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KAIMEI / KM-ROV Cruise Report

KM21-08

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

< Izu-Ogasawara islands surrounding waters >

October 23th, 2021 – October 25th, 2021

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

KM21-08 Cruise Report Contents

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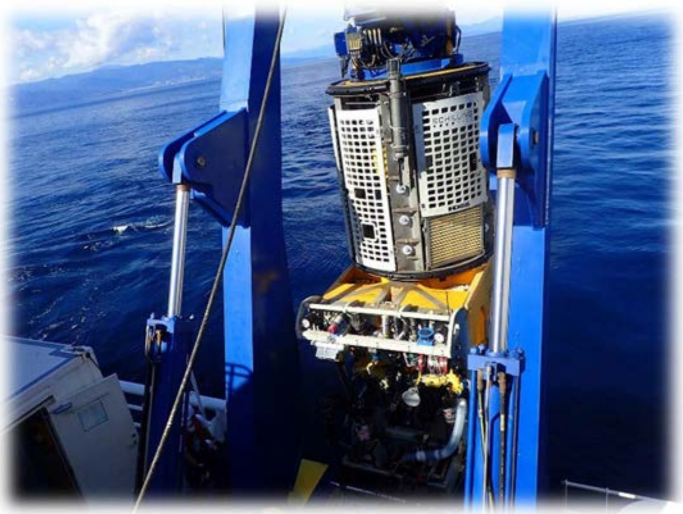


0 Acknowledgements

We are grateful to Captain Mr. Naoto Kimura, Chief Officer Mr. Takeshi Muramatsu and Chief Engineer Mr. Kazuhiko Kaneda for their safe navigation and their skillful handling of "R/V KAIMEI".

Great thanks are due to Commander Mr. Naoto Miura and "KM-ROV" operation team for their operations in sampling.

We also thank Ms. Kimiko Serizawa and Mr. Tohru Kodera, Nippon Marine Enterprises, Ltd., and Mr. Tun Htet Aung, Masanori Enoki, Yukihiko Nakano and Yuta Shinomiya Marine Works Japan, Ltd., for their attentive supports.

Finally, we would like to appreciate all persons who supported directly or indirectly this cruise.

1 Cruise Information

1.1 Cruise ID : KM21-08

1.2 Name of vessel : R/V KAIMEI / KAIMEI-ROV

1.3 Title of the cruise :

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

1.4 Chief scientist : Yasuo Furushima [JAMSTEC]

1.5 Representative of the science party : Katsunori Fujikura [JAMSTEC]

1.6 Research titles :

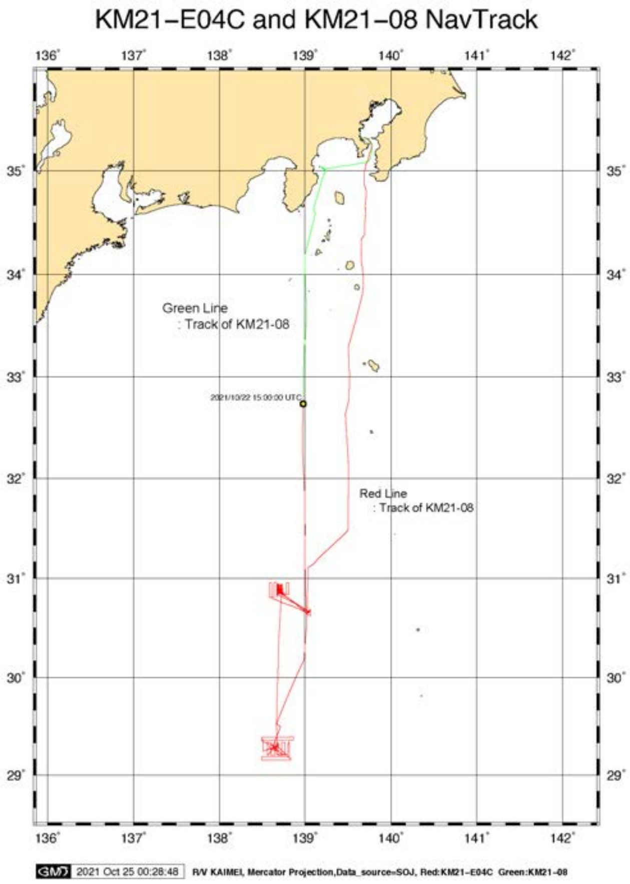
Understanding the actual condition of marine pollutants and their impact on marine ecosystems

1.7 Cruise period: October 23th, 2021 - October 25th, 2021

1.8 Ports of call: off Anei Seamount (Continued from KM21-E04C) – Yokosuka (JAMSTEC)

1.9 Research area: Sagami Bay (off Hatsushima)

1.10 Cruise track (Research Map)



Track charts of the R/V KAIMEI research cruise KM21-08. (Green line; Oct. 23th – Oct. 25th, 2021)

1.11 Cruise log

R/V "KAIMEI" KM21-08 Cruise Log

Date & Time	Description	Weather / Wind / Sea Condition
2021/10/23 Sat.	Noon Position: 35-01.0N, 139-13.3E (SAGAMIWAN Off Hatsushima)	b / East-3 / 2
08:00	Research meeting	
10:20	Arrived at Off Hatsushima	
10:40	Released XCTD at 35-00.0N, 139-14.1E	
11:11-11:57	Carried out CTD operation (w.o. 879m)	
13:35	Hoisted up "KM-ROV"	
13:40	Launched "KM-ROV", then it dove & com'ced her operation KM-ROV158	
14:11	"KM-ROV" landed on the sea floor (D=853m)	
16:28	"KM-ROV" left the sea bottom (D=910m)	
16:59	Hoisted up "KM-ROV"	
17:06	Recovered "KM-ROV"& finished above dive operation	
18:00	Research meeting	
2021/10/24 Sun.	Noon Position: 35-00.9N, 139-13.4E (SAGAMIWAN Off Hatsushima)	bc / ENE-3 / 2
06:56	Released XCTD at 35-00.8N, 139-13.2E	
08:06	Launched VMP-X(Expendable Vertical Microstructure profiler)	
09:02	Recovered VMP-X	
13:26	Hoisted up "KM-ROV"	
13:32	Launched "KM-ROV", then it dove & com'ced her operation KM-ROV159	
14:03	"KM-ROV" landed on the sea floor (D=915m)	
16:35	"KM-ROV" left the sea bottom (D=859m)	
17:05	Hoisted up "KM-ROV"	
17:10	Recovered "KM-ROV"& finished above dive operation	
17:13	Released XCTD at 35-01.0N, 139-13.4E	
18:00	Research meeting	
19:00	Com'ced proceeding to YOKOSUKA sec.4	
2021/10/25 Mon.		
09:00	Sent out 1st shore line, arrived at JAMSTEC at YOKOSUKA, then completed voy. No.KM21-E04C & KM21-08	

2 Cruise Abstract

It is an urgent global issue to understand changes in marine biodiversity, which is considered to be one of the important indicators of global environmental change, and to obtain knowledge that contributes to the assessment of the impact of human activities on ecosystems. In particular, for deep-sea ecosystems, where there is little information on the effects of changes in the marine environment, it is necessary to conduct comprehensive biological surveys using multiple methods and to promote integrated analysis with environmental data. Furthermore, in order to obtain knowledge that will contribute to the understanding and assessment of the impact of human activities on deep-sea ecosystems and diversity, as well as to their conservation, it is important to improve and optimize methods for assessing impacts in the marine environment. For this purpose, it is essential to develop new measurement technologies and conduct surveys to understand the on-site environment and biodiversity in the deep sea.

During this cruise, we conducted research to understand the distribution and behavior of plastic debris caused by human activities and their impact on deep-sea organisms and deep-sea ecosystems. We also conducted a survey to obtain baseline data necessary for the advancement and optimization of the environmental impact assessment on deep-sea ecosystems of the entrainment and redeposition of suspended particles caused by the submarine resource development (one of the human activities). The following investigations were carried out on the deep seafloor (850m-900m depth) off Hatsushima Island, Sagami Bay.

① We collected Bathymodiolus mussels and other organisms for microparticle uptake experiments in deep-sea organisms. Deployment and retrieving of the experimental device for microparticle uptake, which was scheduled to be carried out at Myojin Knoll, was abandoned due to poor sea conditions and will be carried out on the next cruise..

② To understand the actual distribution of marine plastics and their impact on deep-sea ecosystems, we conducted seafloor observation, sediment core sampling, and biological sampling using KM-ROV.

③ The KM-ROV is equipped with RamaCam (a *in-situ* particle counter), which can perform *in-situ* phorography and Raman spectroscopic analysis of suspended particles, and was tested to determine the distribution of suspended particles and their species (organic matter such as plankton and plastics) near the deep sea bottom.

④ A 3D mapping system was installed on the KM-ROV, and high-definition video and image data were acquired to obtain a detailed 3D map of the observation area.

⑤ In order to understand the entrainment and redeposition of suspended particles near the deep sea bottom and to develop and improve the accuracy of the turbulent intensity (turbulent kinetic energy dissipation rate) estimation method, an ultrasonic current meter (ADV) was installed on the sea bottom and velocity data were collected to obtain an estimate of turbulent intensity. In addition, direct observation of turbulence from the surface to just above the seabed was carried out using the Expendable Vertical Microstructure Profiler (VMP-X) to obtain the true value of turbulent intensity.

3 Participants aboard

3.1 Research group

Chief scientist	Yasuo Furushima (JAMSTEC)
Associate chief scientist	Tetsuro Ikuta (JAMSTEC)
Co-Associate chief scientist	Takehisa Yamakita (JAMSTEC)
Scientist	Tomoko Takahashi (JAMSTEC)
Scientist	Sangekar Mehul Naresh (JAMSTEC)
Scientist	Yuka Amari (JAMSTEC)
Observation Engineer	Tohru Kodeara (NME Ltd)
Observation Engineer	Kimiko Serizawa (NME Ltd)
CTD Water Sampling Operator	Tun Htet Aung (NWJ Ltd)
CTD Water Sampling Operator	Masanori Enoki (NWJ Ltd)
CTD Water Sampling Operator	Yukihiko Nakano (NWJ Ltd)
CTD Water Sampling Operator	Yuta Shinomiya (NWJ Ltd)

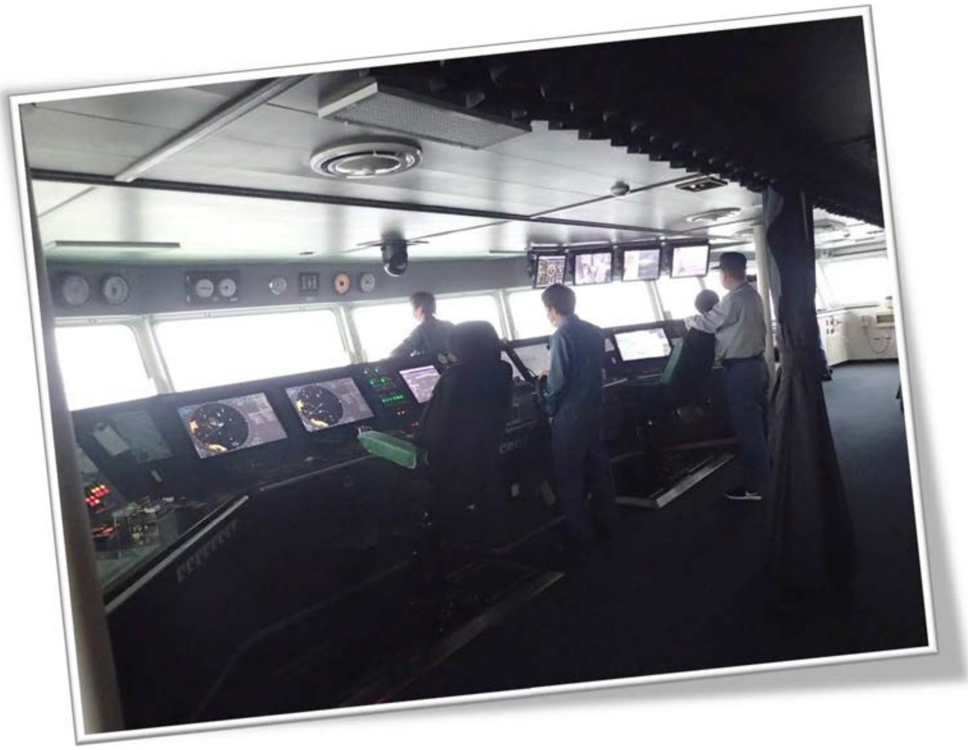
3.2 Operation team of the KM-ROV

Operation Manager	Atsumori Miura
2nd ROV Operator	Yosuke Chida
2nd ROV Operator	Takuma Goto
2nd ROV Operator	Shinnosuke Kumagai
2rd ROV Operator	Shuya Sugiura
3rd ROV Operator	Yuto Okuhira

3.3 Captain and crew of the R/V KAIMEI

Captain	Naoto Kimura
Chief Officer	Takeshi Muramatsu
1nd Officer	Takaaki Shishikura
2nd Officer	Ryo Yamaguchi
3rd Officer	Shun Ito
Chief Engineer	Kazuhiko Kaneda
1st Engineer	Katsuto Yamaguchi
2nd Engineer	Ryuzo Mikami
3rd Engineer	Naoyuki Hamakawa
Chief Electronic Operator	Hiroki Ishiwata
2nd Electronic Operator	Yohei Sugimoto
3rd Electronic Operator	Kohei Ikeda

Boat Swain	Masanori Ohata
Able Seaman	Kaname Hirosaki
Able Seaman	Satoshi Shimpo
Able Seaman	Yuta Ohjiri
Able Seaman	Shinya Kojima
Sailor	Kazuya Sumomozawa
Sailor	Shinnosuke Inoue
No.1 Oiler	Masanori Ueda
Oiler	Yuji Higashigawa
Oiler	Ryota Suzuki
Oiler	Toru Hidaka
Chief Steward	Toru Murakami
Steward	Toru Wada
Steward	Koichiro Kashiwagi
Steward	Yuma Fujimoto



4 Results

4.1 Dive survey results of KM-ROV

4.1.1 Dive list

Dive No.	Date	Time Landing Leaving	Site	Latitude (N)	Longitude (E)	Depth (m)	Main purposes
#158	2021/10/23	13:35	Off Hatsushima	observation start time			・ Installation of ADV. ・ Observation of seafloor navigation using 3D mapp-ing system and RamaCam. ・ Sampling of marine organisms.
		14:11		35°00.9633’	139°13. 3291	853	
		16:28		35°00. 9389’	139°13. 3791’	910	
		17:06		observation end time			
#159	2021/10/24	13:26	Off Hatsushima	observation start time			・ Observation of seafloor navigation using 3D mapp--ing system and RamaCam.. ・ Sampling of marine organisms and core. ・ Recovery of ADV.
		14:03		35°00.9380’	139°13.3898’	915	
		16:35		35°00.9551’	139°13.3252’	859	
		17:10		observation end time			

4.1.2 Preliminary results

Dive Report KM-ROV#158

Date: October 23, 2021

Site: Off Hatsushima, Sagami Bay, ***Depth:*** 913 m

Landing (Lat., Lon., Time, Depth): 35°00.9633’N. 139°13. 3291’E, 14:11, 853 m

Leaving (Lat., Lon., Time, Depth): 35°00. 9389’N. 139°13. 3791’E, 16:28, 910 m

Main Observer: IKUTA, Tetsuro

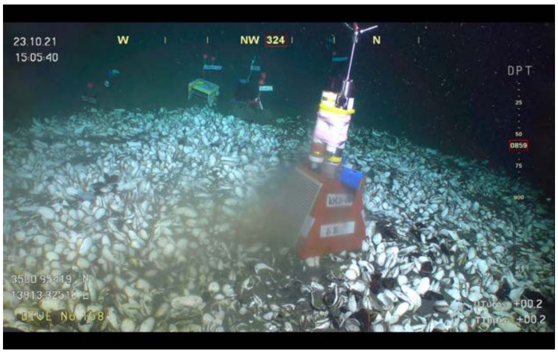
Theme: Marine pollution baseline study and environmental impact assessment

Purposes of dive:

1. Deployment of the acoustic doppler velocimeter (ADV)
2. Sampling of organisms and sediment cores
3. Adjustment of the lighting of ROV for 3D mapping

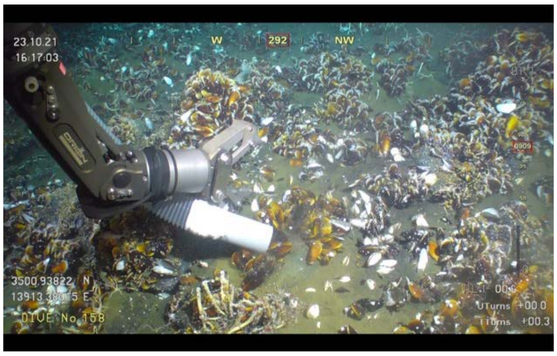
Dive Summary

At the first observation point, on the *Phreagena* clam colony, we deployed the acoustic doppler velocimeter (ADV). At the landing, unusual high turbidity of the sediment was observed. Next, an attempt was made to collect the sediment using an H-type push corer, but the sediment flowed out of the corer and could not be collected, so this task was postponed to the next dive. At that point, we adjusted the lighting of ROV for the 3D mapping that will be done in the next dive. Then, we moved to the second observation point, sampled *Bathymodiolus* mussels, and left the bottom.



ADV deployment

Sediment sampling (failed)

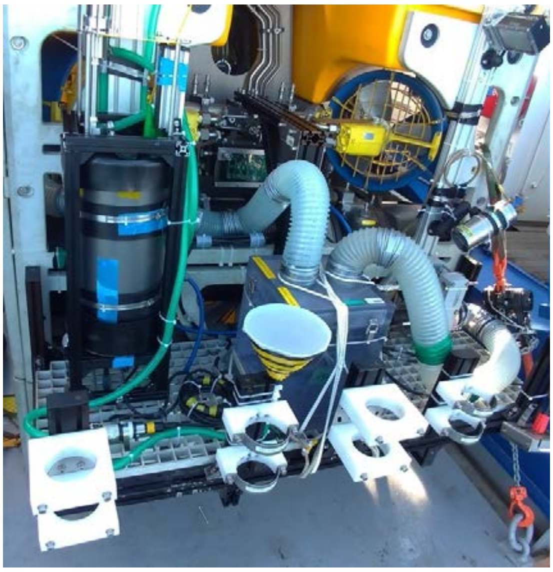


ROV light adjustment

Mussel sampling

Payload Equipment:

1. H-type push corer x2 (front)
2. Sample box x2 (front)
3. 3D mapping system (front)
4. Suction sampler and single-bottled canister x1 (rear)
5. RamaCam x1 (rear)



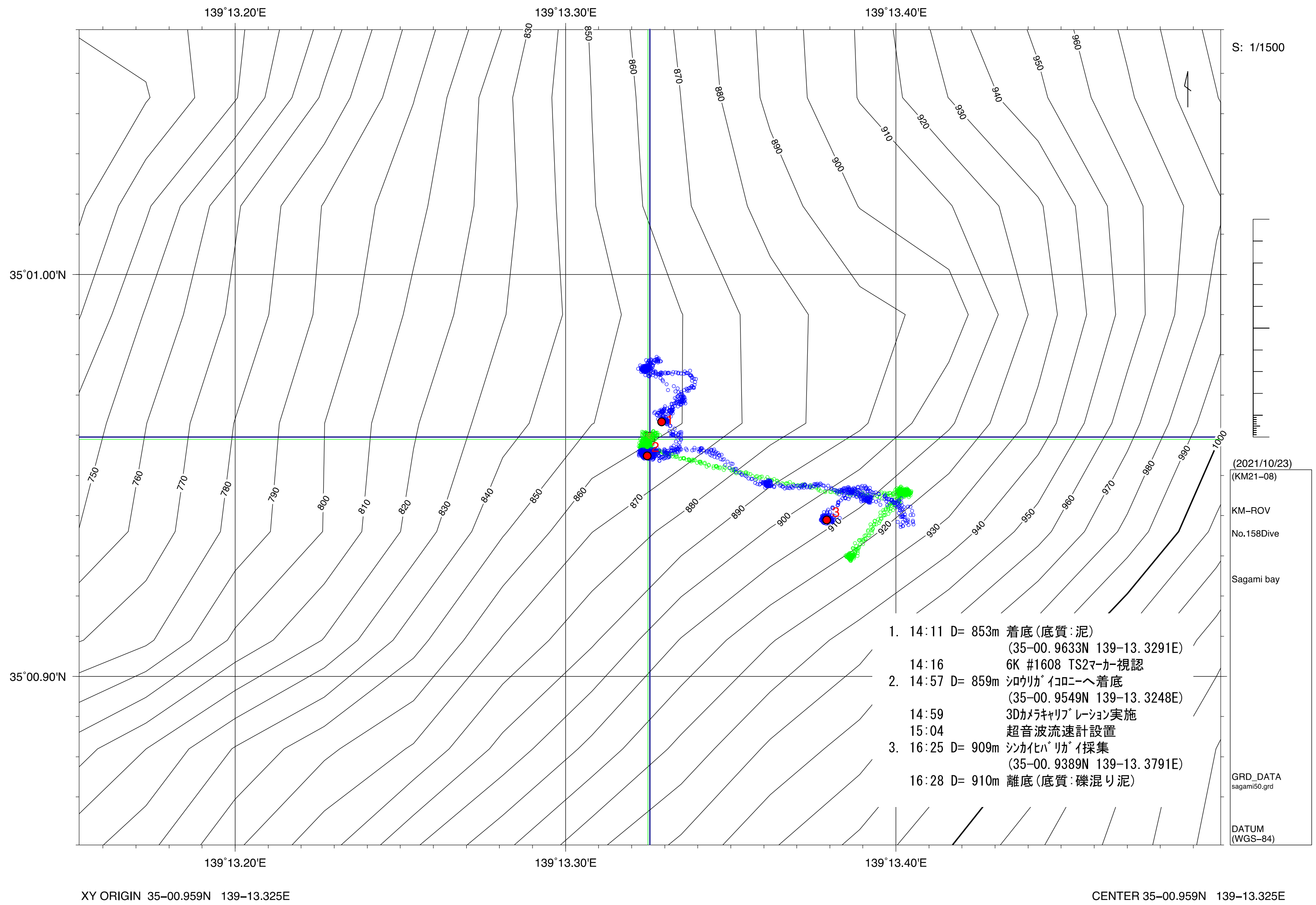
Front payload

Rear Payload

Sampling Points and Events:

Time	Position	Depth	Events
14:11	35-00.9633N 139-13.3291E	853	Landing
14:57	35-00.9549N 139-13.3248E	859	3D camera calibration
15:04			ADV deployment
15:37	35-00.9538N 139-13.3250E	858	ROV lighting adjustment
16:25	35-00.9389N 139-13.3791E	909	Mussel sampling
16:38		910	Leaving

Dive track KM-ROV#158



Dive Report KM-ROV#159

Date: October 24, 2021

Site: Off Hatsushima, Sagami Bay, ***Depth:*** 917 m

Landing (Lat., Lon., Time, Depth): 35°00.9380’N. 139°13.3898’E, 14:03, 915 m

Leaving (Lat., Lon., Time, Depth): 35°00.9551’N. 139°13.3252’E, 16:35, 859 m

Main Observer: IKUTA, Tetsuro

Theme: Marine pollution baseline study and environmental impact assessment

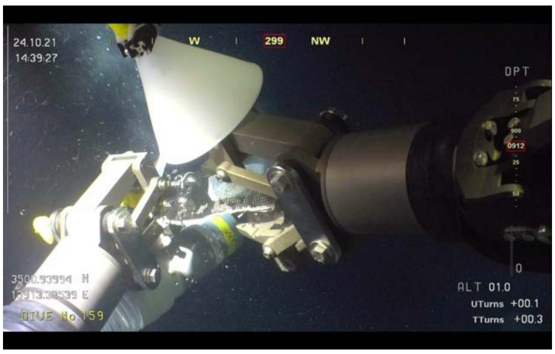
Purposes of dive:

4. Retrieving of the acoustic doppler velocimeter (ADV)
5. Sampling of organisms, sediment cores, and water
6. Particle identification test with RamaCam
7. Collection of image data for habitat mapping

Dive Summary

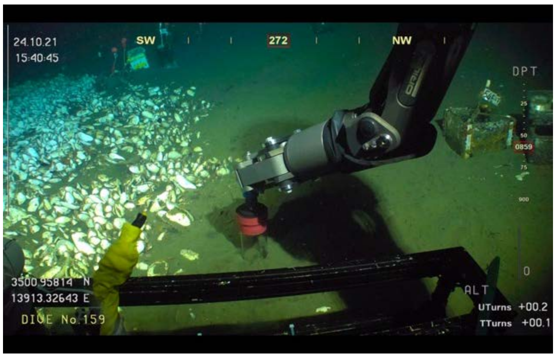
Due to a problem with the power supply of the ROV winch, the dive started about four hours later than planned. After landing, *Bathymodiolus* mussels were collected, and meanwhile coral fragments were crushed for RamaCam calibration. Next, we zigzagged over the mussel colony to collect images for habitat mapping. Intermitted mussel patches around 910m depth contour and a steep slope at 900m was observed. We then moved to the *Phreagena* clam colony site where we collected sediment cores at the colony edge and the normal seafloor. While observing the clam colony, we finally returned to the ADV installation point, retrieved the ADV, and left the bottom.

Mussels sampling

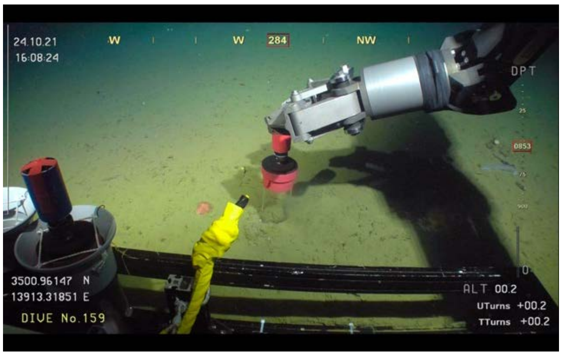


Coral crushing for RamaCam calibration

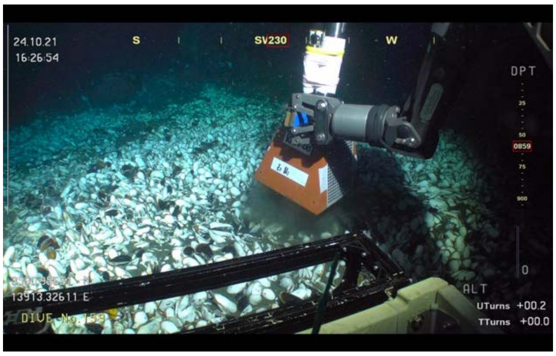
Run for mapping



Sediment sampling



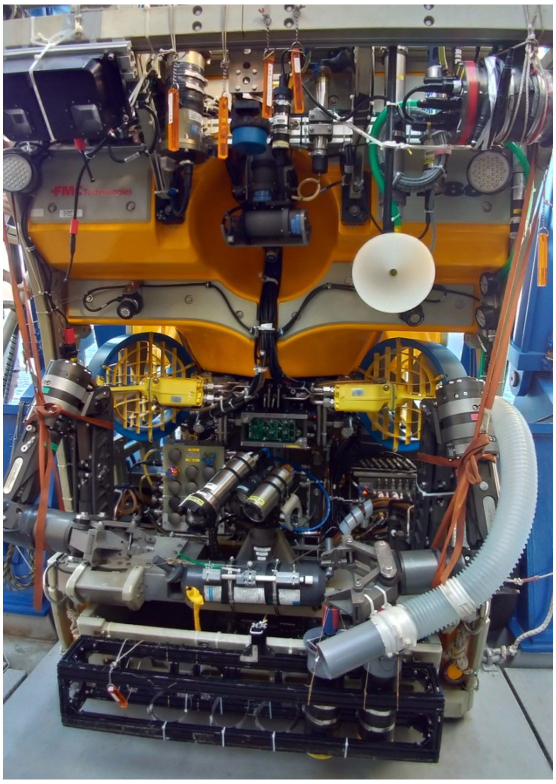
Sediment sampling



ADV retrieving

Payload Equipment:

6. H-type push corer x2 (front)
7. Sample box x2 (front)
8. Niskin water sampler x1 (front)
9. 3D mapping system (front)
10. Coral fragments
11. Suction sampler and single-bottled canister x1 (rear)
12. RamaCam x1 (rear)



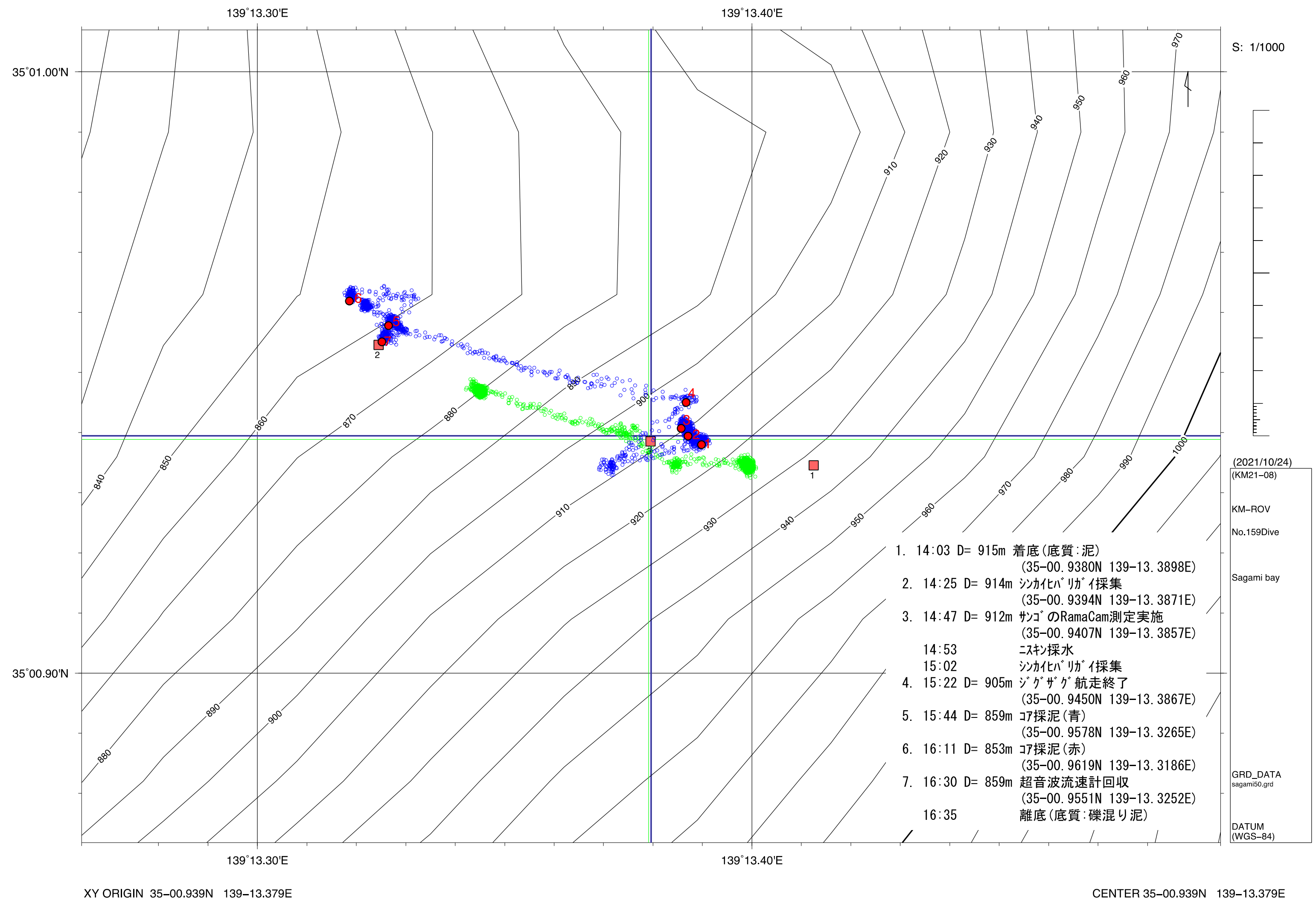
Front payload

Rear Payload

Sampling Points and Events:

Time	Position	Depth	Events
14:03	35-00.9380N 139-13.3898E	915	Landing
14:25	35-00.9394N 139-13.3871E	914	Mussel sampling
14:47	35-00.9407N 139-13.3857E	912	RamaCam caliblation
14:53			Water sampling with Niskin
15:02			Mussel sampling
15:06	35-00.9386N 139-13.3887E	914	Mapping start
15:22	32°06.292'N, 139°52.170'E	915	Mapping end
15:44	35-00.9578N 139-13.3265E	859	Sediment sampling (blue)
16:11	35-00.9619N 139-13.3186E	853	Sediment sampling (red)
16:30	35-00.9551N 139-13.3252E	859	ADV retrieving
16:35			Leaving

Dive track KM-ROV#159



4.1.3 Dive methodology and data management

Sangekar Mehul Naresh (JAMSTEC)

Imaging Payload Equipment

- Standalone Stereo Camera System
- Camera pair with 2.7K resolution
- Underwater housing rated to 4000 m
- Dimensions 280 mm W x 80 mm H x 170 mm D
- Weight (air) 12 Kg, (water) 7 Kg
- Standalone housing with power from separate battery unit

The system connects to a remote laptop using custom Wireless Network which is used to adjust settings, start and stop recording data. The recording frequency can be adjusted and was set to 1 stereo image pair per second for the entire cruise. An initial delay was also added before images are recorded which was set to 60 seconds.

Before each dive, the camera system was connected to a laptop using wireless network and data recording was started. The data was recorded in an SD card internal to the camera housing. At the end of each dive, the camera was removed from the ROV and powered using external power supply for data extraction. The data was downloaded using wireless connection to the laptop.

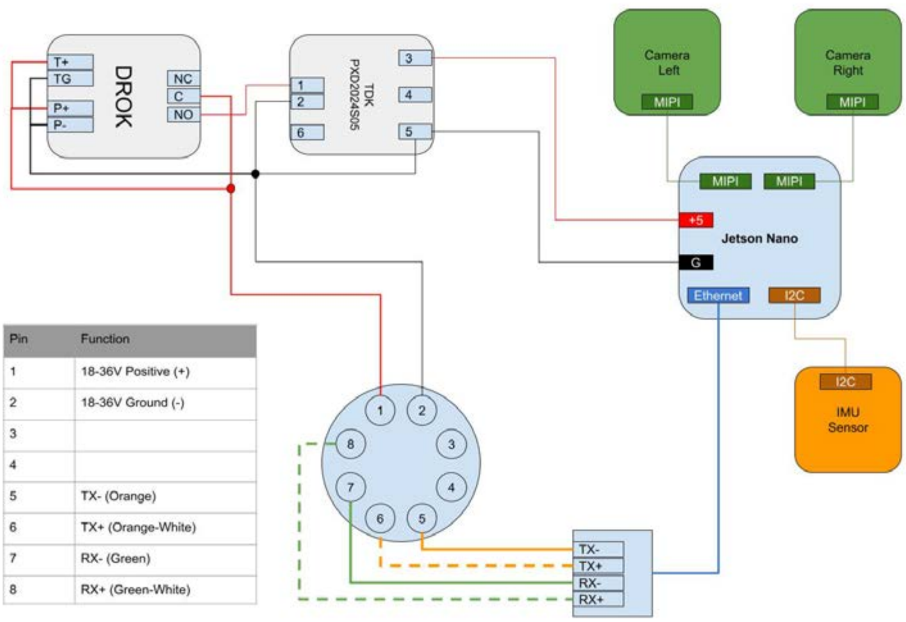


Fig. Schematic circuit diagram of the camera system internals

Battery pack for Camera

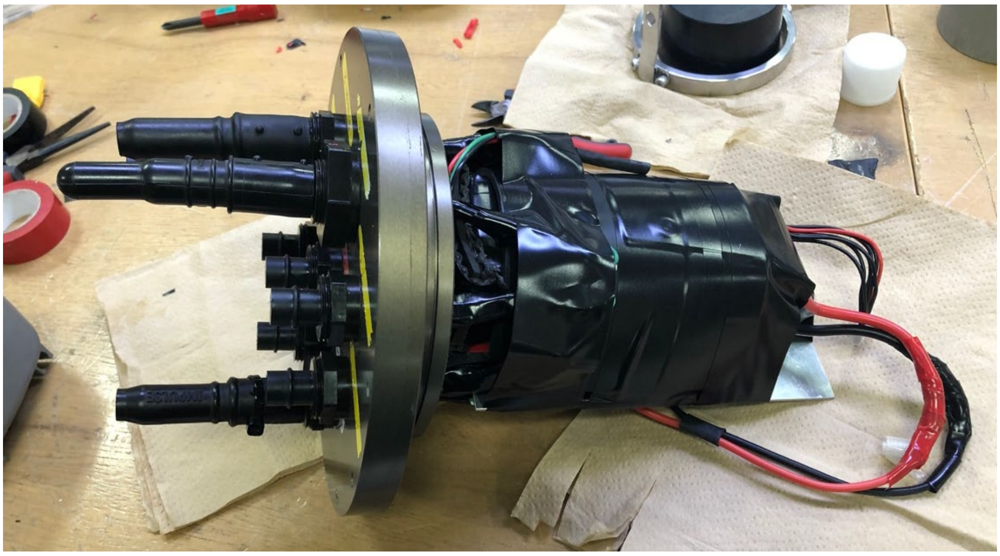


Fig. Internals of the battery pack

The camera system was powered by an external custom-made battery pack. The specifications of the battery pack used are follows:

- Type: Li-Po
- Voltage: 22.2 V (6 cell)
- Capacity: 6000 mAh, 50C
- Dimensions 325 mm H x 130 mm Dia
- Weight (air) 11 Kg, (water) 4.5 Kg

The battery pack is charged by a balanced power charger after each dive. To prevent overheating of the Li-Po batteries, the housing was removed from the ROV after each dive and batteries were charged after opening the housing.

Camera system on the ROV

The camera system was mounted on the top part of the ROV frame, slightly to the left side, as can be seen in the figure. The battery pack was also mounted on the top to the right side.

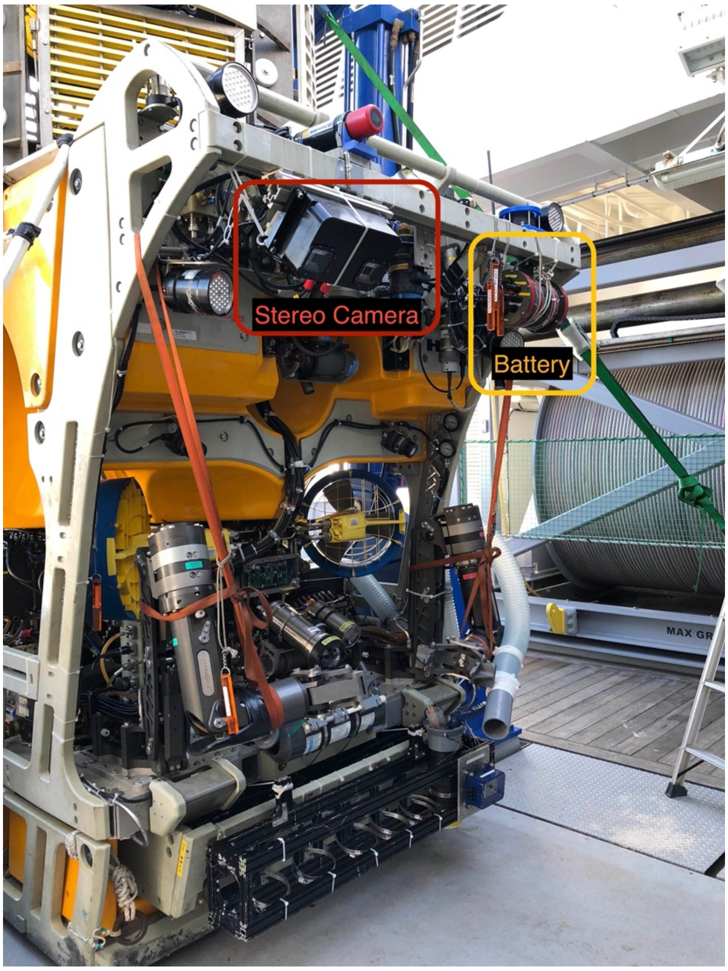


Fig. Camera and battery pack mounted on the ROV

Lighting for Camera

The system does not have its own lighting but relies on illumination from ROV. Since the ROV has multiple forwards lights, tests were performed during one of the dives to find out best suited lighting for images. Images were recorded using different illumination conditions and compared to select those with least particle noise and bright overall illumination. It was found that best illumination was obtained when the top lights were kept at 40% power and the forward spot lights were kept at 80% power.

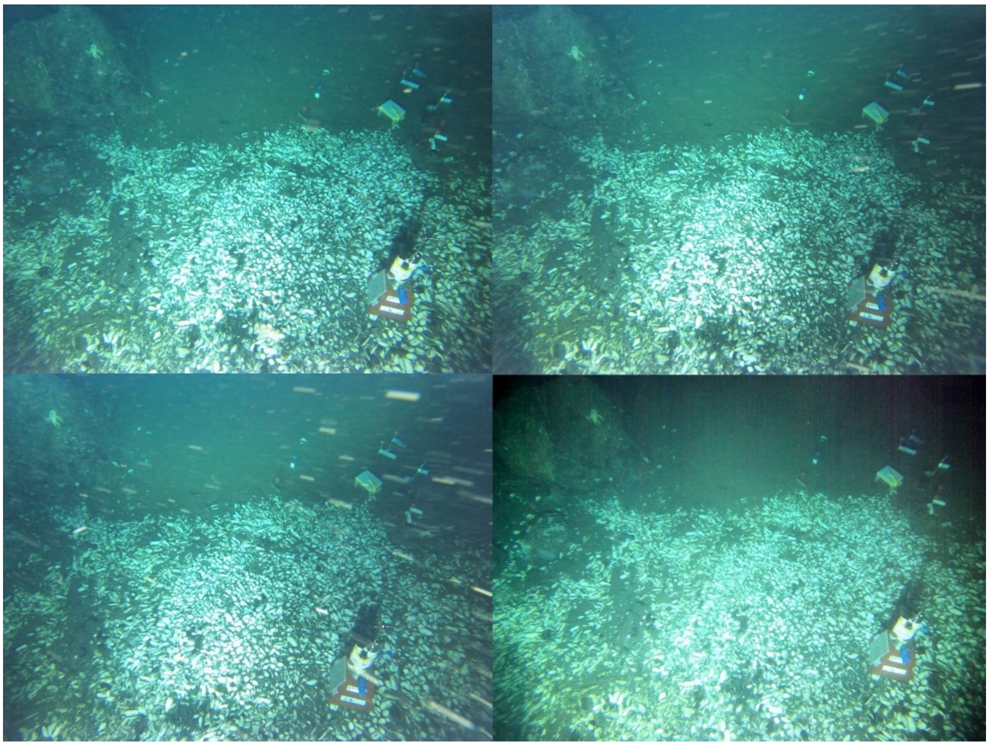


Fig. Images of the same scene takes with different ROV illuminations. Top-left shows best illumination with no particle noise

Data Management

Data was recorded on the internal SSD card of the camera system which was then downloaded after each dive. For each recording, the stereo image pairs were automatically saved in a new folder with left and right cameras having names.

/lcam/ lYYYYMMDD_HHMMSS_MS.png
/rcam/ rYYYYMMDD_HHMMSS_MS.png

This made it easy to identify the individual stereo camera pairs. The laptop computer used to configure the camera system was connected to the ship network. The time for this computer was made to sync with the NTP time server of the ship. Before each dive, the camera clock was made to synchronize with the clock of the laptop to get accurate image pair timings.

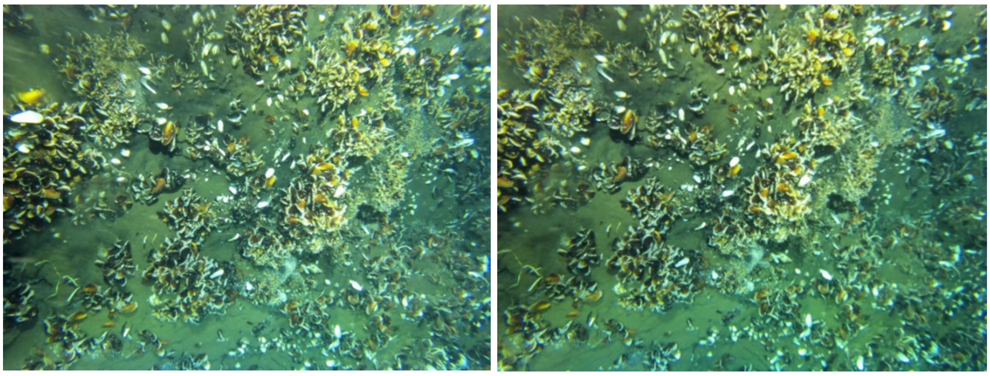


Fig. Example of stereo image pairs. l20212310_161433_007.png and r20212310_161433_007.png

Calibration Images

A circular calibration board was attached to the base of the velocity measurement probe during one of the dives for underwater calibration. The calibration board used has black circles over while background with a grid size of 21 x 15

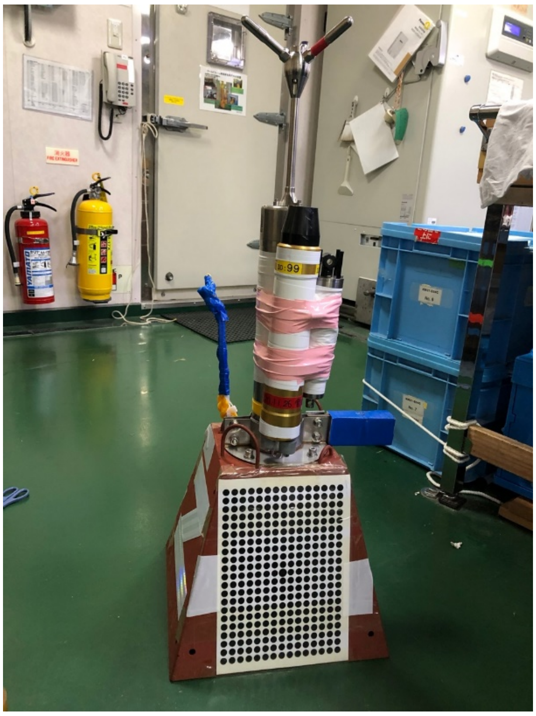


Fig. Calibration board mounted on velocity probe base. Right, image of the calibration board taken during the dive

Stereo images of this board were acquired during the dive which are then used to calibrate the system and estimate the stereo camera parameters. For this, the ROV manipulator was made to pick up the setup and move it in front of the camera system along different orientations as seen in the figure.

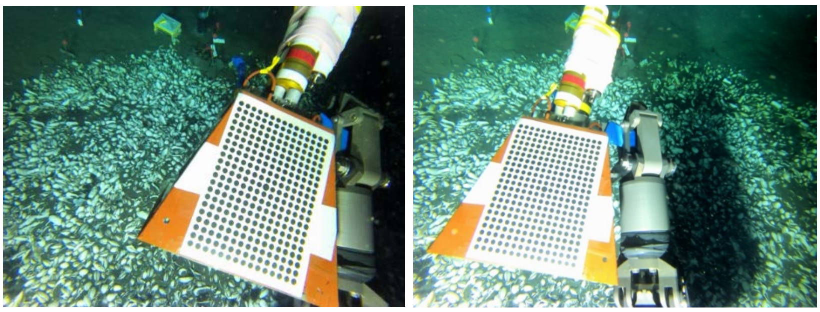


Fig. Calibration board seen in different orientations taken during the dive

4.2 Marine pollution baseline study and environmental impact assessment

4.2.1 CTD water sampling

Marine Works Japan

(1) Personnel

Yasuo Furushima	(JAMSTEC)	*Principal Researcher
Tun Htet Aung	(MWJ)	*Operation Leader
Masanori Enoki	(MWJ)	
Yukihiko Nakano	(MWJ)	
Yuta Shinomiya	(MWJ)	

(2) Objective

Investigation of oceanic structure and water sampling

(3) Parameters

Temperature
Salinity
Pressure
Dissolved Oxygen
Fluorescence
Beam Transmission
Turbidity
Photosynthetically Active Radiation (PAR)
Height Above Sea bottom （Altimeter, 100m range from bottom）

(4) Instruments and Methods

CTD/Carousel Water Sampling System, which is a 36-position Carousel Water Sampler (CWS) with Sea-Bird Electronics, Inc. CTD (SBE9plus), was used during this cruise. 12-liter sample bottles were used for sampling seawater. The sensors attached on the CTD were to measure temperature (primary and secondary), conductivity (primary and secondary), pressure, dissolved oxygen, fluorescence, beam transmission, turbidity, and photosynthetically active radiation and height above sea bottom (range is 100m from bottom). The CTD/CWS was deployed from starboard on working deck.

Specifications of the sensors used are listed below.
CTD: SBE911plus CTD system
Under water unit:

SBE9plus (S/N: 09P84583-1235, Sea-Bird Electronics, Inc.)

Pressure sensor: Digiquartz pressure sensor (S/N: 134402)

Calibrated Date: 04 Mar. 2020

Carousel water sampler:

SBE32 (S/N: 324510-1086, Sea-Bird Electronics, Inc.)

Temperature sensors:

Primary: SBE03Plus (S/N: 03P2730, Sea-Bird Electronics, Inc.)

Calibrated Date: 28-Dec-2019

Secondary: SBE03 (S/N: 034818, Sea-Bird Electronics, Inc.)

Calibrated Date: 05-Jun-2021

Conductivity sensors:

Primary: SBE04C (S/N: 044450, Sea-Bird Electronics, Inc.)

Calibrated Date: 08-Jun-2021

Secondary: SBE04C (S/N: 043889, Sea-Bird Electronics, Inc.)

Calibrated Date: 08-Jun-2021

Dissolved Oxygen sensors:

Primary: RINKOIII (S/N: 0221, JFE Advantech Co., Ltd.)

SBE43(S/N: 433161, Sea-Bird Electronics, Inc.)

Calibrated Date: 25-May-2021

Fluorescence sensor:

Chlorophyll Fluorometer (S/N: 3701, Seapoint Sensors, Inc.)

Gain setting: 30X, 0-5 ug/l

Offset: 0.000

Transmission meter:

C-Star (S/N CST-1727DR, WET Labs, Inc.)

Calibrated Date: 15 May. 2021

Turbidity:

Turbidity Meter (S/N: 14954)

Gain setting: 100X

Scale factor: 1.000

Calibrated Date: None

Photosynthetically Active Radiation (PAR) sensor
PAR-Log ICSW (S/N: 1026, Satlantic, Inc.)
Calibrated Date: 6-Jul-2015

Altimeter:
Benthos PSA-916T (S/N: 52396, Teledyne Benthos, Inc.)

Submersible Pumps:
Primary: SBE5T (S/N: 058088, Sea-Bird Electronics, Inc.)

Secondary: SBE5T (S/N: 058145, Sea-Bird Electronics, Inc.)

Bottom contact switch: (Sea-Bird Electronics, Inc.)

Deck unit: SBE11plus (S/N 11-1033, Sea-Bird Electronics, Inc.)

The CTD raw data were acquired in real time using the Seasave (ver.7.26.7.121) provided by Sea-Bird Electronics, Inc. and stored on the hard disk of the personal computer.

The bottles were fired after waiting for more than 30 seconds from the stop.

Data processing procedures and performed modules of SBE Data Processing-Win32 (ver.7.26.7.129) and their descriptions were as follows:

(The process in order)

DATCNV: Convert the binary raw data to engineering unit data. DATCNV also extracts bottle information where scans were marked with the bottle confirm bit during acquisition. The duration was set to 3 seconds, and the offset was set to 0.0 seconds.

RINKOCOR (original module): Correct the time dependent, pressure induced effect (hysteresis) of the RINKOIII profile data.

RINKOCORROS (original module): Correct the time dependent, pressure induced effect (hysteresis) of the RINKOIII bottle information data by using the hysteresis corrected profile data.

BOTTLESUM: Create a summary of the bottle data. The data were averaged over 3 seconds.

ALIGNCTD: Convert the time-sequence of sensor outputs into the pressure sequence to ensure that all calculations were made using measurements from the same parcel of water. Dissolved oxygen data are systematically delayed with respect to depth mainly because of the long time constant of the dissolved oxygen sensor and of an additional delay from the transit time of water in the pumped pluming line. This delay was compensated by 5 seconds advancing dissolved oxygen sensor (SBE43) output (dissolved oxygen voltage) relative to the temperature data. RINKOIII voltage (User polynomial 0) was advanced to 1 second.

WILDEDIT: Mark extreme outliers in the data files. The first pass of WILDEDIT obtained the accurate estimate of the true standard deviation of the data. The data were read in blocks of 1000 scans. Data greater than 10 standard deviations were flagged. The second pass computed a standard deviation over the same 1000 scans excluding the flagged values. Values greater than 20 standard deviations were marked bad. This process was applied to pressure, depth, temperature (primary and secondary) and conductivity (primary and secondary) dissolved oxygen voltage (SBE43).

CELLTM: Remove conductivity cell thermal mass effects from the measured conductivity. Typical values of thermal anomaly amplitude alpha = 0.03 and the time constant 1/beta = 7.0 were used.

FILTER: Perform a low pass filter on pressure and depth data with a time constant of 0.15 second. In order to produce zero phase lag (no time shift) the filter runs forward first then backward.

WFILTER: Perform a median filter to remove spikes. The window length is determined for a specific data value and the median value is calculated for each specified window, and the data value at the window`s center point is replaced by the median value. The window length is specified as 49 scans for the fluorescence data, beam transmission data, beam attenuation data, output voltage of Transmissometer and turbidity data.

SECTIONU (original module of SECTION): Select a time span of data based on scan number in order to reduce the file size. The minimum number was set to be the starting time when the CTD package was beneath the sea-surface after activation of the pump. The maximum number was set to be the end time when the package came up from the surface.

LOOPEDIT: Marked scans where the CTD was moving less than the minimum velocity of 0.0 m/s (traveling backwards due to ship roll).

DESPIKE (original module): Removed spikes of the data. A median and mean absolute deviation was calculated in 1-dbar pressure bins for both down and up cast, excluding the flagged values. Values greater than 4 mean absolute deviations from the median were marked bad for each bin. This process was performed twice for temperature, conductivity and dissolved oxygen (RINKOIII and SBE43) voltages.

DERIVE: Compute dissolved oxygen data (SBE43).

BINAVG: Averaged the data into 1 decibar pressure bins and 1 second time bins.

BOTTOMCUT (original module): Deleted discontinuous scan bottom data, when it's created by BINAVG.

DERIVE: Compute salinity, potential temperature, and density (sigma-theta).

SPLIT: Separate the data from the input .cnv file into down cast and up cast files.

(5) Station list

1 cast of CTD measurement was carried out (Table 1).

(6) Preliminary Results

No problem found.

(7) Data archive

These data obtained in this cruise will be submitted to the Data Management Group of JAMSTEC, and will be opened to the public via "Data Research System for Whole Cruise

Information in JAMSTEC (DARWIN)" in JAMSTEC web site.
<http://www.godac.jamstec.go.jp/darwin/e>

Table 1: KM21-08 CTD cast table

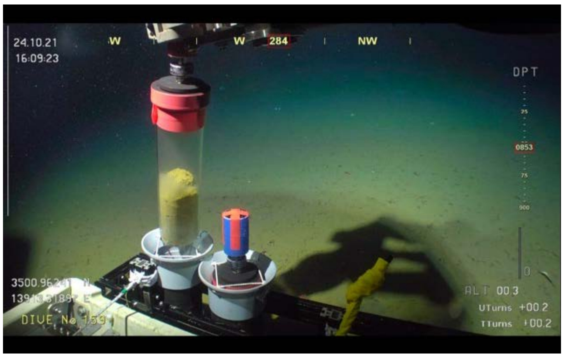
Stnnbr	Castno	Date(JST)	Time(JST)		BottomPosition		Depth	Wire	HT Above	Max	Max	CTD	Remark
		(mmddyy)	Start	End	Latitude	Longitude	(m)	Out (m)	Bottom (m)	Depth	Pressure	Filename	
HAT	1	102321	11:14	11:55	35-00.95N	139-13.33E	866.1	879.5	9.2	873.8	882.0	HATM001	

4.2.2 H-type push core sampling – POPs contamination analysis

Tetsuro Ikuta and Yuka Amari (JAMSTEC)

Despite a previous observation of very low levels of marine debris in Myojin Knoll, which were originally planned to be surveyed during this cruise, our recent analyses have shown that contamination of persistent organic pollutants (POPs) in deep-sea mussels collected from these areas is comparable to that found in the Sagami Bay located near a more highly populated region. In order to investigate the pathways of POPs contamination in the deep-sea benthic animals, this cruise was planned to collect sediment samples from the Myojin Knoll to analyze the extent of habitat contamination. However, due to the poor sea conditions on the days of the dives, we had to abandon the dives at Myojin Knoll. In our recent study, POPs have also been detected in deep-sea bivalves in Sagami Bay, the alternative area. Therefore, we collected sediment samples to investigate the contamination of the habitat of organisms living in this site. In the dive #159, two sediment samples were collected by the H-type push corer. On the ship, outer part of the sediment core, which had contacted to the polycarbonate tube during the sampling, were trimmed off. The samples were stored in clean glass bottles at −30°C. After cruise, the amounts of POPs will be analyzed. Sediment sample from Myojin Knoll will be collected in next year's cruise.

Sediment core #1



Sediment core #2

4.2.3 RamaCam observation

Tomoko Takahashi (onboard), JAMSTEC

Overview

Suspended particles and organisms in the ocean are important for understanding ocean nutrient cycles. Microplastics, which cause serious pollution on a global scale, behave similar as the organic particles and transported to all parts of the oceans, and have become a threat to marine ecosystems. Deep-sea minerals are the focus of much attention recently, while impacts of deep-sea mining on ecosystems needs to be assessed thoroughly, particularly those of scattering mineral particles which contain hazardous materials such as arsenic and mercury. However, very little is known about suspended and sinking particles particularly in the deep ocean due to their extremely low abundance, and currently with most knowledge based on pointwise measurements from sediment traps or sampling nets with accumulated information over long time periods.

RamaCam, an analyzer of deep-sea particles, aims at *in-situ* real-time measurements of suspended particles in the deep sea, and we performed sea trials of the RamaCam prototype at the water depth of 900 m using KM-ROV for the first time during KM21-08.

RamaCam device

RamaCam, as shown in Figure 1, was mounted on the KM-ROV. The power was supplied by a 100V AC line on the ROV. It was controlled using a PC via an Ethernet communication line on the ROV and the measured data can be monitored in real-time. An inlet funnel, attached to the front side of the ROV, was connected to the measurement chamber, and an outlet was attached to also the measurement chamber with a long hose. Between the measurement chamber and the outlet, a pump was connected to make the water flow. The measurement chamber, a 20 cm channel with the inner diameter of 12 mm, was illuminated using a collimated continuous wave laser beam with the wavelength of 532 nm and the diameter of 8 mm for holographic imaging and Raman spectroscopy. This allows both morphological and chemical identification of particles using a compact setup. While holographic imaging can be performed with a fast frame rate, typically several to several tens of Hz, a Raman measurement typically takes several tens of seconds per spectrum. Therefore, we first used holographic imaging to screen the seawater and captured a particle in the measurement chamber so as to perform a Raman measurement only onto a particle and avoid unnecessary measurements of the seawater without a particle. The seawater was continuously sucked from the inlet funnel and holographic images were continuously taken with the frame rate of 4 Hz. The trigger to stop the pump and initiate a Raman measurement was sent manually once a particle was observed in a holographic image. The acquisition time of the Raman measurement was first optimized by taking several test shots, then five Raman spectra were taken for each particle. After the Raman measurement, the pump automatically started again. While this measurement process has been already fully automated in the laboratory setup, during the sea trials, particle detection was performed manually since the illuminated area in the holographic image slightly fluctuated due to vibration caused by the ROV during *in-situ* measurements, which may lead to false detection. Coral skeleton, which consists of calcium carbonate, was crushed by the ROV manipulator in front of the inlet funnel to calibrate the system during the dive 159.

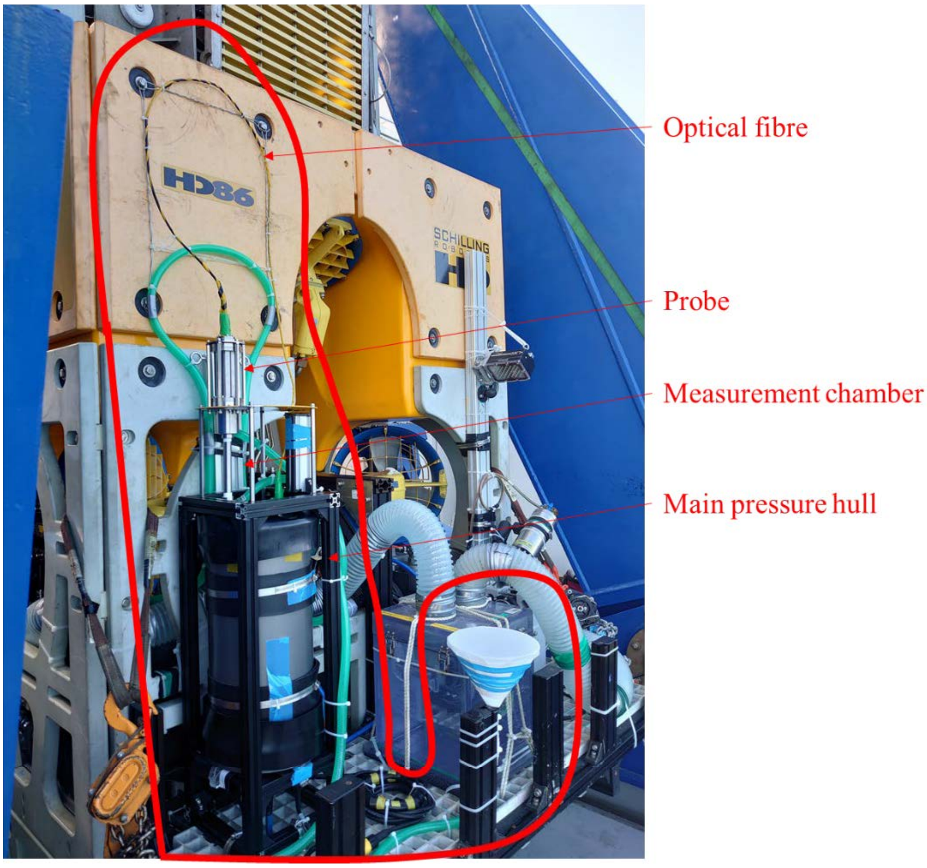


Figure 1 RamaCam mounted on the back side of KM-ROV.

Preliminary results

During the dive 158 and 159 of the KM-ROV, RamaCam was successfully operated to take holographic images of natural particles in the seawater. Fig. 2 shows examples of reconstructed holographic images taken during the dives. Most of particles seen in holographic images had a size with several hundreds of µm, which are considered to be a fragment of organic matters, but these were too small for Raman measurements. Raman spectra have been being analyzed, and it has been found so far that some larger particles and cluster of particles showed broad fluorescence patterns in the spectra.

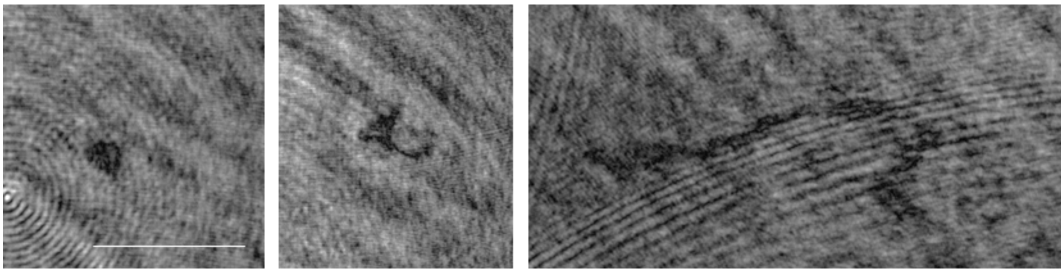


Figure 2 Examples of *in-situ* holographic images. The scalebar indicate 1 mm.

Summary and Future directions

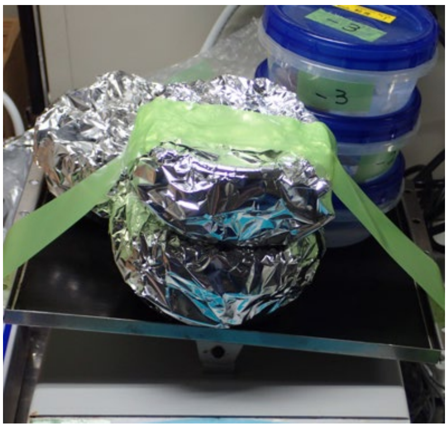
The RamaCam was successfully deployed for the first time in the deep sea at the depth of 900 m. Holographic images were continuously captured. Once a particle was detected in a hologram, the pump immediately stopped, and Raman measurements were performed onto a trapped particle in the chamber. The series of *in-situ* holographic images will be used for development of an automatic particle detection algorithm for next *in-situ* trials. In future works, the *in-situ* RamaCam system is going to be stand-alone, which is suitable for long-term observation by mounting on platforms such as floats and landers.

4.2.4 Physiological impacts of microplastics on deep-sea megabenthic animals

Tetsuro Ikuta and Yuka Amari (JAMSTEC)

The presence of microplastics in the marine environment has become an emerging threat to marine ecosystems. Due to their small size, microplastics may be ingested or uptaken by megabenthic or mega-planktonic animals. The animals living in the deep-sea will be no exception. However, the distribution of microplastics in deep-sea animals and the physiological effects of microplastics on them have been poorly understood.

The deep sea is not only a place where plastic particles accumulate, but also a place where persistent organic pollutant adhering to them also collects. Despite a previous observation of very low levels of marine debris in Myojin Knoll, which were originally planned to be surveyed during this cruise, our recent analyses have shown that contamination of polychlorinated biphenyls (PCBs) in deep-sea mussels collected from these areas is comparable to that found in the Sagami Bay located near a more highly populated region. PCBs are poorly soluble in water and can enter organisms by attaching to organic particles such as microplastics in water. In this cruise, we had planned to collect some benthic animals from Myojin Knoll and to retrieve and deploy the fine particle uptaking experimental cages. However, poor sea conditions on the days of the dives forced us to abandon the dives at Myojin Knoll. In the alternative site, off Hatsushima Island in Sagami Bay, our resent analysis has shown that PCBs were detected in chemosynthetic bivalves collected from there. In this cruise, we collected some benthic animals and carried out on board experiments on the uptake of micro-organic particles. After cruise, histological and molecular analyses will be carried out to investigate the mechanisms of microparticle uptake into the animal body. Experiments on the mechanisms of microplastic uptake will be continuously carried out in next year's cruise. The fine particle uptaking experimental cages at Myojin Knoll will be retrieved in next year's cruise.



Micro-organic particles uptake experiment

4.2.5 Flow observation

Yasuo Furushima (JAMSTEC)

In order to evaluate the entrainment and redeposition of suspended particles near the seafloor, an Acoustic Doppler Velocimetry (ADV, Nortek AS) was installed on the seafloor to measure the high-definition 3D flow near the seafloor. An Expendable Vertical Microstructure Profiler (VMP-X, Rockland Scientific International Inc.) was also used to measure turbulence from the surface layer just above the seafloor. The results of the turbulence observations are given in "4.2.6 Estimating turbulence intensity". Vertical observations of temperature and salinity by XCTD were also carried out together during the period of turbulence measurements (see Appendix).

ADV Observation

The ADV was installed by the KM-ROV on the seafloor at a depth of 859 m off Hatsushima on October 23, 2021 (around 15:00), and the ADP was recovered by the KM-ROV a day and a night later on October 24, 2021 (around 16:00). The east-west, north-south, and vertical components of flow velocity, water temperature, and water pressure were measured at 1-second intervals (continuous mode). The flow component was also recorded at 32 Hz. The results obtained in this study will be used not only to understand the flow environment just above the seafloor, but also to estimate the continuous turbulence intensity.

Fig. 1 shows the variation of horizontal velocity, vertical velocity, water depth, and water temperature just above the seafloor off Hatsushima. The near-seabed current velocity was smaller than 10 cm/sec. It was suggested that the magnitude of the current was in response to tidal fluctuations. The detailed analysis of the flow environment and its relation to turbulence intensity will be continued.

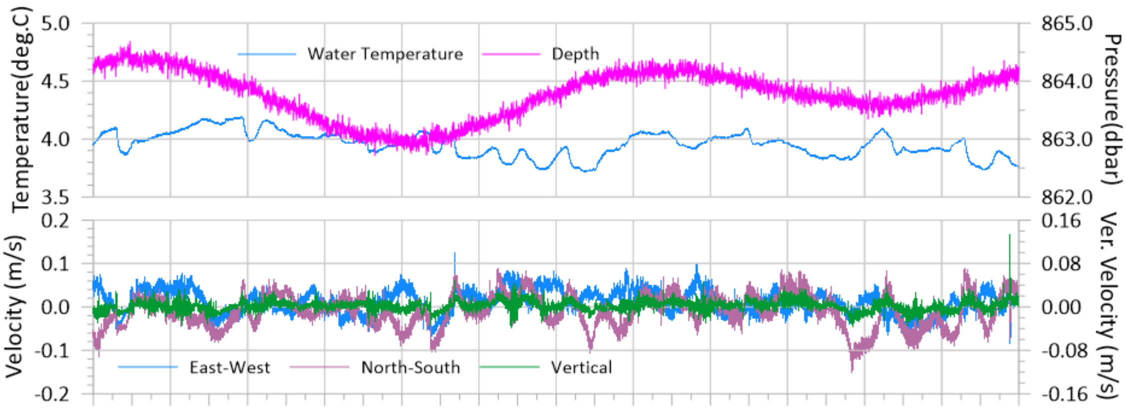


Fig.1 Fluctuations of velocity, pressure (depth index), and water temperature in the horizontal and vertical directions at the seafloor off Hatsushima.

4.2.6 Estimating turbulence intensity

Mamoru Tanaka (Tokyo University of Science), Masayuki Nagao (AIST),
Yasuo Furushima (JAMSTEC)

Long-term monitoring of near-bed turbulence intensity is desirable for marine pollution baseline study. To develop a simple, low-cost method for monitoring near-bed turbulent intensity, an Acoustic Doppler Velocimeter (ADV) was deployed on the deep-sea bed from October 23rd to 24th near Hatsu-shima Island (35.0095417N, 139.1332399E; 859 m) using KM-ROV.

The process for ADV deployment is summarized in Table 1. Vertical Microstructure Profiler-Expendable (VMP-X) was used to directly observe turbulence intensity and to validate indirect estimates from ADV.

Table 1.

Oct 23	14:10	KM-ROV landing
	15:00	ADV deployment
	16:30	Resuspension due to KM-ROV
Oct 24	08:06	VMP-X deployment
	15:30	ADV recovery

Acoustic Doppler Velocimeter

ADV recorded *in-situ* velocity at a small sampling volume (2.3 cm^3) with a sampling rate of 32 Hz. We deployed ADV with a small foundation to minimize artificially generated turbulence, which could be a problem when using relatively large foundation like landers (Fig. 1).

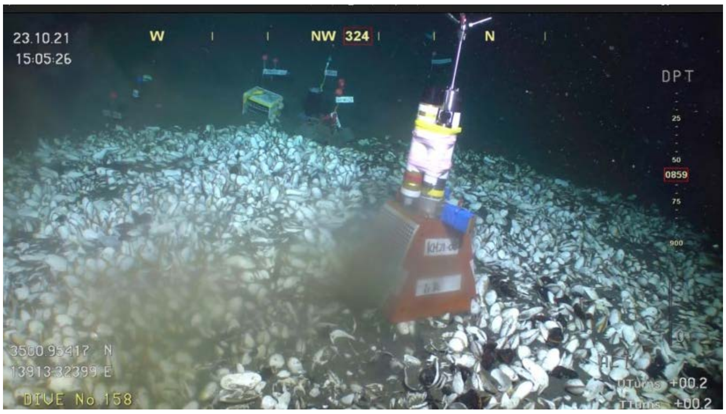


Fig. 1. ADV deployed on the seabed

ADV successfully recorded three directional velocity components (i.e., eastward, northward, and upward) as well as water pressure and echo amplitude (Fig. 2). Velocity data exhibit high levels of noise, which is typical when measuring in clear waters using ultrasonic current meters. We can see the noise reduction around 16:30, which may be caused by resuspension due to the KM-ROV thruster.

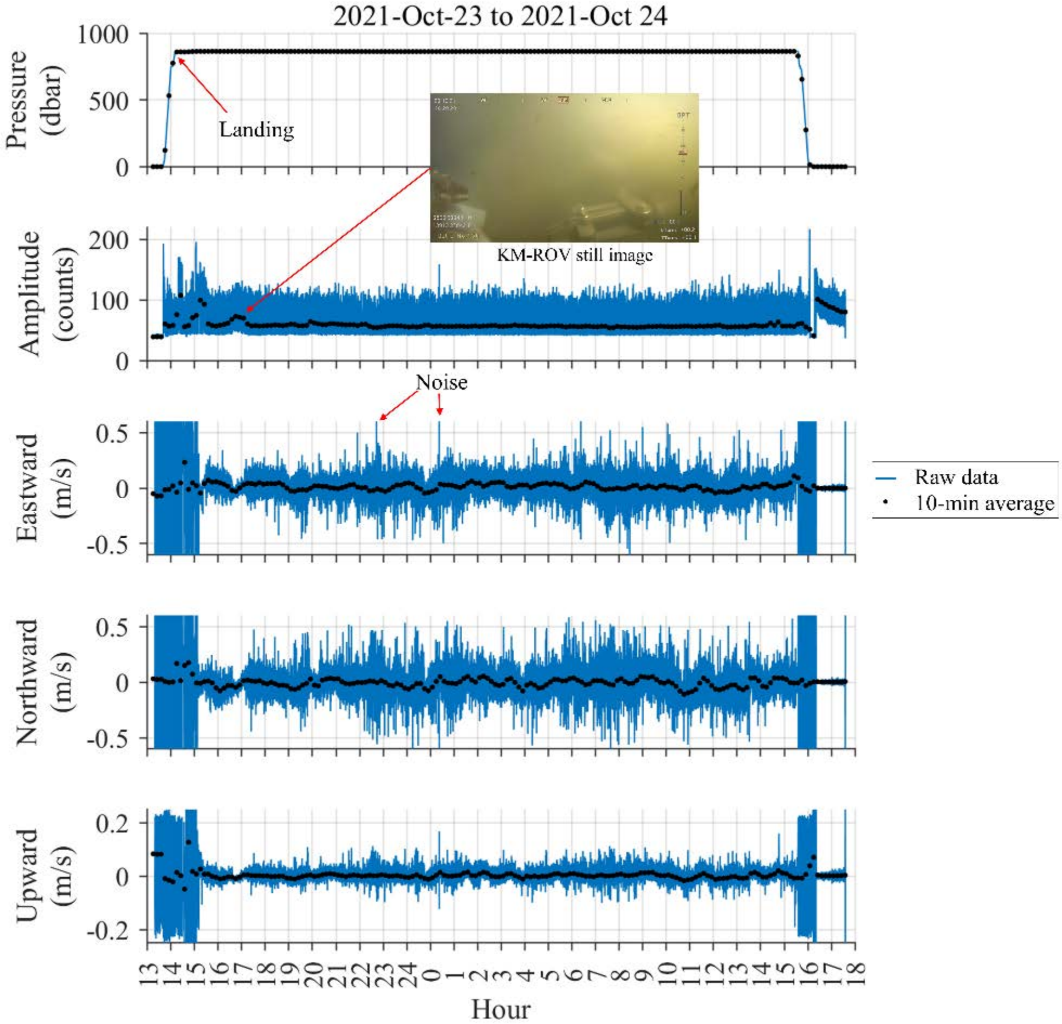


Fig. 2. Time-series data by ADV.

Vertical Microstructure Profiler-Expendable

VMP-X directly measures microscale velocity shear and temperature fluctuation caused by local turbulence. During the ADV deployment period, VMP-X was deployed from the surface, recording microstructure data at a sampling rate of 1250 Hz with fall rate of 0.6 to 0.7 m/s (Fig. 3). The VMP-X recording lasted until it hit the seabed.

Based on data acquired from VMP-X, we estimated turbulent kinetic energy dissipation rate (ε; W/kg) and temperature variance dissipation rate (χ_T; °C^2/s), which are proxies of turbulent intensity (Fig. 4). Both roughly ranged from 10^{-10} to 10^{-6}, which are typical values in the open ocean.

Fig. 3. VMP-X deployment.

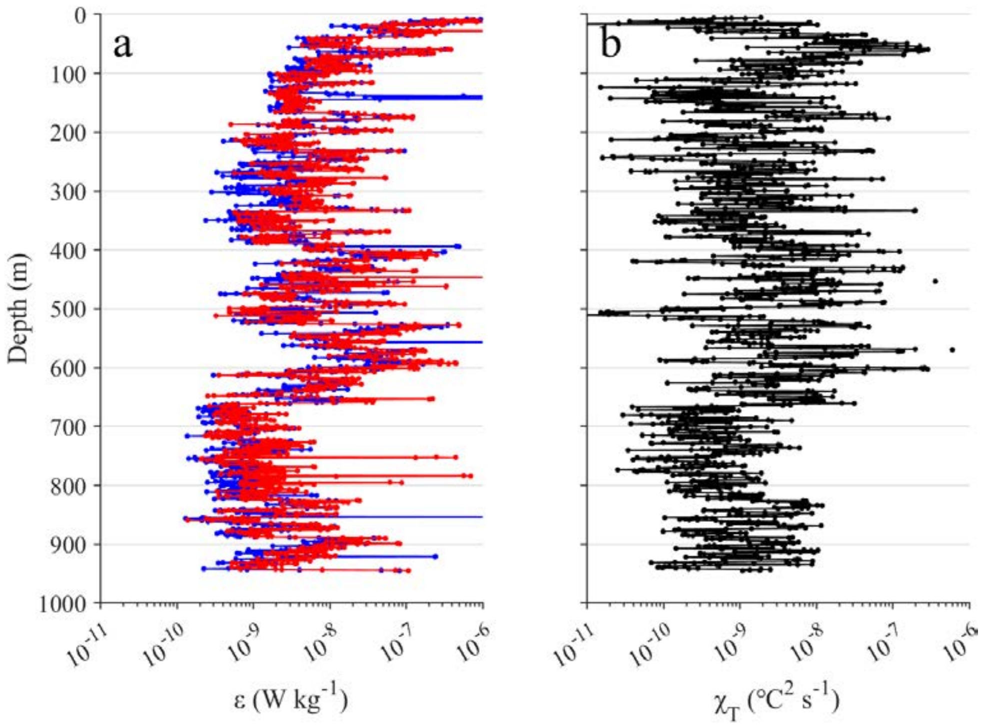


Fig. 4. Turbulent kinetic energy dissipation rate (ε; W/kg) and temperature variance dissipation rate (χ_T; ℃^{2}/s) obtained by VMP-X.

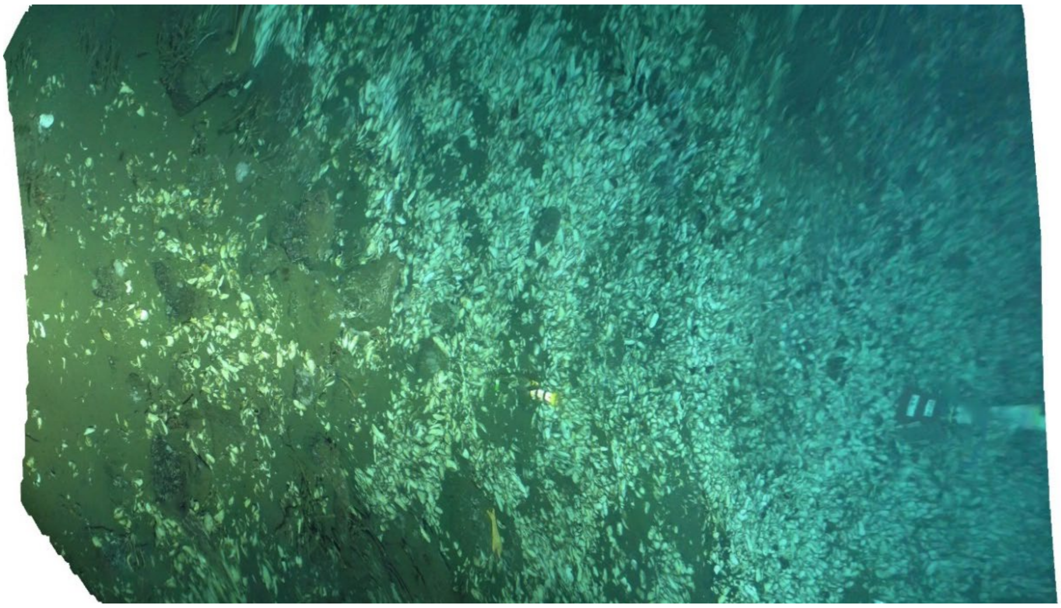
We will estimate turbulent kinetic energy dissipation rates from the ADV data and compare those with those directly observed by VMP-X. Our developing simple, low-cost method for monitoring near-bed turbulence contributes to baseline study, and hence, acquisition of additional data in the next cruise is desirable.

4.2.7 Sea bottom mapping (Yamakita)

Takehisa Yamakita (onboard), JAMSTEC

The mapping of the seafloor using the horizontal main camera on KM-ROV was considered. In particular, lighting which is one of the important factor in mapping was adjusted, and we decided the settings of the lighting as follows. No.5:50%, No.6 & No.7:80%, No.1:70%, No.4: 50%, No.2:50%, No. 8, 9 & 10: 0%. At the *Bathymodiolus* deep-sea mussel (Hibarigai) site, a zigzag run was attempted, but only one diagonal run was possible due to lack of time. However, we were able to create a composite image of the area by integrating some of the continuous parts of the image. We were able to see that there are a large patch and small patches on the slope. There are also another places where cnidarians can be found. We were able to visualize the condition such as dense or sparse of the mussel by producing composite landscape photographs. Although we were not able to map the area of the white deep-sea cold-seep clam (Shirourigai) site, we were able to create the following photos showing the location from the edge to the center of the patch, which were useful for getting a visual image of the site.

Composite image of mussel site

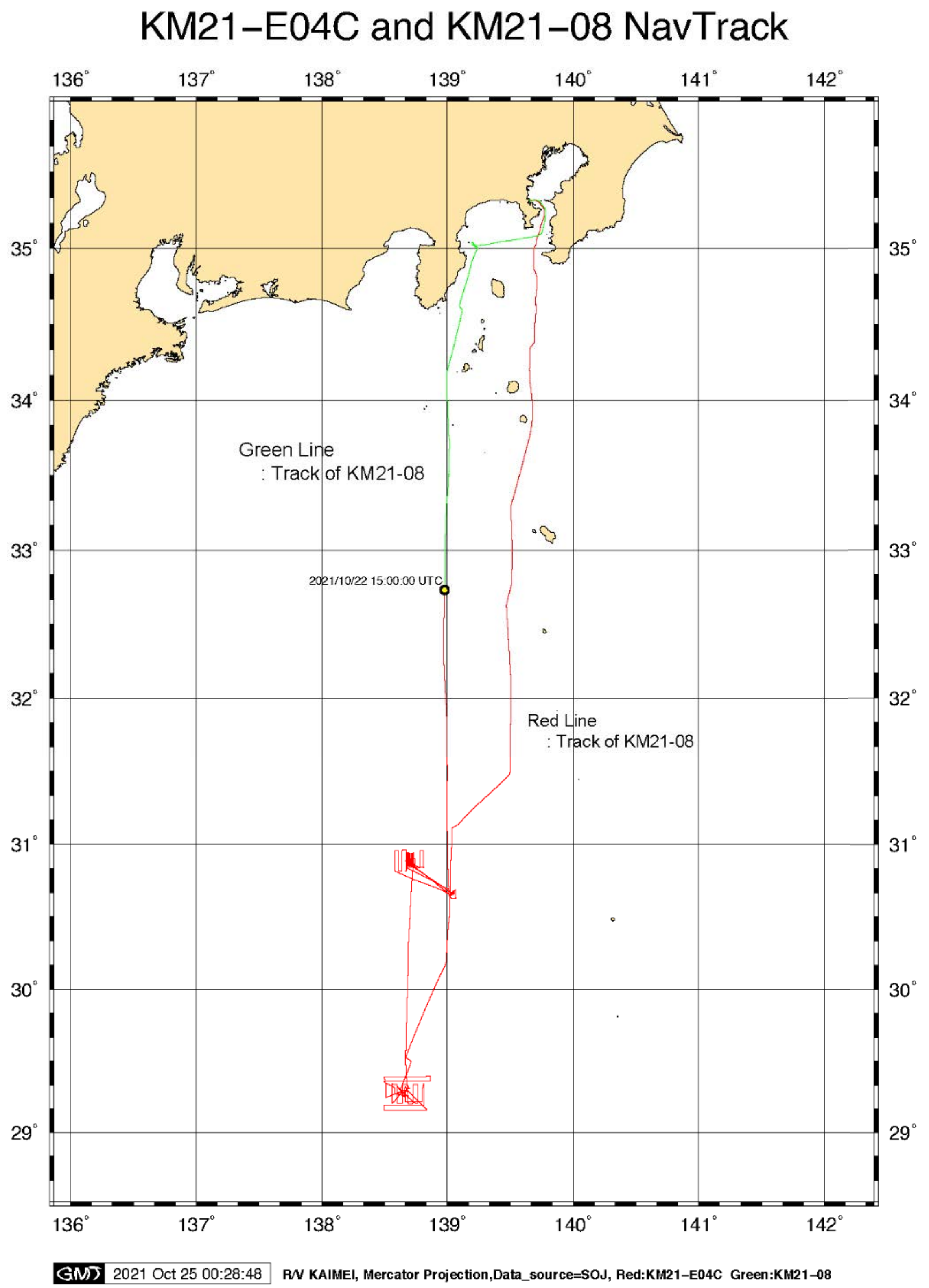


Composite image of white clam site

Notice on Using

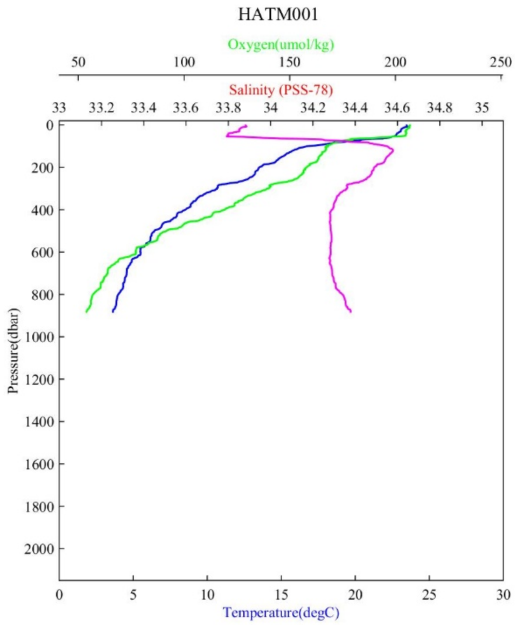
Appendix

I. Ship track



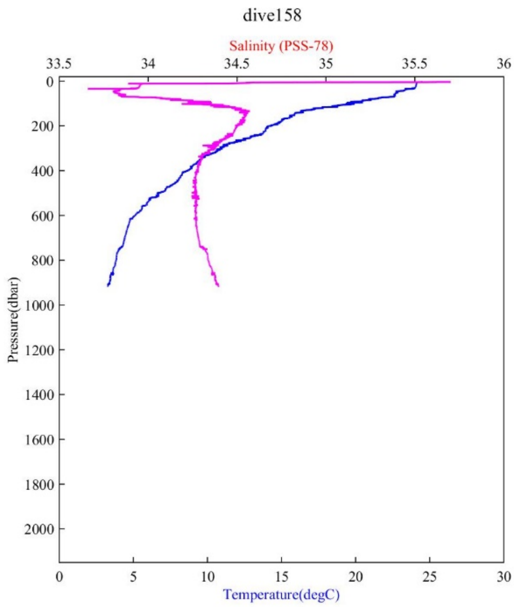
Track charts of the R/V KAIMEI research cruise KM21-E04C (Red line; Oct. 12th – Oct. 22th) and KM21-08 (Green line; Oct. 23th – Oct. 25th, 2021).

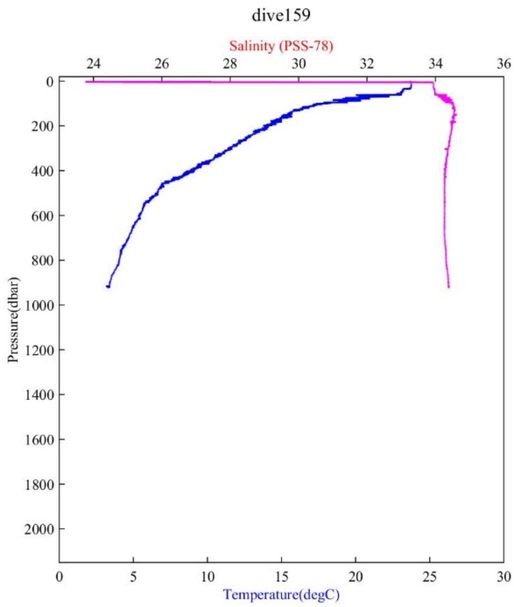
II. CTD/DO profiles_ Water Sampler profile and KM-ROV



CTD Water Sampler profile

(23rd Oct 2021.HATM001)





KM-ROV CTD profile

(23rd Oct 2021 – 24th Oct 2021. Dive 158 - 159)

III. XBT/XCTD profiles

XBT/XCTD measured water depth, temperature, and conductivity.

Equipment Specification

Digital Converter	TS-MK-130
Hand Launcher	LM-3A
Auto Launcher	AL-12B
Software	MK-150L (for Hand Launcher)
	AL-12 (for Auto Launcher)

XBT Probe

Temperature Range	-2.22 to 35.55 degreeC		
Accuracy	±0.2 degreeC		
Depth Range	T-5	1830m	less than 6knot (water speed)
	T-6	460m	less than 15knot (water speed)
	T-7	760m	less than 15knot (water speed)
	T-10	300m	less than 10knot (water speed)
Duration	T-5	291 second	
	T-6	70 second	
	T-7	118 second	
	T-10	48 second	

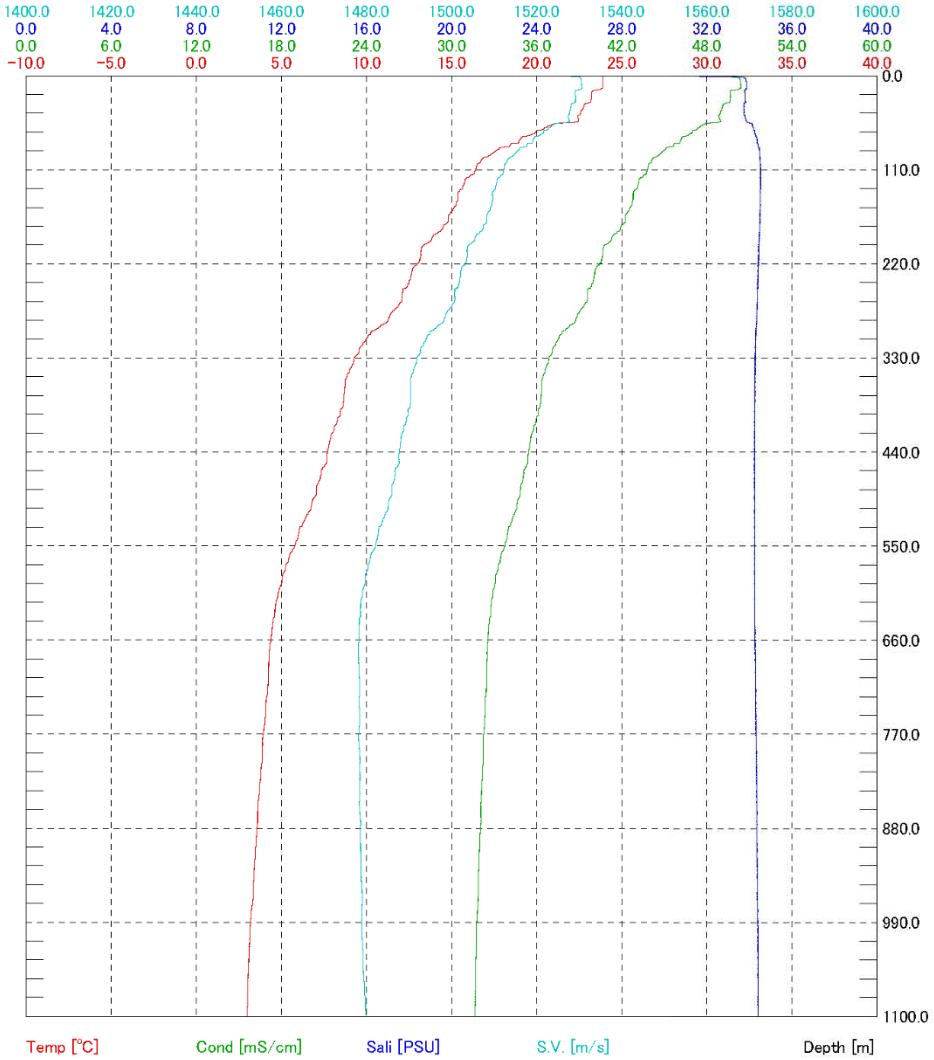
XCTD Probe

Temperature Range	-2.0to 35.0 degreeC		
Accuracy	±0.2 degreeC		
	±0.03mS/cm (Conductivity)		
Depth Range	XCTD-1	1000m	less than 12knot (water speed)
	XCTD-2	1850m	less than 3.5knot (water speed)
	XCTD-3	1000m	less than 20knot (water speed)
	XCTD-4	1850m	less than 6knot (water speed)
Duration	XCTD-1	300 second	
	XCTD-2	600 second	
	XCTD-3	200 second	
	XCTD-4	600 second	

TSK XBT/XCTD-SYSTEM AL-12 Tsurumi-Seiki CO.,Ltd (Ver.1.6.4)

データパス名 : C:¥AL12_Data
データ名 : CTD-202110230135　　デバイス名 : XCTD　　BATHYﾌﾟﾛｰﾌﾞ : 741
データナンバー : 282　　プローブタイプ : XCTD-1　　BATHY処理器 : 49
日付 : 2021年10月23日
時刻 : 01:40:16
緯度 : 34-59.9147N　　最大深度[m] : 1100.1
経度 : 139-14.1209E　　データ数 : 8419　　深度ステップ : ALL

TSK XBT/XCTD-SYSTEM AL-12 -鉛直分布図印刷- (Ver.1.6.4)



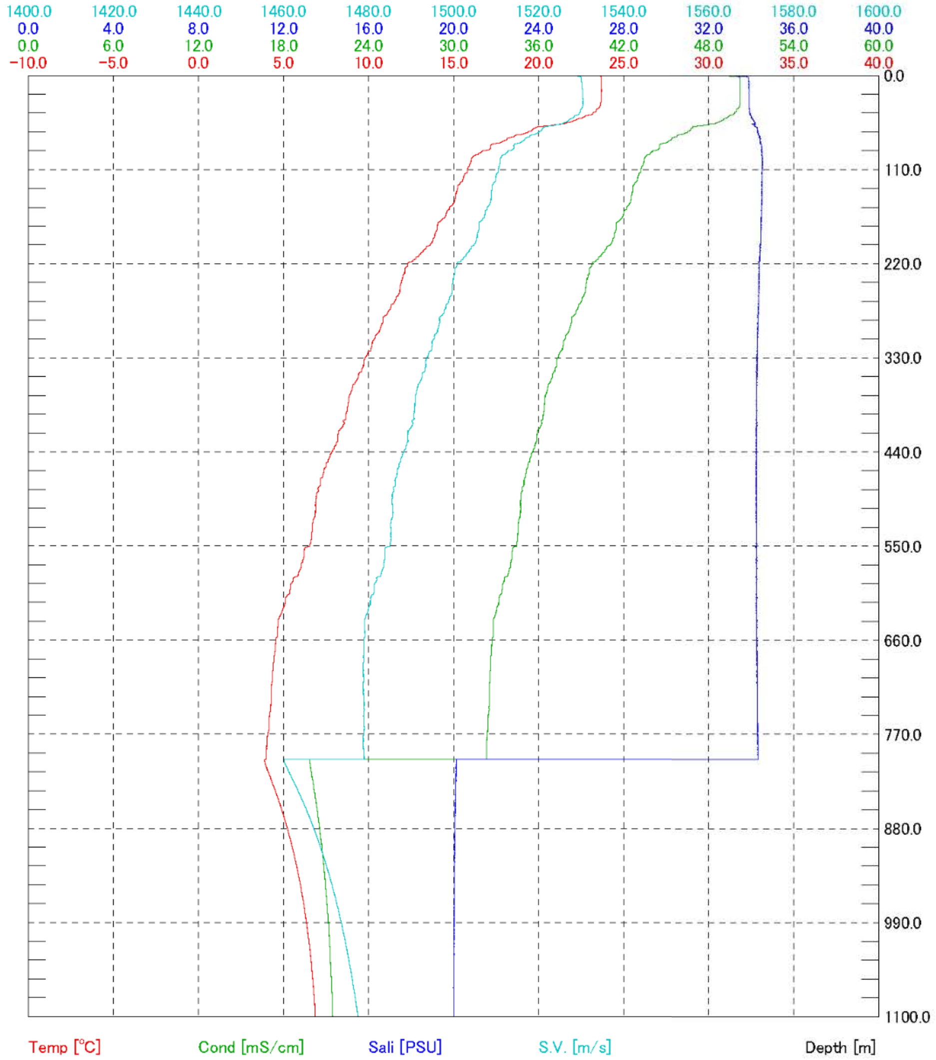
TSK XBT/XCTD-SYSTEM AL-12 Tsurumi-Seiki CO.,Ltd （Ver.1.6.4）

データパス名 : C:¥AL12_Data
データ名 : CTD-202110232150
データナンバー : 283
日付 : 2021年10月23日
時刻 : 21:56:20
緯度 : 35-00.8278N
経度 : 139-13.1963E

デバイス名 : XCTD
プローブタイプ : XCTD-1
最大深度[m] : 1100.1
データ数 : 8419

BATHYﾌﾟﾛｰﾌﾞ : 741
BATHY処理器 : 49
深度ステップ : ALL

TSK XBT/XCTD-SYSTEM AL-12 -鉛直分布図印刷- （Ver.1.6.4）

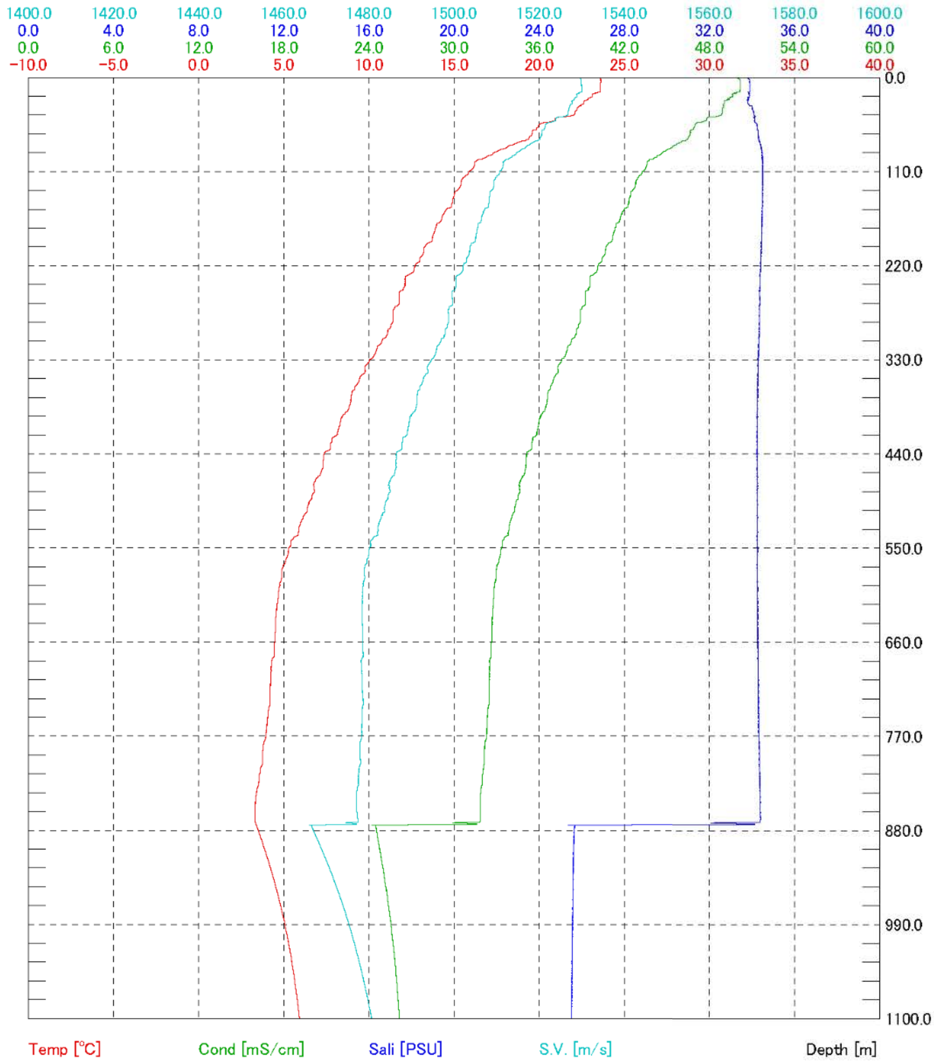


TSK XBT/XCTD-SYSTEM AL-12 Tsurumi-Seiki CO.,Ltd （Ver.1.6.4）

データパス名 : C:¥AL12_Data

データ名 : CTD-202110240806	デバイス名 : XCTD	BATHYﾌﾟﾛｰﾌﾞ : 741
データナンバー : 284	プローブタイプ : XCTD-1	BATHY処理器 : 49
日付 : 2021年10月24日		
時刻 : 08:13:14		
緯度 : 35-00.9522N	最大深度[m] : 1100.1	
経度 : 139-13.3690E	データ数 : 8419	深度ステップ : ALL

TSK XBT/XCTD-SYSTEM AL-12 -鉛直分布図印刷- （Ver.1.6.4）



IV. Research equipment photo

V. Dive Log (Dive158 – Dive159)

<Dive 158>

Dive Log of KM-ROV Dive # 158 シートのコピー LOG Area Name; 初島 2021/10/23

Time (UTC)	Time (Local)	Vehicle Dep.(m)	Vehicle Pos. Lat				Vehicle Pos. Lon				TMS Dep.(m)	TMS Pos. Lat				TMS Pos. Lon				Vehicle Alt(m)	Description	Remarks
4:40:47	13:40:47																				KM-ROV着水	
4:55:08	13:55:08	529.9	35	-	0.9528	N	139	-	13.3191	E	527.1	35	-	0.9535	N	139	-	13.3192	E		ROV-Homer応答確認 -> 応答良好	
4:55:20	13:58:20		35	-	0.9533	N	139	-	13.3147	E		35	-	0.9534	N	139	-	13.3132	E		シビウナギ	
5:04:29	14:04:29	747.2	35	-	0.9547	N	139	-	13.3215	E	744	35	-	0.9554	N	139	-	13.3212	E		TMSとの離脱を試みるも一旦停止	
5:06:54	14:06:54	779.1	35	-	0.9559	N	139	-	13.3246	E	744.1	35	-	0.9554	N	139	-	13.323	E		TMSと離脱	
5:11:13	14:11:13	853.1	35	-	0.9637	N	139	-	13.3299	E	744.1	35	-	0.957	N	139	-	13.3227	E		海底視認、マーカー視認	
5:11:45	14:11:45	852.3	35	-	0.9632	N	139	-	13.3288	E	744	35	-	0.9561	N	139	-	13.3232	E		着底	
5:13:59	14:13:59	853.6	35	-	0.9629	N	139	-	13.3289	E	744.2	35	-	0.9556	N	139	-	13.3234	E		魚	
5:14:23	14:14:23	853.3	35	-	0.9627	N	139	-	13.3304	E	744.1	35	-	0.9559	N	139	-	13.3244	E		マーカー近傍に着底、マーカーを確認(6K)	
5:21:28	14:21:28	857.2	35	-	0.9676	N	139	-	13.3343	E	744	35	-	0.9578	N	139	-	13.3251	E		流向流速計設置地点に着底時濁り発生、ハレ待ち	
5:27:56	14:27:56	854.1	35	-	0.976	N	139	-	13.3238	E	744.1	35	-	0.9597	N	139	-	13.3234	E		Head 240で再着底	
5:35:02	14:35:02	854.1	35	-	0.9751	N	139	-	13.3236	E	744.1	35	-	0.9564	N	139	-	13.323	E		流向流速計を海底設置するが斜面のため場所移動	
5:38:56	14:38:56	854.1	35	-	0.9762	N	139	-	13.3233	E	744.1	35	-	0.9569	N	139	-	13.3229	E		流向流速計を落とす	
5:41:42	14:41:42	853.9	35	-	0.9761	N	139	-	13.3237	E	744.1	35	-	0.9569	N	139	-	13.3235	E		魚	
5:43:43	14:43:43	856.4	35	-	0.9746	N	139	-	13.3319	E	744.1	35	-	0.9582	N	139	-	13.3238	E		向きを変えて地点変更のため航行	
5:49:45	14:49:45	856.8	35	-	0.9594	N	139	-	13.332	E	744	35	-	0.9564	N	139	-	13.3227	E		2Kマーカー視認(コロニー内)	
5:51:14	14:51:14	857.9	35	-	0.956	N	139	-	13.3342	E	744.1	35	-	0.956	N	139	-	13.3249	E		コロニー周辺、ハオリムシ、シロウリガイ	
5:54:59	14:54:59	857.5	35	-	0.9556	N	139	-	13.3266	E	744.1	35	-	0.9567	N	139	-	13.3229	E		藤倉BOX視認	
5:56:17	14:56:17	857.4	35	-	0.955	N	139	-	13.3262	E	744.2	35	-	0.9559	N	139	-	13.3238	E		シロウリガイコロニー着底、	
6:01:36	15:01:36	858.3	35	-	0.9547	N	139	-	13.3238	E	744.1	35	-	0.9554	N	139	-	13.3226	E		ミズムシ	
6:07:28	15:01:36	858.3	35	-	0.9547	N	139	-	13.3238	E	744.1	35	-	0.9554	N	139	-	13.3226	E		流速計設置	
6:07:32	15:07:32	858.3	35	-	0.9544	N	139	-	13.3235	E	744.2	35	-	0.9563	N	139	-	13.3226	E		コア採集準備のために移動	
6:14:34	15:14:34	857.9	35	-	0.9555	N	139	-	13.3227	E	744.1	35	-	0.9565	N	139	-	13.3235	E		コア1採集したが、取れず。明日に延期	
6:25:03	15:25:03	857.5	35	-	0.9549	N	139	-	13.3257	E	744.2	35	-	0.9564	N	139	-	13.3237	E		明るさの確認	
6:27:10	15:27:10	857.5	35	-	0.9545	N	139	-	13.3254	E	744.1	35	-	0.9564	N	139	-	13.3245	E		明るさ50%にした	
6:27:58	15:27:58	857.5	35	-	0.9538	N	139	-	13.3245	E	744.1	35	-	0.9556	N	139	-	13.3238	E		明るさ30%にした	
6:29:43	15:29:43	857.7	35	-	0.9542	N	139	-	13.3259	E	744.3	35	-	0.9556	N	139	-	13.3241	E		5番明るさ50%にした.6、7番50%にする	
6:32:19	15:32:19	857.5	35	-	0.9547	N	139	-	13.3256	E	744.2	35	-	0.9561	N	139	-	13.3238	E		5番明るさ30%にした.6、7番50%にする	
6:33:17	15:33:17	857.6	35	-	0.9544	N	139	-	13.3247	E	744.1	35	-	0.9565	N	139	-	13.3228	E		5番明るさ50%にした.6、7番off	
6:35:01	15:35:01	857.7	35	-	0.9547	N	139	-	13.3244	E	744.1	35	-	0.9564	N	139	-	13.3225	E		5番明るさ30%にした.6、7番30%にする	
6:35:32	15:35:32	857.7	35	-	0.9548	N	139	-	13.3244	E	744.2	35	-	0.956	N	139	-	13.3233	E		5、4番off.6、7番30%にする	
6:36:36	15:36:36	857.3	35	-	0.9551	N	139	-	13.3245	E	744.2	35	-	0.9561	N	139	-	13.3231	E		左側ライトの変化なし	
6:37:35	15:37:35	857.8	35	-	0.9548	N	139	-	13.3249	E	744.2	35	-	0.9558	N	139	-	13.3231	E		5番明るさ50%にした.6、7番80%にする。1番70%、4番50%、2番50%.8,9,10番消灯	
6:39:26	15:39:26	857.9	35	-	0.9538	N	139	-	13.325	E	744.3	35	-	0.9556	N	139	-	13.3236	E		5番明るさ50%にした.6、7番80%にする。1番70%、4番50%、2番50%.8,9,10番消灯	
6:40:46	15:40:46	857.8	35	-	0.9547	N	139	-	13.3251	E	744.3	35	-	0.9563	N	139	-	13.3235	E		ヒバリガイを取るために東へ移動	
6:44:03	15:44:03	859.5	35	-	0.956	N	139	-	13.3398	E	744.3	35	-	0.957	N	139	-	13.3249	E		120度へ	
6:45:08	15:45:08	862	35	-	0.9555	N	139	-	13.3436	E	744.1	35	-	0.956	N	139	-	13.3249	E		140度へ	
6:46:50	15:46:50	868.2	35	-	0.951	N	139	-	13.3512	E	744	35	-	0.9547	N	139	-	13.3316	E		120度へ	
6:49:12	15:49:12	868.5	35	-	0.9478	N	139	-	13.3603	E	743.8	35	-	0.9519	N	139	-	13.3429	E		思ったより斜面であった	
6:53:47	15:53:47	876.1	35	-	0.9468	N	139	-	13.3678	E	744.2	35	-	0.9453	N	139	-	13.3799	E		Head 100	
6:55:31	15:55:31	882.4	35	-	0.9472	N	139	-	13.375	E	755.4	35	-	0.944	N	139	-	13.3945	E		ウインチ10m巻出し	
6:56:42	15:56:42	884.4	35	-	0.9458	N	139	-	13.3825	E	763.7	35	-	0.9447	N	139	-	13.4002	E		ウインチ更に10m巻出し	
6:58:13	15:58:13	890	35	-	0.9454	N	139	-	13.386	E	774.2	35	-	0.9458	N	139	-	13.4006	E		高度5mまで下げる	
6:59:39	15:59:39	896.8	35	-	0.9429	N	139	-	13.3915	E	774	35	-	0.9455	N	139	-	13.4005	E		Head 280右回頭	
7:01:21	16:01:21	898.6	35	-	0.9431	N	139	-	13.3907	E	774.3	35	-	0.9449	N	139	-	13.4017	E		ウインチ10m巻出し	
7:02:10	16:02:10	903.9	35	-	0.9446	N	139	-	13.3891	E	776.4	35	-	0.9461	N	139	-	13.4008	E		前進スロー	
7:02:57	16:02:57	900.4	35	-	0.9452	N	139	-	13.3866	E	780.4	35	-	0.945	N	139	-	13.4015	E		のぼっていく	
7:04:19	16:04:19	895.4	35	-	0.9451	N	139	-	13.3863	E	783.8	35	-	0.945	N	139	-	13.4015	E		高度5mあげる、Head 100左回頭	
7:04:58	16:04:58	899	35	-	0.9429	N	139	-	13.3934	E	783.8	35	-	0.9455	N	139	-	13.4011	E		前進	
7:05:37	16:05:37	901.7	35	-	0.942	N	139	-	13.4013	E	783.9	35	-	0.9452	N	139	-	13.4017	E		Head 280右回頭	
7:07:07	16:07:07	910.3	35	-	0.9391	N	139	-	13.4022	E	783.8	35	-	0.9445	N	139	-	13.4038	E		Head 300右回頭、前進、ヒバリガイを探す	
7:10:59	16:10:59	900.2	35	-	0.9466	N	139	-	13.388	E	783.9	35	-	0.9457	N	139	-	13.4019	E		Head 240	
7:11:14	16:11:14	900.9	35	-	0.9457	N	139	-	13.3872	E	783.9	35	-	0.9453	N	139	-	13.4026	E		Head 250、深度900mになったら等深線沿いに走る	
7:11:34	16:11:34	899.7	35	-	0.9451	N	139	-	13.3851	E	783.9	35	-	0.9459	N	139	-	13.4022	E		Head 230	
7:12:00	16:12:00	900.5	35	-	0.9437	N	139	-	13.3843	E	783.7	35	-	0.9448	N	139	-	13.4027	E		深度900mの等深線沿いに走る	
7:13:13	16:13:13	903.3	35	-	0.9396	N	139	-	13.379	E	783.7	35	-	0.9451	N	139	-	13.4019	E		ヒバリガイ確認	
7:14:20	16:14:20	908.6	35	-	0.9381	N	139	-	13.3798	E	783.8	35	-	0.9449	N	139	-	13.4015	E		TMSは船より深い方へ移動する	
7:15:17	16:15:17	908.6	35	-	0.9387	N	139	-	13.3794	E	783.9	35	-	0.9454	N	139	-	13.4015	E		ヒバリガイスラープガンで採取	
7:23:09	16:23:09	908.5	35	-	0.9388	N	139	-	13.3783	E	783.6	35	-	0.9292	N	139	-	13.3853	E		小さい貝がついているヒバリガイを採取	
7:25:20	16:25:20	908.4	35	-	0.9386	N	139	-	13.3787	E	783.9	35	-	0.9294	N	139	-	13.3856	E		深海ヒバリガイを採取	
7:28:20	16:28:20	908.9	35	-	0.9383	N	139	-	13.3778	E	783.7	35	-	0.9294	N	139	-	13.3838	E		離底	

<Dive 159>

Dive Log of
KM-ROV Dive # 159

シートのコピー

LOG

Area Name; 初島

2021/10/24

Time (UTC)	Time (Local)	Vehicle Dep.(m)	Vehicle Pos. Lat	Vehicle Pos. Lon	TMS Dep.(m)	TMS Pos. Lat	TMS Pos. Lon	Vehicle Alt(m)	Description	Remarks
4:32:35	13:32:35								KM-ROV着水、直下水深940m	
4:51:39	13:51:39	695.2	35 - 0.9297 N	139 - 13.3918 E	0	35 - 0.9308 N	139 - 13.3861 E		RamaCom通信断 -> 復旧を試みる	
4:52:14	13:52:14	655.7	35 - 1.0564 N	139 - 13.2865 E	0	35 - 0.9308 N	139 - 13.3861 E		RamaCom通信復旧	
4:59:32	13:59:32	877.8	35 - 0.9333 N	139 - 13.4074 E	814.1	35 - 0.934 N	139 - 13.4026 E		TMSと離脱	
5:01:44	14:01:44	913.9	35 - 0.9364 N	139 - 13.3952 E	814.1	35 - 0.9345 N	139 - 13.3963 E		海底視認、ヒバリガイコロニー	
5:03:37	14:03:37	913.7	35 - 0.9385 N	139 - 13.3892 E	814.1	35 - 0.934 N	139 - 13.3984 E		着底	
5:07:41	14:07:41	913.8	35 - 0.9386 N	139 - 13.3895 E	814.2	35 - 0.934 N	139 - 13.398 E		ライトセッティング。#2と#5ライトを40%。他は昨日通り。	
5:16:06	14:16:06	913.1	35 - 0.9394 N	139 - 13.3874 E	793.8	35 - 0.9344 N	139 - 13.3996 E		ナツシマチョウジャゲンゲ、ヌタウナギ	
5:16:51	14:16:51	913.5	35 - 0.9384 N	139 - 13.388 E	793.7	35 - 0.9331 N	139 - 13.3983 E		スラープガンでヒバリガイをサンプリング開始。黄色いカイメンの右	
5:26:21	14:26:21	912.8	35 - 0.9398 N	139 - 13.3871 E	793.7	35 - 0.9342 N	139 - 13.3979 E		上記サンプリング終了	
5:28:53	14:28:53	912.2	35 - 0.9385 N	139 - 13.3875 E	793.6	35 - 0.933 N	139 - 13.3987 E		サンプリング地点を変える。移動。	
5:30:21	14:30:21	910	35 - 0.9404 N	139 - 13.3861 E	793.8	35 - 0.9342 N	139 - 13.3991 E		人工物？	
5:31:14	14:31:14	910.7	35 - 0.9404 N	139 - 13.3856 E	793.8	35 - 0.9344 N	139 - 13.3992 E		上記サンプリング地点着。着底	
5:39:27	14:39:27	910.6	35 - 0.9399 N	139 - 13.3854 E	793.6	35 - 0.9334 N	139 - 13.3991 E		サンゴを潰す、RamanCamera測定	
5:57:51	14:57:51	911.3	35 - 0.9403 N	139 - 13.3867 E	793.8	35 - 0.9344 N	139 - 13.399 E		スラープガンでヒバリガイをサンプリング開始。	
6:00:17	15:00:17	911.1	35 - 0.9399 N	139 - 13.387 E	793.8	35 - 0.9337 N	139 - 13.3991 E		上記サンプリング終了	
6:06:10	15:06:10	913.6	35 - 0.9386 N	139 - 13.3887 E	793.8	35 - 0.9349 N	139 - 13.397 E		ジグザグ走行開始	
6:21:18	15:21:18	903.8	35 - 0.9445 N	139 - 13.3877 E	784	35 - 0.9376 N	139 - 13.3774 E		ジグザグ走行終了	
6:21:44	15:21:44	903.7	35 - 0.9446 N	139 - 13.3863 E	781.7	35 - 0.9381 N	139 - 13.376 E		シロウリガイコロニーに向かう	
6:26:20	15:26:20	883.2	35 - 0.9468 N	139 - 13.3663 E	758.7	35 - 0.9393 N	139 - 13.3735 E		メヌケの仲間	
6:26:53	15:26:53	879.9	35 - 0.9477 N	139 - 13.3627 E	754.9	35 - 0.9399 N	139 - 13.3711 E		スポンジ多い	
6:32:50	15:32:50	857.9	35 - 0.9563 N	139 - 13.3318 E	732.2	35 - 0.9449 N	139 - 13.3507 E		シロウリガイコロニー到着	
6:40:19	15:40:19	857.8	35 - 0.9573 N	139 - 13.3266 E	732.3	35 - 0.9458 N	139 - 13.3458 E		シロウリガイコロニーのへり(ペットボトルのマーカーの横)でコア(青)を採取	
6:45:26	15:45:26	857.9	35 - 0.9576 N	139 - 13.3271 E	732.3	35 - 0.9464 N	139 - 13.3449 E		シロウリガイコロニーのへりから10mぐらい走行する	
6:47:55	15:47:55	856.5	35 - 0.9581 N	139 - 13.3266 E	732.3	35 - 0.9464 N	139 - 13.3447 E		浮いて、Head 266右回頭し、前進10mする	
6:49:29	15:49:29	853.6	35 - 0.9612 N	139 - 13.3217 E	732.3	35 - 0.9475 N	139 - 13.3436 E		10m先到着(斜面ではない)	
6:57:21	15:57:21	853.7	35 - 0.9606 N	139 - 13.3208 E	732.1	35 - 0.9464 N	139 - 13.3438 E		コア(赤)を採取する	
6:58:53	15:58:53	854	35 - 0.9606 N	139 - 13.3219 E	732.1	35 - 0.9467 N	139 - 13.3441 E		コアが空になってしまったので、再度採取する	
6:59:37	15:59:37	853.9	35 - 0.9604 N	139 - 13.3213 E	732.1	35 - 0.9462 N	139 - 13.3439 E		コア(赤)を再採取する	
7:02:05	16:02:05	853.9	35 - 0.9603 N	139 - 13.321 E	732.1	35 - 0.9457 N	139 - 13.3436 E		振ってコアを空にして再再コア(赤)採取をこころみる	
7:03:05	16:03:05	852.8	35 - 0.9613 N	139 - 13.321 E	732.1	35 - 0.9459 N	139 - 13.3439 E		移動する	
7:06:27	16:06:27	852	35 - 0.962 N	139 - 13.3193 E	732.3	35 - 0.9463 N	139 - 13.3452 E		着底して、コア(赤)を再再採取する	
7:09:15	16:09:15	852.3	35 - 0.9624 N	139 - 13.3191 E	732.5	35 - 0.9463 N	139 - 13.3447 E		コアを回収する	
7:12:33	16:12:33	849.4	35 - 0.9624 N	139 - 13.3185 E	732.2	35 - 0.9457 N	139 - 13.345 E		シロウリガイコロニーに戻る	
7:16:28	16:16:28	854.7	35 - 0.96 N	139 - 13.3287 E	732.3	35 - 0.9466 N	139 - 13.3445 E		前進しながらHead 220	
7:16:36	16:16:36	855.5	35 - 0.9587 N	139 - 13.3274 E	732.2	35 - 0.9461 N	139 - 13.3445 E		前進停止	
7:18:00	16:18:00	855.7	35 - 0.9581 N	139 - 13.3263 E	732.4	35 - 0.9461 N	139 - 13.3441 E		シロウリガイのふち回頭、Head 220固定のまま、高度1.5m、カメラでとる、流速計の周りを回頭	
7:20:22	16:20:22	856.5	35 - 0.9573 N	139 - 13.3286 E	732.4	35 - 0.9466 N	139 - 13.3455 E		サンゴを右手から左手に持ち変える	
7:23:53	16:23:53	856.7	35 - 0.9566 N	139 - 13.3278 E	732.3	35 - 0.9454 N	139 - 13.3448 E		バスケットを中に入れる	
7:24:24	16:24:24	856.7	35 - 0.9569 N	139 - 13.3276 E	732.4	35 - 0.9464 N	139 - 13.3446 E		流向流速計の前に着底するために前進	
7:25:21	16:25:21	858.1	35 - 0.9548 N	139 - 13.3276 E	732.7	35 - 0.9453 N	139 - 13.3456 E		流向流速計の前に着底	
7:26:45	16:26:45	858	35 - 0.9561 N	139 - 13.3266 E	732.5	35 - 0.9471 N	139 - 13.3439 E		流向流速計を右手でもつ	
7:28:46	16:28:46	857.8	35 - 0.9559 N	139 - 13.3255 E	732.3	35 - 0.947 N	139 - 13.345 E		流向流速計をバスケットに入れる	
7:30:53	16:30:53	858.3	35 - 0.9549 N	139 - 13.3259 E	732.3	35 - 0.9464 N	139 - 13.3449 E		左手でサンゴを吸い込み口へ持って行く	
7:33:13	16:33:13	857.9	35 - 0.9548 N	139 - 13.3248 E	732.3	35 - 0.9463 N	139 - 13.3442 E		左手の角度を決める	
7:33:43	16:33:43	857.7	35 - 0.9553 N	139 - 13.3251 E	732.2	35 - 0.9468 N	139 - 13.3446 E		離底の準備	
7:35:18	16:35:18	858.2	35 - 0.9555 N	139 - 13.3234 E	732.3	35 - 0.9468 N	139 - 13.3439 E		離底