plankton net is used to collect live plankton and deep-sea suspended particles. The net is designed for vertical towing from the surface of the ocean to a depth of 800 m. The depth of the net is estimated from the line inclination angle. Plankton is collected by throwing the net over the side of the ship with your hands. After capturing images of the specimens, DNA barcoding is attempted.

The composition of small plankton net:

(1) Fishing rod: Power Fighter GONG (230 g) for tuna, total length 2.3 m, weight load (No.): 400- 600 (1.5-2.25 kg weights are considered the most suitable)

(2) Electric reel: Miya Epoch US-50R, drag resistance 34-80 kg, instantaneous maximum lifting force 130 kg, Winding speed (no load) 110 m/min, shifting: stepless (pause to maximum speed). specification (such as rollable weight), the line is 12 series of Yotsuami Ultra Dyneema No. 30 Tie (strength 120 kg)

(3) Fishing rod and electric reel fixing device: Miya Epoch Maximum X (bat type G2), left Right operating angle approx. 150°.

(4) Net: ring net 50 cm by 230 cm in dimension with two mesh sizes, 1 mm and 330 μm. The codend is 9.6 cm by 18.7 cm in dimension. The codend can hold approximately 1 L of seawater.

Operation method when using a fishing rod:

With the vessel drifting, in consideration of the wind direction and tidal current, the fixed platform is appropriately placed on the starboard or port side of the vessel. It will be installed in places and a small plankton net will be introduced. A small plankton net is sunk to a depth of up to 800 m, and the plankton net is towed vertically and recovered by winding it with an electric reel. This work will be carried out only when there is time to carry it out, and the purpose is to collect samples for DNA metabarcoding. The electric reel is wound with 1,200 m of thread (breaking strength 120 kg). Since the electric reel has a drag function, the tension force is set to about half the breaking strength of the thread. The locking device is designed to touch the rod 150° left and right, so you can pull the tip to your hand. In addition, the rod has a structure that can be folded and fixed on the ship side. While attached to the tip of the small plankton net thread, remove the cod end at the bottom end of the small plankton net, put the sample in a bucket, and transport it to the wet lab for analysis.

Summary of small plankton net tows carried out during KM24-03 leg. 1

Date	Time (local, JST)	Position	Location
2024/4/17	13:26-16:46	32-25.88180N 139-53.86640E	Off Aogashima #24
2024/4/21	13:30-TBC	34-33.86770N 138-34.49860E	Suruga Bay #3
2024/4/22	9:45- TBC	34-41.41880N 138-33.00200E	Suruga Bay #7
2024/4/22	14:02- TBC	34-41.47710 138-32.96140E	Suruga Bay #4
2024/4/24	09:13- TBC	34-44.97370N 138-40.43590E	Suruga Bay #5
2024/4/24	14:11- TBC	34-51.12240N 138-42.06300E	Suruga Bay #10
2024/4/25	08:31- TBC	35-03.42780N 138-43.50340E	Suruga Bay #12
2024/4/25	12:50- TBC	34-53.97880N 138-38.50600E	Suruga Bay #11

3-7. Elucidation of Marine-Atmospheric-Terrestrial Interactions of Micro-and Nanoplastics.

The upper ocean air was sampled off the Pacific Ocean, Suruga Bay, and Sagami Bay using an MCI sampler at a flow rate of 20 L/min every 6 days. Fallouts was collected at each precipitation event using a rainwater sampler. For the MCI sampler, the sampling was done by wind direction and wind speed to prevent contamination by exhaust gases from the ship, and the pump was stopped when the wind speed did not meet the conditions. On board, collected filters were stored in centrifuge tubes or glass petri dishes according to particle size. After that, the filters were subjected to water extraction, organic decomposition with 30% hydrogen peroxide, and mineral removal with 5.3M NaI. Subsequently, polymer identification and particle size are measured using the μFTIR-ATR imaging method.

3-8. In-situ Gamma-Ray sensor observation

The high sensitivity and lightweight underwater in-situ gamma-ray sensor using NaI(Tl) doped plastic scintillator was developed for oceanographic applications. The plastic scintillator was coated by light-resistant paint and used as a part of pressure housing. Therefore, the sensor can expect high sensitivity because the plastic scintillator contacts seawater directly. This sensor consists of plastic scintillator, photomultiplier tube, preamplifier unit, high-voltage power supply, data logger and lithium-ion battery, and all parts are stored in a pressure housing.

The in-situ gamma-ray sensor was installed to the CTD/CWS frame and in-situ vertical data of gamma-rays was measured every 5 seconds during descent and ascent of the CTD/CWS system at #25 (32°27.62N, 139°55.06E) and #26 (32°26.24N, 139°53.92E) in Higashi-Aogashima Caldron. The sensor was deployed at the South East Site of Higashi-Aogashima Caldron (#24: 32°26.20N, 139°53.91E) at KMROV #263 dive and observed the gamma-rays originating from hydrothermal activity every 60 seconds for 6 hours. The sensor detected the hydrothermal gamma-rays in 600 m depth (about 150 m above the bottom) at #26 and monitored background level of gamma-rays at hydrothermal area.

3-9. Exploration of enzymes for the degradation of polysaccharides and plastics

The global challenge of transitioning to a sustainable society in harmony with the Earth's environment requires the further utilization of enzymes. The discovery of novel and valuable enzymes, particularly those capable of degrading polysaccharides and plastics, is essential to this effort. We have developed methods based on microbial single-cell analysis to access enzymatic resources from environmental microorganisms efficiently. The outline of the methods is as follows:

1. Environmental microbes are encapsulated in water-in-oil microdroplets at the single-cell level to screen for microbial cells with enzymatic activities of interest.
2. The microbial cells are recovered and subjected to whole genome amplification.
3. The amplified genomes are sequenced to identify the target enzyme genes.

During this cruise, we collected seawater from nine different locations.

3-10. Seawater collection for isolation of possible microplastic degrading bacterial strains

The main objective for seawater sampling is to investigate the marine bacterial species involved in the degradation of compounds related to microplastics including plastic polymers and plasticizers. The research activity of seawater sampling started from 21 April 2024 to 24 April 2024 focusing on 3 areas of sampling, 1) close proximity to coastal areas (within the bay), 2) relatively distant from coastal areas (within the bay) and 3) open sea (outside Suruga bay).

Sampling Date	Sampling Time	Voyage point	GPS Coordinates
21 Apr 2024	8:34	#9	34.8488889, 138.4047
21 Apr 2024	11:59	#3	34.5738889, 138.5802
22 Apr 2024	8:44	#7	34.6947222, 138.5500
24 Apr 2024	13:30	#10	34.8513889, 138.7019
24 Apr 2024	7:50	#12	34.0616667, 138.7305

Table. 3-10 Summary of seawater sampling sites during KM24-03 Leg. 1

Method of seawater collection

Seawater samples were collected by using buckets before transferred into polyethylene water tanks utilizing plastic funnels. A total of 10 L seawater was collected at each voyage point. To preserve the condition of samples, water tanks were stored in refrigerator and transported cold to destination laboratory in Saitama city. Marine bacterial cell will be concentrated and enriched for strain isolation and further analyses.

3-11. H-type push core sampling – POPs contamination analysis

Some organic compounds are resistant to environmental degradation and can accumulate in organisms, thereby causing harmful effects. These chemicals are called persistent organic pollutants (POPs) and they have been of great academic and social interest since the late 20th century. We recently reported that polychlorinated biphenyls (PCBs), a long-known POPs, were detected in deep-sea bivalves in Sagami Bay, located near a highly populated region (Ikuta et al., 2021). Furthermore, despite a previous observation of very low levels of marine debris in Myojin Knoll (Nakajima et al., 2021), which is a relatively remote area located far from dense human activity, our recent report showed that PCB contamination in deep-sea mussels collected from this area is comparable to that in *Phreagena* clams collected from Sagami Bay (Ikuta et al., 2021). In our most recent study, PCBs were also detected in the sediments of the *Phreagena* clam habitat in Sagami Bay and were found to accumulate in their ovaries, raising concerns about a potentially severe direct impact on the survival of vulnerable and highly endemic deep-sea chemosynthetic bivalves (Ikuta et al., 2024).

To investigate the contamination of chemosynthetic habitats in Sagami Bay by POPs recently listed in the Stockholm Convention, in this cruise we have collected bottom sediment samples from these areas using an H-type push corer. On the ship, the outer parts of the sediment cores that had contacted the polycarbonate tube during sampling were trimmed off. The samples were stored in clean glass bottles at −20°C. After the cruise, the amounts of POPs will be analyzed.

Fig. 3-10 Overview of the core sample

References

Ikuta, T., Nakajima, R., Tsuchiya, M., Chiba, S., and Fujikura, K. (2021). Interdecadal distribution of persistent organic pollutants in deep-sea chemosynthetic bivalves. Front. Mar. Sci. 8, 1735. doi: 10.3389/fmars.2021.751848.

Ikuta, T., Nomaki, H., and Nakajima, R. (2024). Accumulation of polychlorinated biphenyls in the ovaries of deep-sea chemosynthetic clam Phreagena okutanii. Front. Mar. Sci. 11. doi: 10.3389/fmars.2024.1358774.

Nakajima, R., Tsuchiya, M., Yabuki, A., Masuda, S., Kitahashi, T., Nagano, Y., et al. (2021). Massive occurrence of benthic plastic debris at the abyssal seafloor beneath the Kuroshio Extension, the North West Pacific. Mar. Pollut. Bull. 166, 112188. doi: 10.1016/j.marpolbul.2021.112188.

3-12. Physiological impacts of microplastics on deep-sea megabenthic animals

It is becoming obvious that the abundance of microplastics is increasing in worldwide oceans, raising concerns about their impact on marine ecosystems. As microplastics occupy a similar size range as some planktons, suspended particles, and marine sediments, they are potentially bioavailable to many organisms. Animals living in the deep seas are no exception. However, the distribution of microplastics in deep-sea animals and the physiological impacts of microplastics on them have been poorly understood. We have recently reported that microplastic particles were internalized via the body surface into gill cells of deep-sea mussels by phagocytosis (Ikuta et al., 2022). Furthermore, polychlorinated biphenyls, well-known persistent chemical pollutants, were detected in deep-sea chemosynthetic bivalves with limited or no filter feeding, including *Phreagena* clams and *Bathymodiolus* mussels, suggesting the possibility of contamination by absorbing organic particles such as pollutant-associated microplastics from the body surface (Ikuta et al., 2021; Ikuta et al., 2024). These observations highlighted the need for further detailed investigations to conserve the highly endemic and vulnerable deep-sea fauna.

In this cruise, we collected some benthic animals to investigate the mechanisms of internalization of microplastics and other organic particles into animal bodies. Furthermore, after the cruise, the amount of chemical contaminants associated with plastics in these animals will be analyzed.

References

Ikuta, T., Nakajima, R., Tsuchiya, M., Chiba, S., and Fujikura, K. (2021). Interdecadal distribution of persistent organic pollutants in deep-sea chemosynthetic bivalves. *Front. Mar. Sci.* 8**,** 1735. doi: 10.3389/fmars.2021.751848.

Ikuta, T., Nomaki, H., and Nakajima, R. (2024). Accumulation of polychlorinated biphenyls in the ovaries of deep-sea chemosynthetic clam *Phreagena okutanii*. *Front. Mar. Sci.* 11. doi: 10.3389/fmars.2024.1358774.

Ikuta, T., Tame, A., Takahashi, T., Nomaki, H., and Nakajima, R. (2022). Microplastic particles are phagocytosed in gill cells of deep-sea and coastal mussels. *Front. Mar. Sci.* 9**,** 1034950. doi: 10.3389/fmars.2022.1034950.

3-13. Observations and data collection for the establishment of more efficient Environmental Impact Assessment tools

3-13-1. Data collection by LISST-Deep

LISST-DEEP

To measure the volume and size of particles in the water column at locations #24 (32°26.14N, 139°54.46E), #25 (32°27.62N, 139°55.06E), and #26 (32°26.24N, 139°53.92E) in Higashi-Aogashima Caldron, a Laser In-Situ Scattering and Transmissometry (LISST-Deep) instrument was integrated with the CTD/CWS package. The LISST-Deep (S/N 4016, SEQUOIA SCIENTFIC, INC., Bellevue, WA, USA) uses the technique of laser diffraction to obtain particle size-distribution (PSD), rated to 3000 m, and it makes 32 size classes (1.25 – 250micron diameter) PSD data at each depth. The LISST-Deep was powered during the CTD casts by a 12 V battery pack. After each CTD cast the internally stored observed data was uploaded to the computer on-board.

3-13-2. Sediment sampling for meiofaunal community analysis

We collected sediment samples using core samplers equipped in a Free Fall Lander System. The sediment samples were sliced into several layers, fixed with formalin, and treated according to the procedure described by Kitahashi et al. (2018). We will acquire meiofaunal images using FlowCAM in a land-based lab. The obtained images will be classified AI system which we are developing.

3-13-3. Water and sediment sampling for eDNA analysis

We collected water samples using water samplers integrated with the CTD/CWS package and another water sampler equipped in a Free Fall Lander System. The water samples were filtered using a Strivex filter (pore size: 0.45 μm) and preserved with adding RNAlater. The filter samples will be analyzed for fish composition using NGS techniques. Integrating these results, we will consider an optimal EIA methods for mining of seafloor massive sulphides.

The initially planned eDNA sampling of sediment samples was not conducted due to the coarse granularity.

3-13-4. Deep-sea soundscape monitoring observation

AUSOMS-V5.0 (short-term observation)

The hydroacoustic recorder AUSOMS-V5.0 (S/N 16-0101, AquaSound INC., Kobe, Hyogo, JAPAN) was deployed at the South East Site of Higashi-Aogashima Caldron (#24: 32°26.20N, 139°53.91E) for short-term acoustic monitoring, utilizing the KM-ROV for placement. The AQH-020D hydrophone within the system is capable of recording frequencies from 20Hz to 20kHz, and the AQH-100D can record from 20Hz to 100kHz, which sampling rate is 44.1kHz. The recorder was powered by twenty D-cell alkaline batteries. We used continuous recording mode in this observation. The short-term observation was conducted from 9:05 (the time of seafloor deployment) to 15:48 (the

time of retrieval) at 4/20. Stored observed data was uploaded to the computer on-board, and we obtained the noises of ship engines, the KM-ROV, and the acoustic release signal of the Free Fall Lander System.

Porpoise-EXT 6000 (long-term observation)

The hydro acoustic recorder Porpoise-EXT 6000（S/N 205, Turbulent Research INC., Scotia, Nova, CANADA）with hydrophone (S/N 478, GeoSpectrum Technologies INC., Scotia, Nova, CANADA) was deployed at the South Site of Higashi-Aogashima Caldron (#21: 32°25.86N, 139°53.91E) for long-term acoustic monitoring, utilizing the KM-ROV for placement. The hydrophone is capable of recording frequencies ranging from 10Hz to 200kHz. The sampling rate was set to 96kps. The recorder was equipped with a high-capacity external battery, is programmed to record for 5 minutes and rest for 25 minutes in cycles. The device is scheduled to be retrieved during a JAMSTEC cruise in the Higashi-Aogashima area in the autumn of 2024 or FY 2025.

4. Future Proposals

4-1. Environmental DNA analyses for the monitoring deep-sea biodiversity compensated with actual observation data

Yabuki, Yoshida, Kawato, Fujiwara, Tsuchida, Nagano

The monitoring of the deep-sea biodiversity is one of the most crucial research subjects for proper management of deep sea. The combination of eDNA analysis and actual observation is very strong approach for it. The eDNA that is extracted from the filter samples prepared in KM22-15 leg. 1 cruise will be subjected to the analyses to estimate the diversity of several deep-sea organism's groups, such as fish, fungi and diplonemids protists. To confirm and/or compensate the results of the eDNA analyses, we will also obtain the biodiversity information from baited camera system and shadowgraph camera observation and compare them.

4-2. Data analysis for the verification and technological development of environmental impact assessment techniques

Furushima, Yamakita, Kawaguchi

The advancement and practical application of environmental impact assessment and monitoring techniques adapted to marine environments, including the open ocean and deep sea, are required. This is a crucial step for accurately evaluating and predicting environmental impacts due to climate change, seabed resource development, and marine debris. The establishment of effective and efficient methods will elevate the level of environmental impact assessment technology not only in the field of marine environment research but also at the industrial level.

In the next fiscal year, as in the current fiscal year, we will conduct environmental baseline surveys in the vicinity of the deep-sea floor. We will use the environmental impact survey technologies developed through SIP1-SIP2, new survey technologies contributing to environmental impact assessment, and existing survey technologies (CTD, seafloor mapping, biological distribution, etc.). These surveys will be conducted at the planned drilling sites (three sites near the hydrothermal vent area) on the Higashi Aogashima Knoll, and at one additional site located several kilometers from the drilling site, where the impact of drilling is expected to be less than that of BMS drilling. These surveys will allow us to determine the biological, physical, and chemical environmental characteristics.

These results are expected to lead to the evaluation of the scale of environmental impacts and considerations for environmental conservation due to BMS drilling. Furthermore, these results can serve as baseline data when constructing an environmental impact prediction model. This is an important technological development for constructing a comprehensive environmental impact assessment package.

4-3. Imaging Surveys

Lindsay, Sangekar

We will add a light diffuser to the 100 mm imaged area shadowgraph camera as the light field had brighter and darker areas compared to the 60 mm shadowgraph camera, which has a diffuser. We are currently working on a new system for detecting regions of interest (ROI) in the images that is less susceptible to the effect of different refractive indices in mixing water of different densities. We hope to use this for imaging within the thermocline and in and around a hydrothermal vent plume in the future.

Lab experiments with a polarizing filter deployed on the LED light pod and an analyzer film deployed on the camera pod will be conducted to assess whether muscle-containing "living" particles can be distinguished from "dead" particles such as moults and other marine snow.

4-4. Continuous monitoring of particles at various locations using RamaCam

Takahashi, Sangekar, Kleboe

In our future studies, we will further improve the particle detection algorithm and trapping system for fully automated and standalone operations with the battery power supply. This enables continuous water column measurements by attaching RamaCam to CTD or a winch cable as well as time-series measurements of falling particles by locating it on the seafloor.

Since RamaCam is a powerful tool particularly for identification of particle with less morphologically remarkable features, such as small debris and microplastics, continuous monitoring at rivers and mouths from which those debris would first flow into aquatic environments will be also targeted.

4-5. *Taxonomic review and Horizontal distribution of Appendicularians*

Miyake, Tokutake

Appendicularians collected in this cruise will be sorted and then subjected for further analyses/observation, for example DNA extraction and morphological observation. The obtained information will be discussed for their taxonomic review and understanding of their horizontal distribution.

4-6. Elucidation of Marine-Atmospheric-Terrestrial Interactions of Micro-and Nanoplastics.

Komatsu, Ohama

The results of the analysis of these samples will be compared with the results of the analysis of marine surface microplastics collected off the Pacific Ocean and in Suruga Bay last year to clarify the interaction between the atmosphere and the ocean.

4-7. Observation of distribution and behavior of hydrothermal gamma-rays

Shitashima

Because of hydrothermal ore and hydrothermal fluid content high level of gamma-rays, hydrothermal organisms are continually expose to gamma-rays. In order to understand the

environmental impact of gamma-rays to hydrothermal biota, the enforcement of long-term monitoring and mapping survey of hydrothermal gamma-rays by using in-situ sensor are desired.

4-8. Isolation of microplastic and plasticizer chemicals metabolizing bacteria and analyses of related genes

ZULKHARNAIN, YOSHIDA

Isolation of bacterial strains involved in microplastic degradation in the marine environment is important to understand the fate of marine microplastics. Bacterial strains from the collected seawater will be filtered. The isolation method involves enrichment culture of strains using microplastic, plasticizer chemicals, and aromatic compounds as sole carbon source for bacterial growth. Isolated strains will be characterized and analyzed for their degradation performance. Genetic analyses will be conducted to detect possible genes involved in metabolisms of chemicals related to microplastic degradation.

4-9. Chemical contamination/pollution in deep-sea organisms and sediments

Ikuta, Yuasa

The amounts of chemical contaminants associated with plastics in these animals and the sediments that were collected by core sampler will be measured and analyzed.

4-10. Consideration of Physical and Biological Environmental Survey Methods for the Development of Tools for Optimization of Environmental Impact Assessment (EIA)

Kitahashi, Toyoda, Kondo, Okamura, Kato, and Fukuhara

1. *Consideration of water column environmental survey methods using LADCP and LISST-Deep.*

   Data obtained from the LISST-Deep, when analyzed in conjunction with data from the LADCP integrated with the CTD/CWS package, enable the acquisition of baseline data on flow conditions and particle size distribution within the water column. Furthermore, with the objective of clarifying the relationship between underwater particles and turbulence intensity, we are considering a method of analysis that combines data from ADV and VMPX, both deployed on a Free Fall Lander System on the seafloor. This approach aims to enhance the data required for deep-sea turbulence estimates and to advance the practical application of environmental baseline survey methods.
2. *Consideration of meiofaunal community analysis methods using an automated classification system with FlowCAM (Flow Cytometer and Microscope).*

   Sediment samples are analyzed for meiofauna communities, which are important biological groups in environmental impact assessments, using the automated classification system of the imaging flow cytometer FlowCAM. We aim to expand the baseline data for the Higashi-Aogashima Caldron and to investigate the applicability and usefulness of this method for detecting the impacts of human activities on the ecosystem.
3. *Consideration of environmental DNA sampling methods in pelagic water columns and sediments*

for fish community and microbial community analysis.

Water samples are filtered and analyzed for fish fauna composition using NGS techniques with the aim of establishing a method for environmental DNA analysis in the pelagic and advancing its practical application as an environmental impact assessment technique. The objectives include acquiring environmental baseline data, comparing the observed fish species in video footage, and investigating methods for detecting the impact of activities such as drilling on the ecosystem.

4. *Consideration of deep-sea soundscape monitoring observation methods using underwater recording devices.*

The impacts of underwater noise which caused by seafloor exploration and drilling on ecosystems have been raised concerns. The International Seabed Authority (ISA) added a section on underwater sound in the revised guidelines in 2019. Two types of acquired soundscape data (continuous short-term and intermittent long-term) are analyzed about frequency and sound pressure to understand the characteristics of natural underwater sounds such as waves and rainfall, and biological sounds such as whale calls (acoustic baseline), as well as anthropogenic underwater sounds like ship engine noise and machinery used for seafloor operations.

4-11. Exploration of enzymes for the degradation of polysaccharides and plastics

Iizuka, Takao Yoshida

We will use our developed methods to isolate microorganisms that can degrade polysaccharides and plastics from the seawater and obtain their respective enzymes.

5. Cruise log.

JST		UTC	Lat.	Lon.	Event
4月16日 11時00分 出港	20240416,020000	2024/04/16	02:00 35-19.11810N	139-38.98860E	Departure from Yokosuka
4月17日 1時00分 調査海域（東青ヶ島海丘）着	20240416,160000	2024/04/16	16:00 32-23.58750N	139-49.76530E	Arrived at search area off Aogashima
4月17日 6時13分 XBT投入	20240416,211300	2024/04/16	21:13 32-23.57860N	139-49.71300E	XBT Observation
4月17日 8時38分 ランダー投入	20240416,233800	2024/04/16	23:38 32-25.74750N	139-53.77370E	Deployed lander system
4月17日 9時00分 ランダー着底（32-25.8099N, 139-53.8962E）	20240417,000000	2024/04/17	00:00 32-25.67830N	139-53.75050E	Fixed position of lander system (32-25.8099N, 139-53.8962E)
4月17日 11時00分 海況不良のため、KM-ROV潜航中止	20240417,020000	2024/04/17	02:00 32-25.89070N	139-53.94310E	Suspended KM-ROV dive due to rough sea
4月17日 13時26分 小型プランクトンネットによる生物採取	20240417,042600	2024/04/17	04:26 32-25.88180N	139-53.86640E	Com'ced Small Plankton Net (SPN) Observation
4月17日 16時46分 小型プランクトンネットによる生物採取終了	20240417,074600	2024/04/17	07:46 32-25.12320N	139-58.68140E	Finished SPN Observation
XCTD投入 計19点 #13-22	20240417,081932	2024/04/17	08:19 32-26.01230N	139-58.96770E	XCTD Observation (#13-22)
#13-13	20240417,083746	2024/04/17	08:37 32-26.41050N	139-57.34440E	XCTD Observation (#13-13)
#13-14	20240417,085937	2024/04/17	08:59 32-26.39960N	139-55.77140E	XCTD Observation (#13-14)
#13-15	20240417,091810	2024/04/17	09:18 32-26.42340N	139-54.40310E	XCTD Observation (#13-15)
#13-26	20240417,093217	2024/04/17	09:32 32-26.37090N	139-53.84000E	XCTD Observation (#13-26)
#13-17	20240417,094820	2024/04/17	09:48 32-26.39140N	139-52.78560E	XCTD Observation (#13-17)
#13-18	20240417,100949	2024/04/17	10:09 32-26.39650N	139-51.35980E	XCTD Observation (#13-18)
#13-19	20240417,102235	2024/04/17	10:22 32-26.38480N	139-50.47440E	XCTD Observation (#13-19)
#13-06	20240417,105420	2024/04/17	10:54 32-27.53130N	139-50.53250E	XCTD Observation (#13-06)
#13-07	20240417,110959	2024/04/17	11:09 32-27.49290N	139-52.08490E	XCTD Observation (#13-07)
#13-08	20240417,112400	2024/04/17	11:24 32-27.50000N	139-53.74870E	XCTD Observation (#13-08)
#13-09	20240417,113414	2024/04/17	11:34 32-27.50350N	139-55.08650E	XCTD Observation (#13-09)
#13-10	20240417,114540	2024/04/17	11:45 32-27.49340N	139-56.46970E	XCTD Observation (#13-10)
#13-11	20240417,115855	2024/04/17	11:58 32-27.50650N	139-58.05770E	XCTD Observation (#13-11)
#13-01	20240417,122907	2024/04/17	12:29 32-28.60150N	139-57.93470E	XCTD Observation (#13-01)
#13-02	20240417,124739	2024/04/17	12:47 32-28.60760N	139-56.24840E	XCTD Observation (#13-02)
#13-03	20240417,130537	2024/04/17	13:05 32-28.60860N	139-54.55290E	XCTD Observation (#13-03)
#13-04	20240417,132410	2024/04/17	13:24 32-28.59790N	139-52.74210E	XCTD Observation (#13-04)
#13-05	20240417,134559	2024/04/17	13:45 32-28.60840N	139-50.45290E	XCTD Observation (#13-05)
4月18日 8時05分 潜航開始 #262	20240417,230500	2024/04/17	23:05 32-25.98340N	139-53.52600E	KM-ROV dive & started her oparation#262
4月18日 8時36分 TMS/V離脱	20240417,233600	2024/04/17	23:36 32-25.92100N	139-53.90250E	
4月18日 8時42分 ビークル着底 深度806m	20240417,234200	2024/04/17	23:42 32-25.92120N	139-53.90150E	KM-ROV vehicle landed on the sea bottom. (D=806m)
4月18日 10時01分 ビークル離底 深度809m	20240418,010100	2024/04/18	01:01 32-25.80580N	139-53.88570E	KM-ROV vehicle left the sea bottom. (D=809m)
4月18日 10時06分 TMS/V結合	20240418,010600	2024/04/18	01:06 32-25.80580N	139-53.88600E	
4月18日 10時33分 水切り	20240418,013300	2024/04/18	01:33 32-25.80560N	139-54.10630E	
4月18日 11時10分 八丈島向け発航	20240418,021000	2024/04/18	02:10 32-26.11340N	139-54.64020E	Left search area for off Hachijo-jima
4月18日 14時30分 八丈島着	20240418,053000	2024/04/18	05:30 33-04.62710N	139-45.53890E	Arrived at off Hachijo-jima
4月19日 4時00分 調査海域（東青ヶ島海丘）向け発航	20240418,190000	2024/04/18	19:00 33-04.75810N	139-45.50000E	Departured for off Aogashima
4月19日 7時25分 調査海域（東青ヶ島海丘）着	20240418,222500	2024/04/18	22:25 32-25.81130N	139-53.89160E	Arrived at search area off Aogashima
4月19日 9時47分 CTD採水（1回目）	20240419,004700	2024/04/19	00:47 32-26.15060N	139-54.24140E	Com'ced CTD cast (#13-24)
4月19日 10時34分 CTD採水（1回目）終了	20240419,013400	2024/04/19	01:34 32-26.11290N	139-54.68390E	Finished CTD cast (#13-24)
4月19日 11時55分 CTD採水（2回目）	20240419,025500	2024/04/19	02:55 32-26.36380N	139-53.80210E	Com'ced CTD cast (#13-26)
4月19日 13時01分 CTD採水終了	20240419,040100	2024/04/19	04:01 32-26.21860N	139-53.94460E	Finished CTD cast (#13-26)
4月19日 14時21分 XCTD投入	20240419,052100	2024/04/19	05:21 32-25.79900N	139-54.63530E	XCTD Observation
4月19日 14時42分 VMP-X観測実施	20240419,054200	2024/04/19	05:42 32-25.78440N	139-53.91980E	Com'ced VMP-X observation
4月19日 15時32分 VMP-X観測実施終了	20240419,063200	2024/04/19	06:32 32-25.68420N	139-54.51260E	Finished VMP-X observation
4月19日 16時17分 CTD採水（3回目）	20240419,071700	2024/04/19	07:17 32-27.91590N	139-54.84490E	Com'ced CTD cast (#13-25)
4月19日 17時09分 CTD採水（3回目）終了	20240419,080900	2024/04/19	08:09 32-27.42070N	139-55.34890E	Finished CTD cast (#13-25)
4月20日 7時40分 潜航開始 #263	20240419,224000	2024/04/19	22:40 32-26.29370N	139-54.58610E	KM-ROV dive & started her oparation#263
4月20日 8時07分 TMS/V離脱	20240419,230700	2024/04/19	23:07 32-26.20480N	139-54.69300E	
4月20日 8時14分 ビークル着底 深度763m	20240419,231400	2024/04/19	23:14 32-26.20470N	139-54.69380E	KM-ROV vehicle landed on the sea bottom. (D=763m)
4月20日 10時11分 ビークル離底 深度747m	20240420,011100	2024/04/20	01:11 32-26.16740N	139-54.70210E	KM-ROV vehicle left the sea bottom. (D=747m)
4月20日 10時15分 TMS/V結合	20240420,011500	2024/04/20	01:15 32-26.16710N	139-54.70080E	
4月20日 10時36分 水切り	20240420,013600	2024/04/20	01:36 32-26.13530N	139-54.92020E	
4月20日 10時41分 揚収 #263	20240420,014100	2024/04/20	01:41 32-26.12510N	139-54.98500E	Recovered KM-ROV & finished #263 operation
4月20日 11時44分 ランダー回収	20240420,024400	2024/04/20	02:44 32-25.85160N	139-54.30480E	Recovered lander system on deck
4月20日 13時08分 潜航開始 #264	20240420,040800	2024/04/20	04:08 32-26.15080N	139-54.47330E	KM-ROV dive & started her oparation#264
4月20日 13時30分 TMS/V離脱	20240420,043000	2024/04/20	04:30 32-26.12450N	139-54.64970E	
4月20日 13時35分 ビークル着底 深度 775m	20240420,043500	2024/04/20	04:35 32-26.12410N	139-54.64930E	KM-ROV vehicle landed on the sea bottom. (D=775m)
4月20日 16時14分 ビークル離底 深度 763m	20240420,071400	2024/04/20	07:14 32-26.19540N	139-54.65640E	KM-ROV vehicle left the sea bottom. (D=763m)
4月20日 16時21分 TMS/V結合	20240420,072100	2024/04/20	07:21 32-26.19550N	139-54.65630E	
4月20日 16時41分 水切り	20240420,074100	2024/04/20	07:41 32-26.13130N	139-54.88240E	
4月20日 16時49分 揚収 #264	20240420,074900	2024/04/20	07:49 32-26.08600N	139-55.03040E	Recovered KM-ROV & finished #264 operation
4月20日 17時25分 調査海域（東青ヶ島海丘）発	20240420,082500	2024/04/20	08:25 32-25.41930N	139-54.59390E	Departured for off Aogashima
4月21日 5時55分 調査海域（駿河湾）着	20240420,205500	2024/04/20	20:55 34-40.35010N	138-23.97690E	Arrived at search area Suruga Bay
4月21日 8時19分 CTD観測 (#9)	20240420,231900	2024/04/20	23:19 34-40.56790N	138-23.77590E	Com'ced CTD cast (#9)
4月21日 9時05分	20240421,000500	2024/04/21	00:05 34-40.56810N	138-23.77640E	Finished CTD cast (#9)
4月21日 11時07分 CTD観測 (#3)	20240421,020700	2024/04/21	02:07 34-33.86780N	138-34.49850E	Com'ced CTD cast (#3)
4月21日 13時06分	20240421,040600	2024/04/21	04:06 34-33.86780N	138-34.49840E	Finished CTD cast (#3)
4月21日 13時30分 小型プランクトンネット観測	20240421,043000	2024/04/21	04:30 34-33.86770N	138-34.49860E	Com'ced SPN Observation
4月21日 16時18分	20240421,071800	2024/04/21	07:18 34-33.86760N	138-34.49870E	Finished SPN Observation
4月22日 8時13分 CTD観測 (#7)	20240421,231300	2024/04/21	23:13 34-41.41880N	138-33.00180E	Com'ced CTD cast (#7)
4月22日 9時27分	20240422,002700	2024/04/22	00:27 34-41.41880N	138-33.00190E	Finished CTD cast (#7)
4月22日 9時45分 小型プランクトンネット観測	20240422,004500	2024/04/22	00:45 34-41.41880N	138-33.00200E	Com'ced SPN Observation
4月22日 11時36分	20240422,023600	2024/04/22	02:36 34-41.47710N	138-32.96140E	Finished SPN Observation
4月22日 14時02分 小型プランクトンネット観測	20240422,050200	2024/04/22	05:02 34-39.39780N	138-37.38810E	Com'ced SPN Observation
4月22日 15時54分	20240422,065400	2024/04/22	06:54 34-39.51970N	138-37.40190E	Finished SPN Observation
4月22日 16時31分 CTD観測 (#4)	20240422,073100	2024/04/22	07:31 34-39.41970N	138-37.40140E	Com'ced CTD cast (#4)
4月22日 17時31分	20240422,083100	2024/04/22	08:31 34-39.41970N	138-37.40130E	Finished CTD cast (#4)
4月23日 4時16分 CTD観測 (#6)	20240422,191600	2024/04/22	19:16 34-41.97820N	138-35.03760E	Com'ced CTD cast (#6)
4月23日 6時50分	20240422,215000	2024/04/22	21:50 34-41.97810N	138-35.03750E	Finished CTD cast (#6)
4月23日 7時10分 調査海域（相模湾）向け発航	20240422,221000	2024/04/22	22:10 34-42.00240N	138-35.12580E	Left search area for Sagami Bay
4月23日 10時45分 調査海域（相模湾）着	20240423,014500	2024/04/23	01:45 35-00.28500N	139-13.60860E	Arrived at search area Sagami Bay
4月23日 10時45分 XCTD投入	20240423,014500	2024/04/23	01:45 35-00.28500N	139-13.60860E	XCTD Observation
4月23日 11時24分 潜航開始 #265	20240423,022400	2024/04/23	02:24 35-00.88890N	139-13.40430E	KM-ROV dive & started her oparation#265
4月23日 11時48分 TMS/V離脱	20240423,024800	2024/04/23	02:48 35-00.93140N	139-13.40880E	
4月23日 11時53分 ビークル着底 深度 927m	20240423,025300	2024/04/23	02:53 35-00.93110N	139-13.40900E	KM-ROV vehicle landed on the sea bottom. (D=927m)
4月23日 15時01分 ビークル離底 深度 856m	20240423,060100	2024/04/23	06:01 35-00.95340N	139-13.36600E	KM-ROV vehicle left the sea bottom. (D=856m)
4月23日 15時06分 TMS/V結合	20240423,060600	2024/04/23	06:06 35-00.95330N	139-13.36600E	
4月23日 15時29分 水切り	20240423,062900	2024/04/23	06:29 35-00.95320N	139-13.36610E	
4月23日 15時35分 揚収完了 #265	20240423,063500	2024/04/23	06:35 35-00.95350N	139-13.36600E	Recovered KM-ROV & finished #263 operation
4月23日 16時20分 調査海域（相模湾）発	20240423,072000	2024/04/23	07:20 35-00.56580N	139-13.12610E	Departured from Sagami Bay
4月23日 20時30分 調査海域（駿河湾）着	20240423,113000	2024/04/23	11:30 34-44.65010N	138-39.21760E	Arrived at Suruga Bay
4月24日 8時12分 CTD観測 (#5)	20240423,231200	2024/04/23	23:12 34-44.92150N	138-40.39490E	Com'ced CTD cast (#5)
4月24日 9時02分	20240424,000200	2024/04/24	00:02 34-44.97060N	138-40.43380E	Finished CTD cast (#5)
4月24日 9時13分 小型プランクトンネット観測	20240424,001300	2024/04/24	00:13 34-44.97370N	138-40.43590E	Com'ced SPN Observation
4月24日 11時19分	20240424,021900	2024/04/24	02:19 34-45.34200N	138-40.62290E	Finished SPN Observation
4月24日 13時11分 CTD観測 (#10)	20240424,041100	2024/04/24	04:11 34-51.01530N	138-42.07100E	Com'ced CTD cast (#10)
4月24日 14時00分	20240424,050000	2024/04/24	05:00 34-51.10550N	138-42.06570E	Finished CTD cast (#10)
4月24日 14時11分 小型プランクトンネット観測	20240424,051100	2024/04/24	05:11 34-51.12240N	138-42.06300E	Com'ced SPN Observation
4月24日 16時07分	20240424,070700	2024/04/24	07:07 34-51.64100N	138-41.89100E	Finished SPN Observation
4月25日 7時23分 CTD観測 (#12)	20240424,222300	2024/04/24	22:23 35-03.42770N	138-43.50330E	Com'ced CTD cast (#12)
4月25日 8時22分	20240424,232200	2024/04/24	23:22 35-03.42790N	138-43.50360E	Finished CTD cast (#12)
4月25日 8時31分 小型プランクトンネット観測	20240424,233100	2024/04/24	23:31 35-03.42780N	138-43.50340E	Com'ced SPN Observation
4月25日 9時49分	20240425,004900	2024/04/25	00:49 35-03.41420N	138-43.28790E	Finished SPN Observation
4月25日 11時22分 CTD観測開始 (#11)	20240425,022200	2024/04/25	02:22 34-53.97870N	138-38.50590E	Com'ced CTD cast (#11)
4月25日 12時44分 CTD観測終了 (#11)	20240425,034400	2024/04/25	03:44 34-53.97830N	138-38.50590E	Finished CTD cast (#11)
4月25日 12時50分 小型プランクトンネット観測	20240425,035000	2024/04/25	03:50 34-53.97880N	138-38.50600E	Com'ced SPN Observation
4月25日 13時57分	20240425,045700	2024/04/25	04:57 34-53.97780N	138-38.70190E	Finished SPN Observation
4月25日 14時00分 清水港向け発航	20240425,050000	2024/04/25	05:00 34-53.97810N	138-38.70130E	Left search area for Shimizu
4月25日 15時50分 清水入港	20240425,065000	2024/04/25	06:50 35-01.91070N	138-30.31150E	Arrived at Shimizu

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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.
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