doi : 10.17596/0003444

R/V *Yokosuka*/HOV *Shinkai 6500* Cruise Report

YK22-17C Leg1

Suruga Bay & Nishi-Shichito Ridge

Sep. 21, 2022–Sep. 25, 2022

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

YK22-17C Leg1 onboard report

Contents

Abstract

A deep-sea research cruise was conducted at Suruga Bay and the Nishi-Shichito Ridge from September 21 to September 25, 2022 to develop novel monitoring methods for offshore seabed nature conservation areas and to acquire baseline data on the faunal diversity. Two *Shinkai 6500* dives, two baited camera casts, and two lander cast were conducted at Suruga Bay and Hoei Seamount. A newly developed deep-sea lander equipped with three water sampling bottles, two water filtration systems, three sediment corers, several physico-chemical sensors, and a video camera was deployed at a depth of 1200 m in Suruga Bay and at a depth of 2178 m at the base of Hoei Seamount, and water, sediment, and filtered particles were successfully collected during two casts in addition to video footage and physico-chemical measurements. About 100 biological samples, sediments, water sample, filtered samples, video footage, and photographs were taken during the *Shinkai 6500* dives to obtain baseline information.

1. Participants aboard

1.1. Research group

FUJIWARA, Yoshihiro	RIGC, JAMSTEC
FURUSHIMA, Yasuo	RIGC, JAMSTEC
KAWATO, Masaru	RIGC, JAMSTEC
YOSHIDA, Takao	RIGC, JAMSTEC
YAMAKITA, Takehisa	RIGC, JAMSTEC
WU, Qianqian	Graduate School of Human Development and Environment, Kobe University
HAMASAKI, Koji	Atmosphere and Ocean Research Institute, The University of Tokyo
HOOKABE, Natsumi	Graduate School of Science, The University of Tokyo
OKA, Shinichiro	Okinawa Churashima Foundation
YOKOOKA, Hiroyuki	IDEA Consultants, Inc.
KITAHASHI, Tomo	KANSO Tecnos, Inc.
TAKAESU, Morifumi	Nippon Marine Enterprises

1.2. Operation team of the HOV *Shinkai 6500*

Submersible Operation Manager	CHIBA, Kazuhiro
Deputy Submersible Operation Manager	MATSUMOTO, Keita
1st Submersible Staff	KONDO, Tomoe
1st Submersible Staff	ISHIKAWA, Akihisa
1st Submersible Staff	SAITO, Fumitaka
2nd Submersible Staff	UEKI, Hirofumi
2nd Submersible Staff	SUZUKI, Keigo
2nd Submersible Staff	SAIGO, Ryo
2nd Submersible Staff	IIJIMA, Satsuki
2nd Submersible Staff	MINAMINO, Naoto
3rd Submersible Staff	SATO, Kaisei
3rd Submersible Staff	ICHINOSE, Daiki
3rd Submersible Staff	MATSUSAKA, Motohiro

1.3. Captain and crew of the R/V *Yokosuka*

Captain	NAKAMURA, Yoshiyuki
Chief Officer	KATO, Hiroyuki
2nd Officer	KAJISA, Tomonari
3rd Officer	MORIYA, Daisuke
Jr.3rd Officer	MATSUDA, Riku
Jr.3rd Officer	OJIMA, Takumi
Chief Engineer	ABE, Tadashi
1st Engineer	NOGUCHI, Kazunori
2nd Engineer	ONO, Kazuki
3rd Engineer	MATSUMOTO, Kazunami
Jr.3rd Engineer	OCHIAI, Takamasa
Chief Electronic Op.	ISHIWATA, Hiroki
2nd Electronic Op.	ONIKUBO, Ryuji
3rd Electronic Op.	MAEDA, Kohei
Boatswain	ISOBE, Hideo
Quarter Master	OGASAWARA, Kazumi
Quarter Master	ISHIZUKA, Nao
Quarter Master	HONJO, Hotaka
Quarter Master	KOJIMA, Shinya
Quarter Master	NASU, Kenta
Quarter Master	MIURA, Takumi
No.1 Oiler	MORI, Junji
Oiler	UEDA, Masanori
Oiler	FUJIWARA, Masayuki
Oiler	WATANABE, Seiya
Assistant Oiler	FUJISHIMA, Tamaki
Assistant Oiler	ONO, Yutaro
Chief Steward	ABE, Takahiro
Steward	HONDA, Seiji
Steward	HIDAKA, Yoshie
Steward	NAKANO, Mizuki
Steward	HANGAI, Yuta

2. Purposes

On December 3, 2020, four areas were designated as the first offshore seabed nature conservation areas based on the Nature Conservation Act. Baseline data acquisition and continuous monitoring are required to understand the status of conservation areas, but due to their remote locations, such surveys are not easy to conduct. Human-occupied vehicles (HOVs) and remotely operated vehicles (ROVs) are commonly used for field observations of deep-sea ecosystems. Carousel-type water samplers and multiple corers are used to collect a large amount of seawater and sediments, respectively. Such equipment requires relatively large research vessels and well-trained operators, and the research expenses are quite high.

A research project “development of new biodiversity monitoring methods for offshore seabed nature conservation areas management”, funded by Environmental Restoration and Conservation Agency of Japan, was started in April, 2020, for sustainable monitoring of the conservation areas. The purposes of this cruise were as follows.

1. To test a newly developed deep-sea lander equipped with water sampling bottles, a mass filtration system for water, a core sampler, several physico-chemical sensors, and a video camera
2. To acquire the biodiversity baseline data for seamounts on the Nishi-Shichito Ridge
3. To compare the diversity acquired by two different methods: the traditional and newly developed methods

3. Results

3.1. *Shinkai6500* dives

3.1.1. Dive list

Date	Dive#	Site	Landing Leaving	Lat	Lon	Depth (m)	Comment
Sep. 23	DIVE#1649	Suruga Bay	10:22 13:37	35°0.598'N 35°0.736'N	138°39.379'E 138°40.767'E	1368 1234	Sampling of organisms, sediments, and water
Sep. 25	DIVE#1650	Hoei Seamount	11:24 15:03	30°46.004'N 30°46.482'N	138°45.393'E 138°45.150'E	2175 2109	Sampling of organisms, wood debris, sediments, and water

3.1.2. Dive report

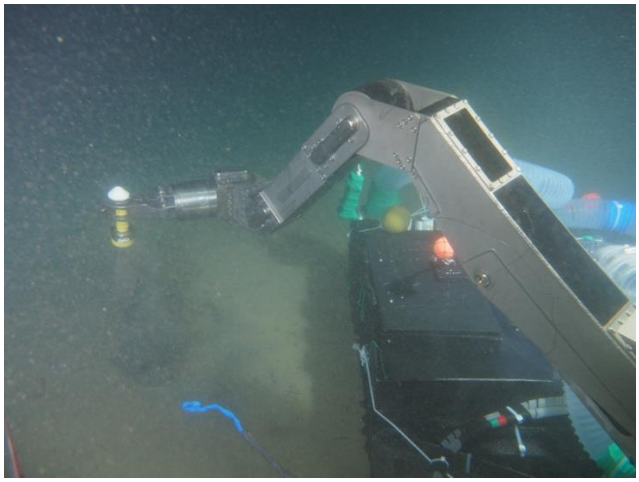
Shinkai 6500 dive report #1649

Date: Sepember 23, 2022
Site: Suruga Bay ***Depth:*** 1368 m
Landing (Lat., Lon., Time, Depth): 35°0.598'N, 138°39.379'E, 10:22, 1368 m
Leaving (Lat., Lon., Time, Depth): 35°0.736'N, 138°40.767'E, 13:37, 1234 m
Observer: OKA, Shin-ichiro

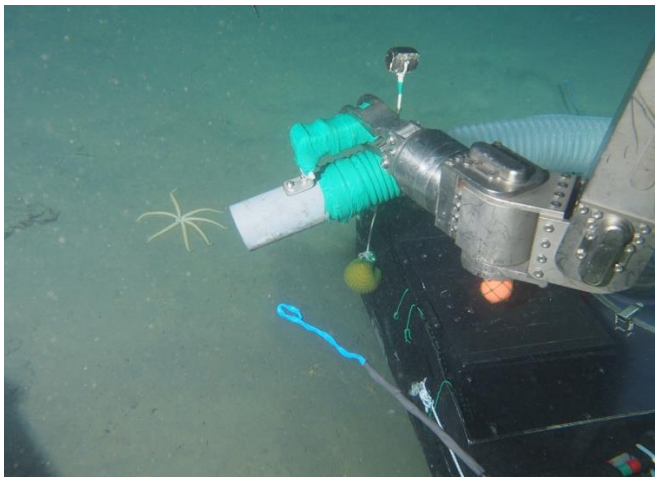
Theme: Development of deep-sea biodiversity monitoring technology for marine protected area management

Purpose of dive:
Acquisition of biodiversity baseline data around deep-sea marine protected area, including observation of deep-sea fauna and topology and sampling of organisms, sediments, and water

Dive Summary
We landed at a depth of 1368m northern of Suruga Bay and moved eastward. We sampled bottom water by use of a Niskin bottle, collected sediments using three push corers and two M-type sediment samplers, and collected benthos and fish using a suction sampler.



Sediment core sampling



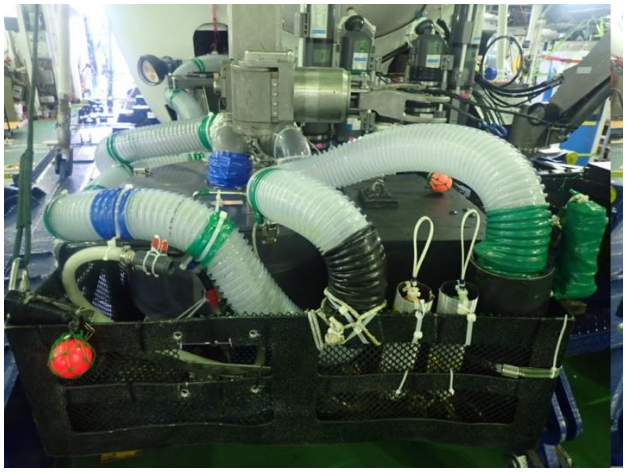
Sampling starfish

Fish (Ophidiidae)

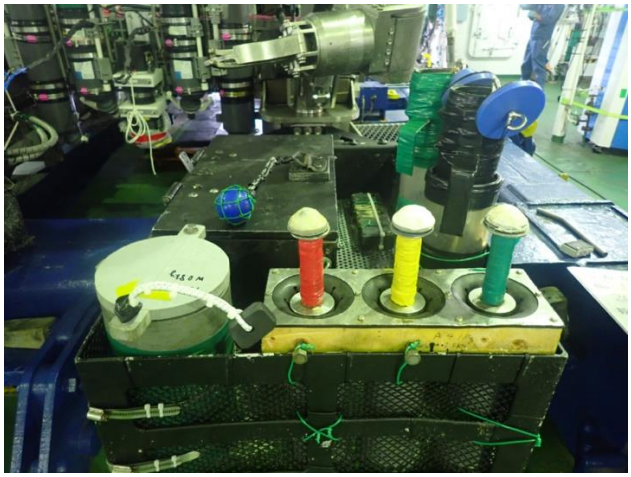
Fish (Alepocephalidae ?)

Payload Equipment:

Suction sampler and multi-bottled canister x1 (Right)
Push corer x3 (Left)
M-type sediment sampler x2 (Left)
Sample box x3 (Right:1 Left:2)
Niskin bottle x4 (Left)
Environmental DNA filtering system (Left)



Right payload

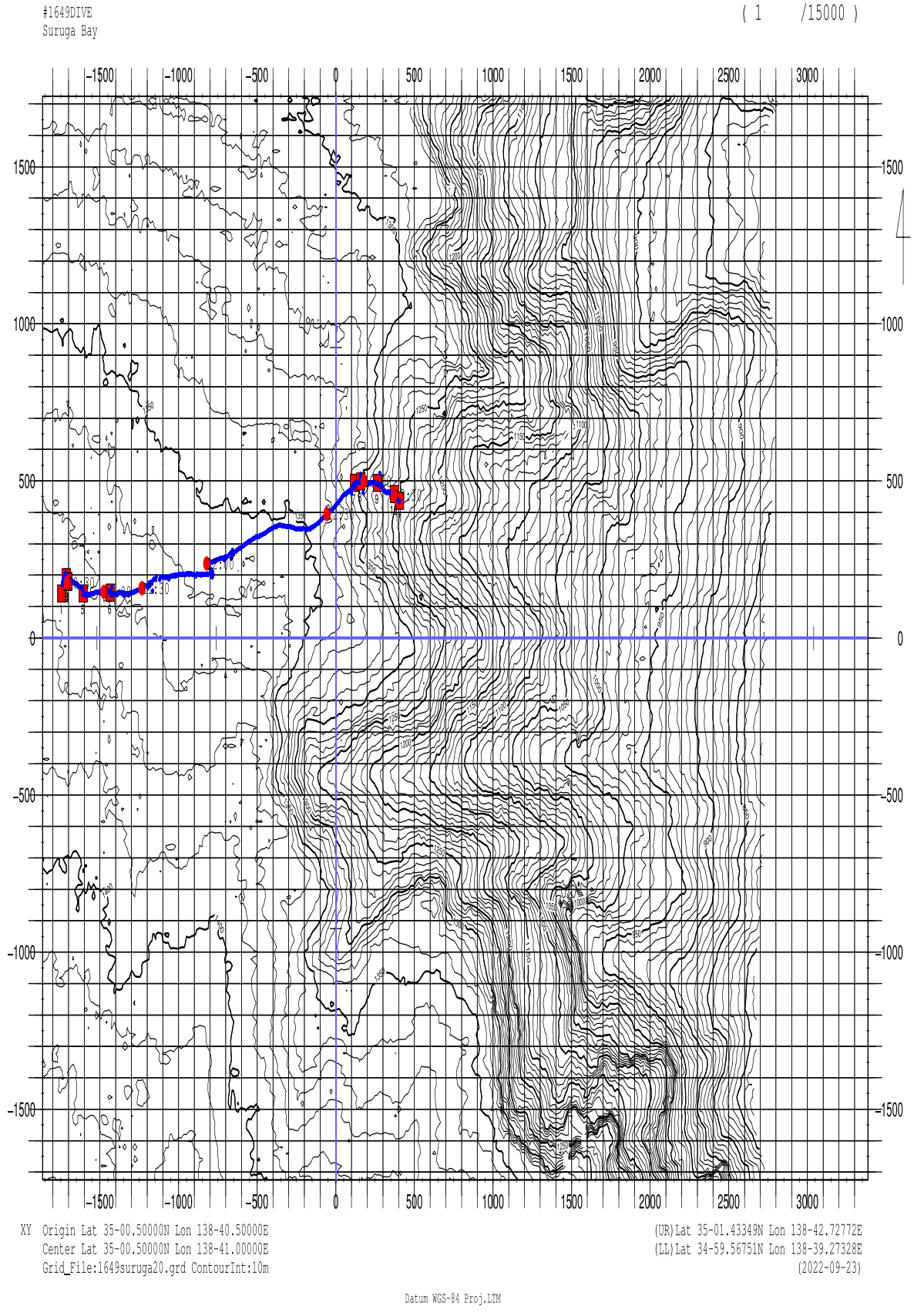


Left Payload

Sampling Points and Markers:

Time	Position	Depth (m)	Events
10:15	35°00.605'N 138°39.372'E	1360	Water sampling using Niskin bottle
10:30	35°00.597'N 138°39.378'E	1368	Biological sampling using suction sampler
10:49	35°00.577'N, 138°39.444'E	1365	Biological sampling using suction sampler
11:10	35°00.579'N, 138°39.557'E	1362	Sediment sampling using push and M-type sediment sampler
12:46	35°00.767'N, 138°40.579'E	1300	Sediment sampling using M-type sediment sampler
12:56	35°00.771'N, 138°40.605'E	1290	Biological sampling using suction sampler
13:05	35°00.767'N, 138°40.675'E	1267	Biological sampling using suction sampler
13:30	35°00.748'N, 138°40.745'E	1245	Biological sampling using suction sampler

Dive track 6K #1649



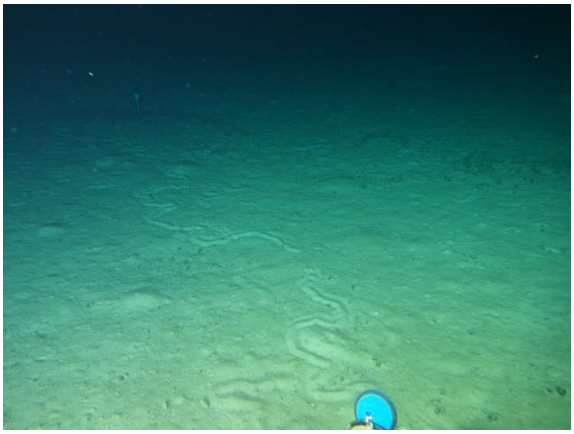
Shinkai 6500 dive report #1650

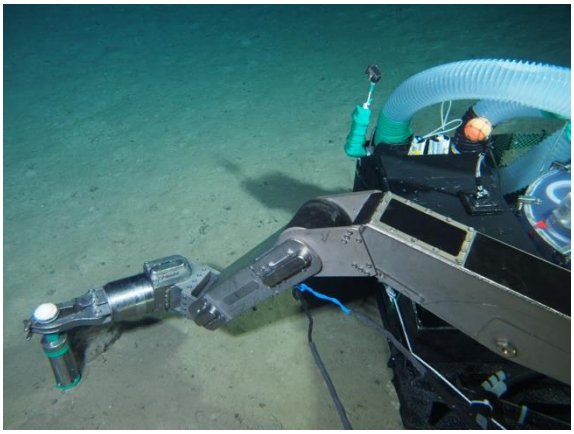
Date: Sepember 25, 2022
Site: South of Hoei Seamount ***Depth:*** 2178 m
Landing (Lat., Lon., Time, Depth): 30°46.004'N, 138°45.393'E, 11:24, 2175 m
Leaving (Lat., Lon., Time, Depth): 30°46.482'N, 138°45.150'E, 15:00, 2109 m
Observer: Fujiwara, Yoshihiro and Wu, Quianquian

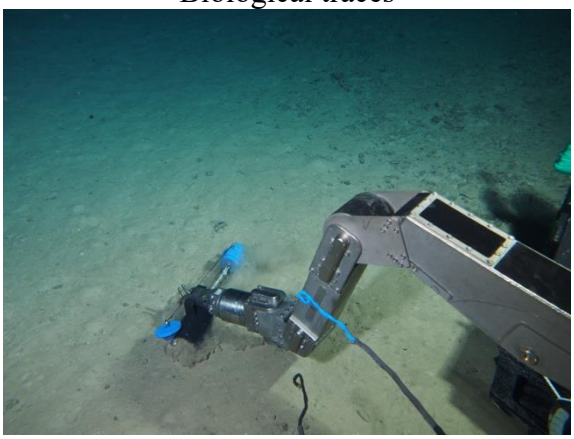
Theme: Monitoring of deep-sea biodiversity for marine protected area management

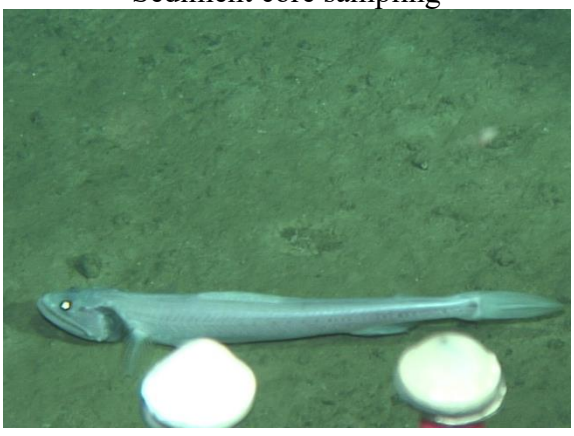
Purpose of dive:
Acquisition of biodiversity baseline data around offshore marine protected area, including observation of deep-sea fauna and topology and sampling of organisms, sediments, and water

Dive Summary
We landed at a depth of 2175 m south of Hoei Seamount and headed north. Bottom water was sampled using four Niskin bottles before landing. Sediment cores were collected using three small corers, and sediment was also collected using a M-type sediment sampler at a flat seafloor. Several benthic invertebrates sponges, shrimps, cnidarians, and echinoderms were collected using manipulators and a suction sampler in addition to a piece of sunken wood.


Biological traces


Sediment core sampling


Sediment sampling


Bathysauridae

Nematocarcinus shrimp?

Stalked glass sponge

Brisingidae

Sunken wood

Benthodytes sp.

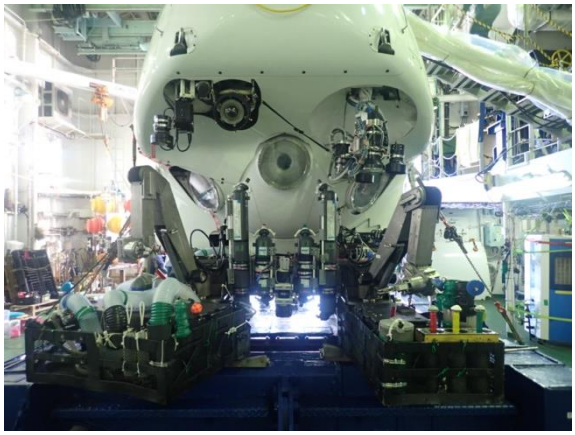
Actiniaria

Chrysogorgiidae

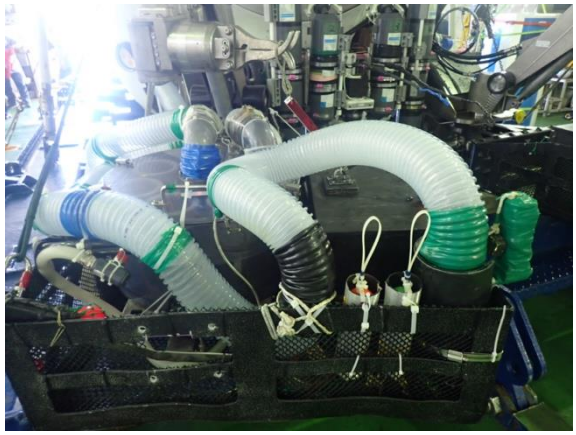
Echinoidea

Payload Equipment:

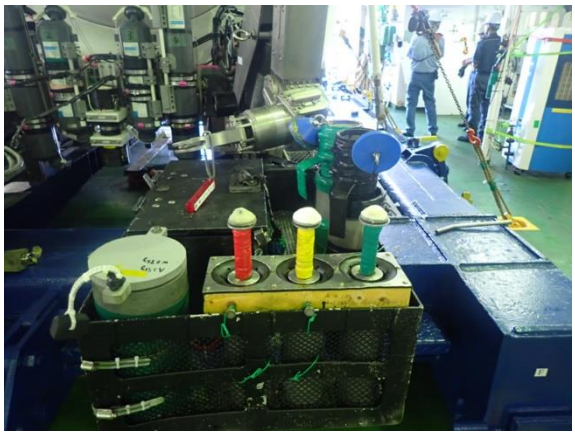
Suction sampler and multi-bottled canister x1 (Right)
Push corer x3 (Left)
M-type sediment sampler x2 (Left)
Sample box x3 (Right:1 Left:2)
Niskin bottle x4 (Left)
MASS Pump (Left)



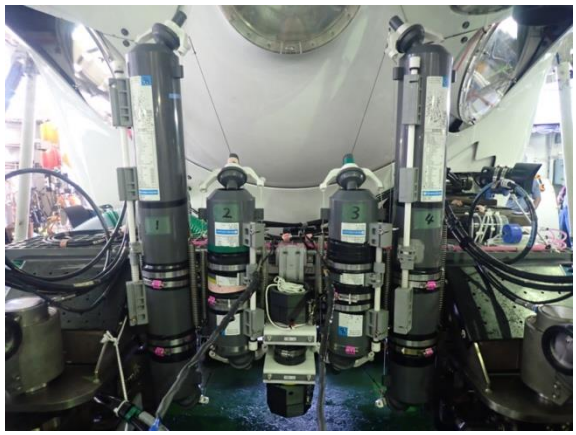
Front view



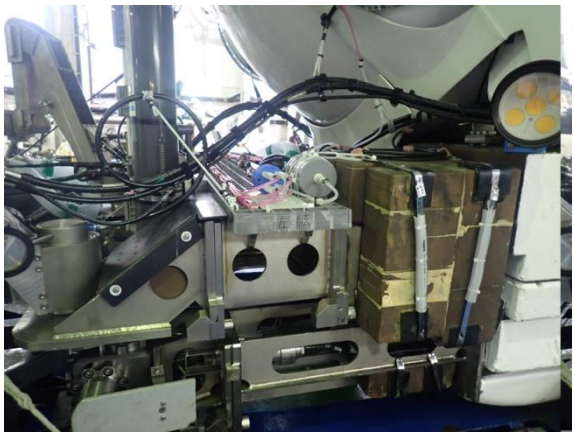
Starboard payload



Port payload



Niskin bottles



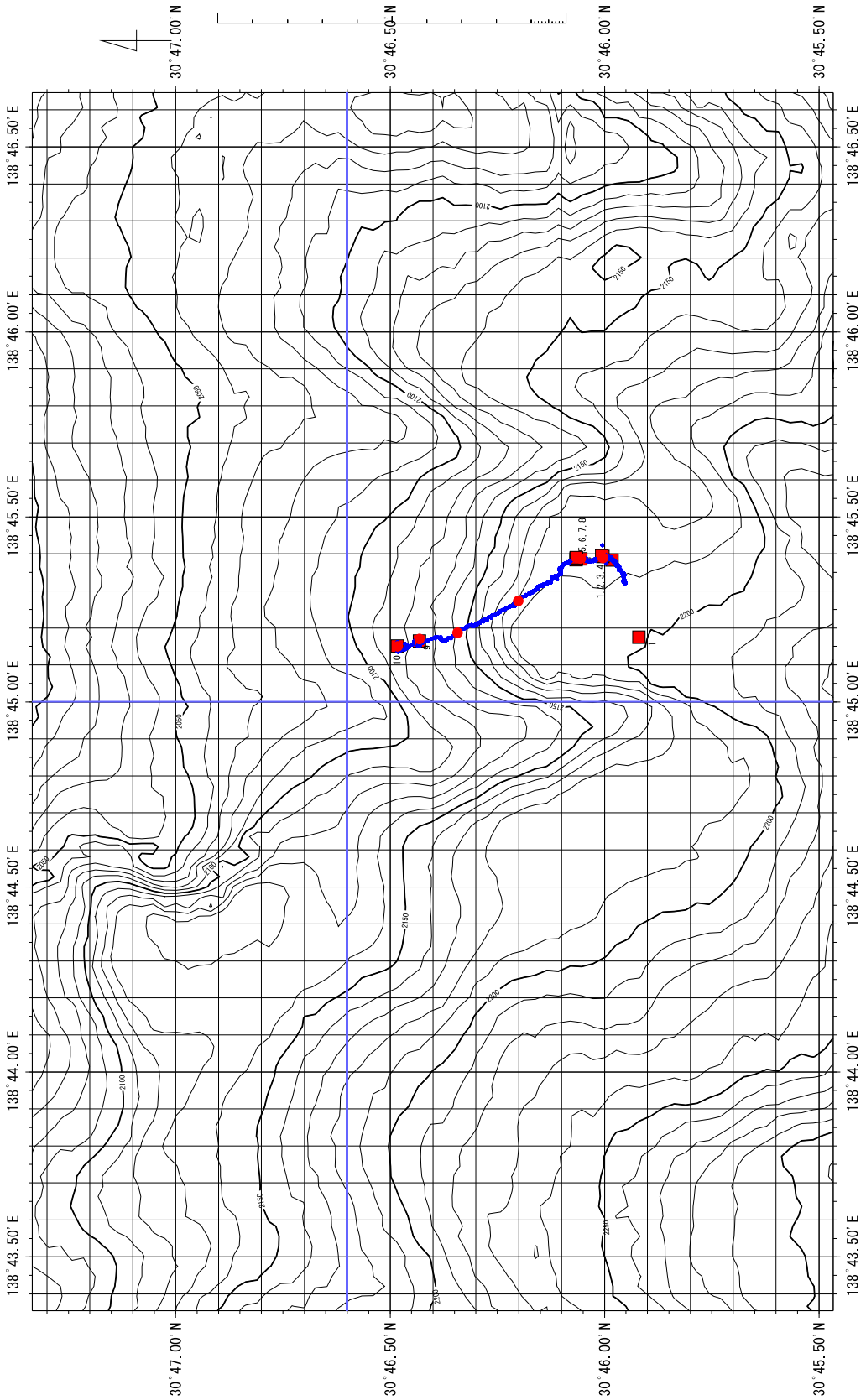
MASS Pump

MASS Pump tubing

Sampling Points and Markers:

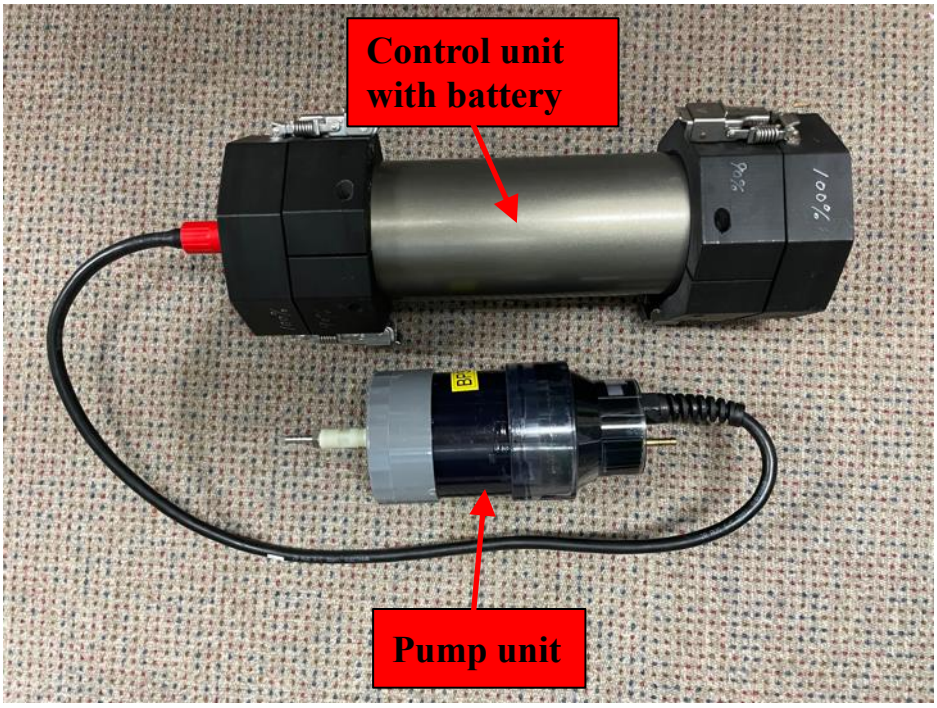
Time	Position	Depth (m)	Events
11:17	30°45.983’N, 138°45.383’E	2171	Water sampling using Niskin (#1–#4)
11:24	30°46.004’N, 138°45.393’E	2175	Landing, core sampling (3 corers), sediment sampling using M-type sampler
11:57	30°46.006’N, 138°45.394’E	2175	Asteroid sampling
12:27	30°46.056’N, 138°45.386’E	2177	Sampling of sponge and shrimp
12:40	30°46.067’N, 138°45.384’E	2177	Asteroid sampling
12:55	30°46.066’N, 138°45.388’E	2177	Benthos sampling
13:04	30°46.066’N, 138°45.389’E	2178	Echinoid sampling
14:33	30°46.431’N, 138°45.164’E	2115	Sampling of sunken wood and sediment
15:00	30°46.482’N, 138°45.150’E	2109	Holothurian sampling, left bottom

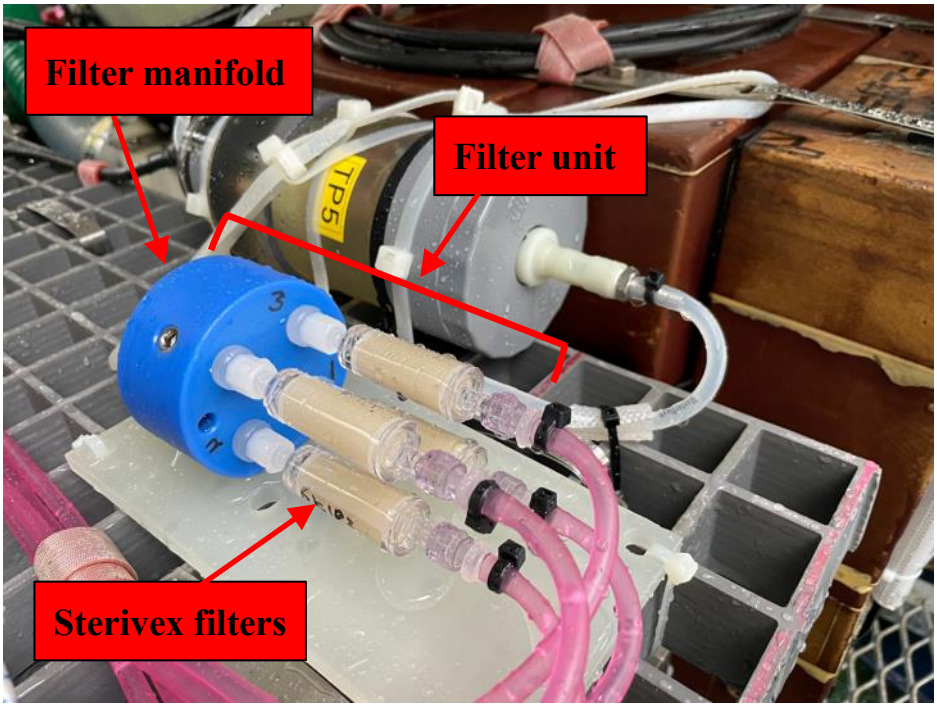
Dive track 6K#1650



3.2. MASS pump filtration

The “MASS Pump” is a large-scale *in situ* filtration system for seawater sampling for environmental DNA research. It consists of three units: a filter unit (Sterivex filters with 0.45 μm in pore size installed), a pump unit, and a control unit containing a system controller and a battery (Fig. 3.2.1). During this cruise, pumps were equipped on a baited camera (Fig. 3.2.2) and *Shinkai6500* (Fig. 3.2.3) for the first time. In addition, two pumps were equipped on a lander simultaneously (Fig. 3.2.4). Four trials of filtration were conducted at Suruga Bay, and five trials were conducted at Hoei Seamount. In this cruise, new filter manifolds were equipped on each pump system, which were installed four Sterivex filters (*Shinkai6500*) and six Sterivex filters (lander and baited camera). MASS Pump settings and detail filtration results were shown in Table 3.2.1~9.





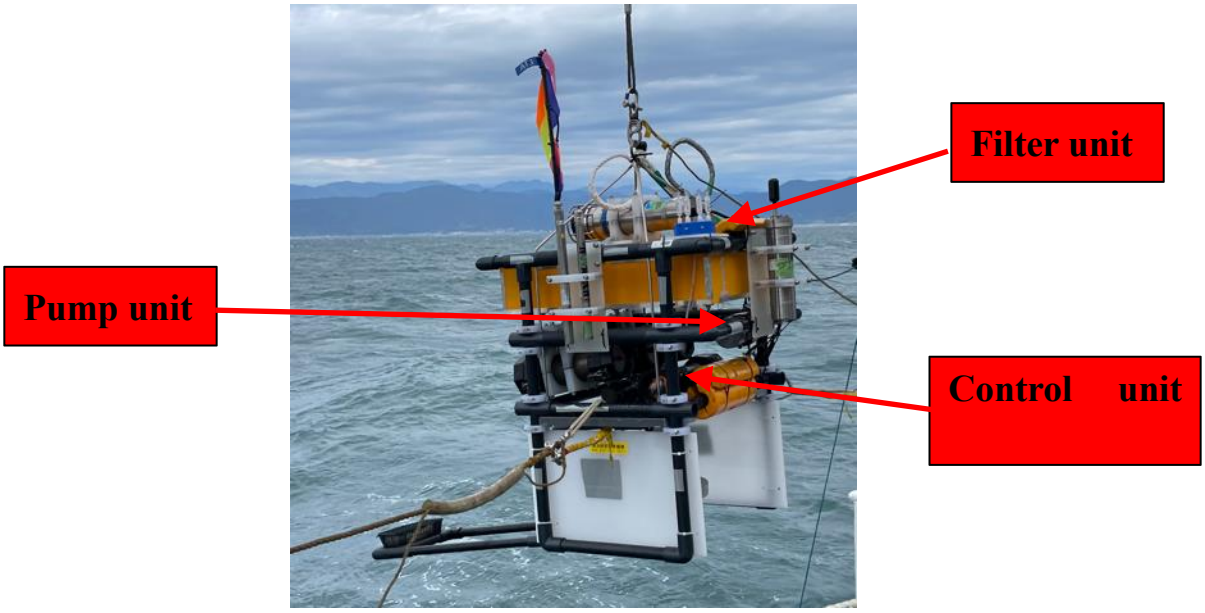


Fig. 3.2.2. MASS Pump installed on the baited camera

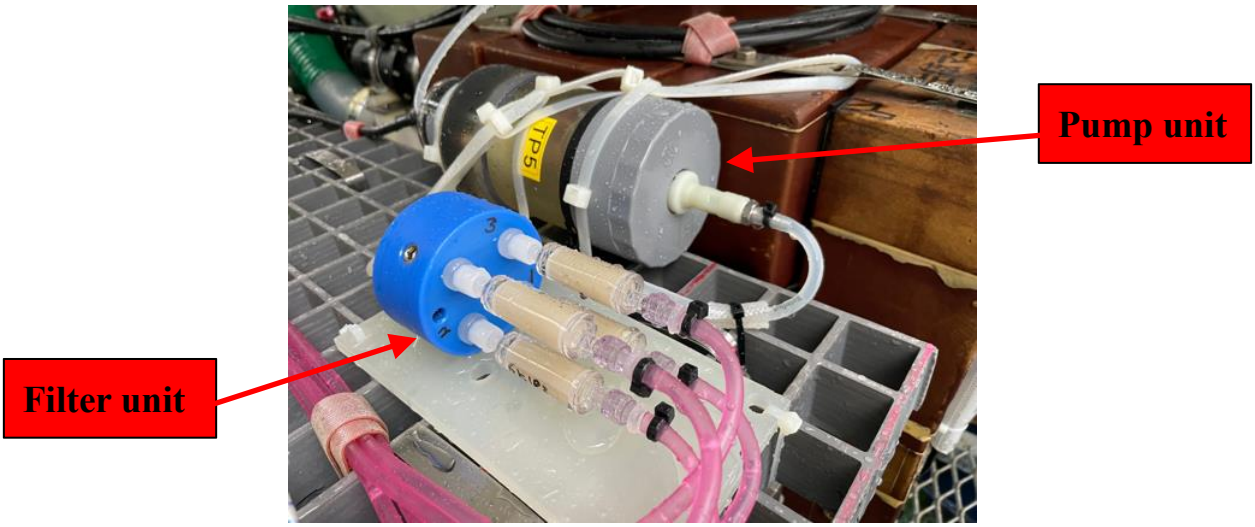


Fig. 3.2.3. MASS Pump installed on *Shinkai6500*

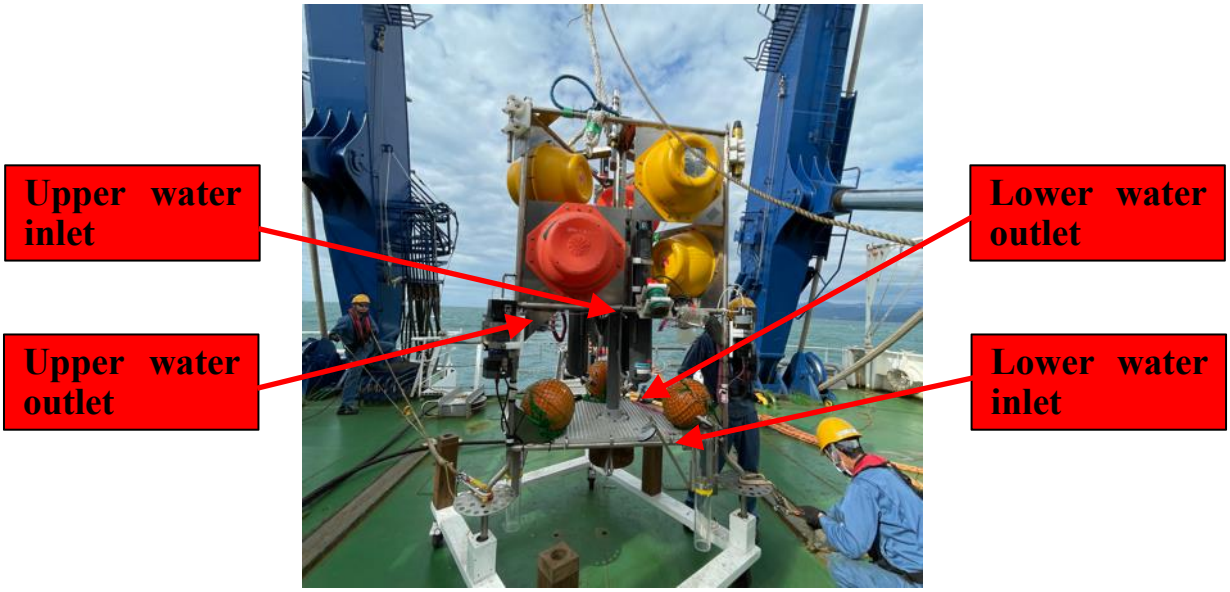


Table 3.2.1. MASS PUMP setting and filtration results -1.

BEFORE DEPLOYMENT			
Deployment date (dd-mmm-yyyy)		22-SEP-2022	
Location/Target depth (m)		Suruga Bay/1200 m	
Coordinate, Depth		35-2.2727N / 138-37.8655E, 1200 m	
Cast (dive) number		FL003	
Start time (hh:mm dd-mmm-yyyy)		8:00 23-SEP-2022	
End time (hh:mm dd-mmm-yyyy)		15:00 23-SEP-2022	
Duration (hh:mm)		7:00	
Pump ID/Controller ID		NO. (BP6)/No. (7)	
Time calibration		[Yes] / No	
Battery ID/voltage (V)		No. (19)/ 16.82V	
Flow meter counter at the time of setting		5	
Number of filters	6	Bait	NA
Filter ID(s)		L3P1, 2, 3, 4, 5, 6	
Inlet height from bottom (cm)		30 cm (Lower)	
Line cleaning (Washing reagent/duration)		[Yes] / No	
~~Installation of air vent plug (FD only)~~		~~Yes / No~~	
Underwater cable connection		[Yes] / No	
Filling with purified water		[Yes] / No	
Removal of tube caps (number)		[Yes] (7) / No	
AFTER RECOVERY			
Tubing Condition		[Good] / Bad	
Flow meter counter at recovery		193367	
Estimated filtration volume (L)		58 L (y=0.0003x) (possibly filtered up to 105.5 L)	
Battery voltage (V) at recovery		13.0 V	
Remarks		Monitor screen blackout, except blue LED	
Filter image			

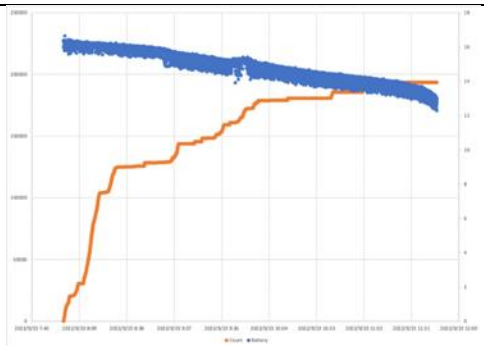
Filtration record	

Table 3-2-2. MASS PUMP setting and filtration results -2.

BEFORE DEPLOYMENT			
Deployment date (dd-mmm-yyyy)		22-SEP-2022	
Location/Target depth (m)		Suruga Bay/1200 m	
Coordinate, Depth		35-2.2727N / 138-37.8655E, 1200 m	
Cast (dive) number		FL003	
Start time (hh:mm dd-mmm-yyyy)		8:00 23-SEP-2022	
End time (hh:mm dd-mmm-yyyy)		15:00 23-SEP-2022	
Duration (hh:mm)		7:00	
Pump ID/Controller ID		NO. (TP3)/No. (2)	
Time calibration		[Yes] / No	
Battery ID/voltage (V)		No. (17)/ 16.82V	
Flow meter counter at the time of setting		0	
Number of filters	6	Bait	NA
Filter ID(s)		L3P7, 8, 9, 10, 11, 12	
Inlet height from bottom (cm)		90 cm (Upper)	
Line cleaning (Washing reagent/duration)		[Yes] / No	
~~Installation of air vent plug (FD only)~~		~~Yes / No~~	
Underwater cable connection		[Yes] / No	
Filling with purified water		[Yes] / No	
Removal of tube caps (number)		[Yes] (7) / No	
AFTER RECOVERY			
Tubing Condition		[Good] / Bad	
Flow meter counter at recovery		436011	
Estimated filtration volume (L)		131 L (y=0.0003x) (possibly filtered up to 196L)	
Battery voltage (V) at recovery		10.32 V	
Remarks			

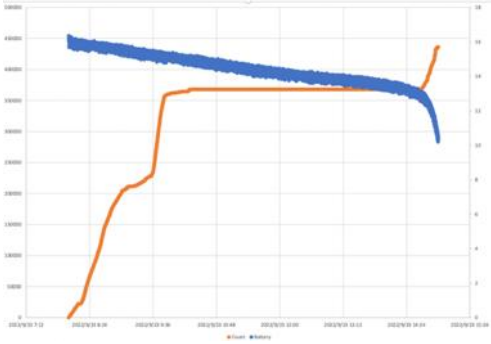
Filter image	
Filtration record	

Table 3-2-3. MASS PUMP setting and filtration results -3.

BEFORE DEPLOYMENT			
Deployment date (dd-mmm-yyyy)		22-SEP-2022	
Location/Target depth (m)		Suruga Bay/1223 m	
Coordinate, Depth		35-02.1188N / 138-40.2044E, 1224 m	
Cast (dive) number		POP1-4	
Start time (hh:mm dd-mmm-yyyy)		07:00 23-SEP-2022	
End time (hh:mm dd-mmm-yyyy)		14:00 23-SEP-2022	
Duration (hh:mm)		7:00	
Pump ID/Controller ID		NO. (TP4)/No. (1)	
Time calibration		Yes / No	
Battery ID/voltage (V)		No. (18)/ 16.8V	
Flow meter counter at the time of setting		0	
Number of filters	6	Bait	Squid
Filter ID(s)		B1P1, 2, 3, 4, 5, 6	
Inlet height from bottom (cm)		110 cm	
Line cleaning (Washing reagent/duration)		Yes / No	
~~Installation of air vent plug (FD only)~~		~~Yes / No~~	
Underwater cable connection		Yes / No	
Filling with purified water		Yes / No	
Removal of tube caps (number)		Yes (7) / No	
AFTER RECOVERY			
Tubing Condition		Good / Bad	
Flow meter counter at recovery		974173	

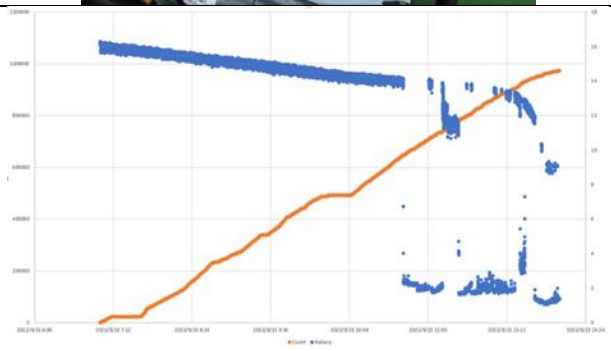
Estimated filtration volume (L)	292 L (y=0.0003x)
Battery voltage (V) at recovery	1.391 V
Remarks	Pressure vessel (aluminium) horizontal
Filter image	
Filtration record	

Table 3-2-4. MASS PUMP setting and filtration results -4.

BEFORE DEPLOYMENT			
Deployment date (dd-mmm-yyyy)		23-SEP-2022	
Location/Target depth (m)		Suruga Bay/1200 m	
Coordinate, Depth		35-0.5982 N / 138-39.3787E, 1368 m (Landing)	
Cast (dive) number		6K#1649	
Start time (hh:mm dd-mmm-yyyy)		manually-operated	
End time (hh:mm dd-mmm-yyyy)		manually-operated	
Duration (hh:mm)		0:38	
Pump ID/Controller ID		NO. (TP5)/No controller	
Time calibration		Yes / No	
Battery ID/voltage (V)		Supplied by *Shinkai 6500*/ AC100V	
Flow meter counter at the time of setting		0	
Number of filters	4	Bait	NA
Filter ID(s)		6K1P1, 2, 3, 4	
Inlet height from bottom (cm)		180 cm	
Line cleaning (Washing reagent/duration)		Yes / No	
~~Installation of air vent plug (FD only)~~		~~Yes / No~~	
Underwater cable connection		Yes / No	
Filling with purified water		Yes / No	

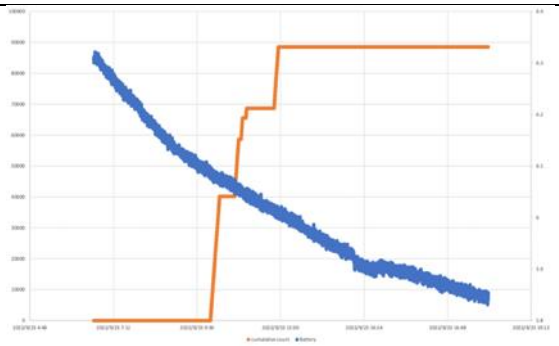
Removal of tube caps (number)	Yes (5) / No
AFTER RECOVERY	
Tubing Condition	Good / Bad
Flow meter counter at recovery	88474
Estimated filtration volume (L)	26.5 L (y=0.0003x)
Battery voltage (V) at recovery	NA
Remarks	Short circuit at pump
Filter image	 
Filtration record	

Table 3-2-5. MASS PUMP setting and filtration results -5.

BEFORE DEPLOYMENT			
Deployment date (dd-mmm-yyyy)		25-SEP-2022	
Location/Target depth (m)		Hoei Seamount/2100 m	
Coordinate, Depth		30-46.0037N / 138-45.3927E, 2175 m (Landing)	
Cast (dive) number		6K#1650	
Start time (hh:mm dd-mmm-yyyy)		manually-operated	
End time (hh:mm dd-mmm-yyyy)		manually-operated	
Duration (hh:mm)		:	
Pump ID/Controller ID		NO. (BP5)/ No controller	
Time calibration		Yes / No	
Battery ID/voltage (V)		Supplied by *Shinkai 6500*/ AC100V	
Flow meter counter at the time of setting		0	
Number of filters	4	Bait	NA
Filter ID(s)		6K2P1, 2, 3, 4	
Inlet height from bottom (cm)		180 cm	
Line cleaning (Washing		Yes / No	

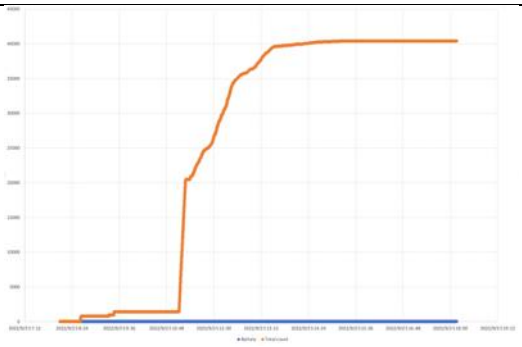
reagent/duration)	
~~Installation of air vent plug (FD only)~~	~~Yes / No~~
Underwater cable connection	Yes / No
Filling with purified water	Yes / No
Removal of tube caps (number)	Yes (5) / No
AFTER RECOVERY	
Tubing Condition	Good / Bad
Flow meter counter at recovery	40377
Estimated filtration volume (L)	12.1 L (y=0.0003x)
Battery voltage (V) at recovery	2.432 V
Remarks	possibly filtered up to 186.7 L（due to flowmeter trouble)
Filter image	
Filtration record	

Table 3-2-6. MASS PUMP setting and filtration results -6.

BEFORE DEPLOYMENT	
Deployment date (dd-mmm-yyyy)	25-SEP-2022
Location/Target depth (m)	Hoei Seamount/2000 m
Coordinate, Depth	30-47.0757 N / 138-44.3481E, 2138 m
Cast (dive) number	PC1-5
Start time (hh:mm dd-mmm-yyyy)	17:00 25-SEP-2022
End time (hh:mm dd-mmm-yyyy)	0:00 26-SEP-2022
Duration (hh:mm)	7:00
Pump ID/Controller ID	NO. (TP4)/No. (1)
Time calibration	Yes / No
Battery ID/voltage (V)	No. ( )/ 16.8 V

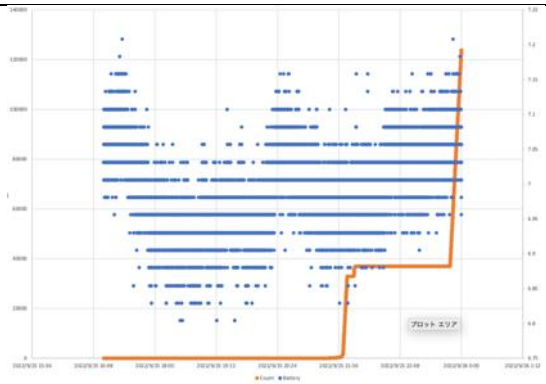
Flow meter counter at the time of setting		0	
Number of filters	6	Bait	Squid
Filter ID(s)		B2P1, 2, 3, 4, 5, 6	
Inlet height from bottom (cm)		110 cm	
Line cleaning (Washing reagent/duration)		[Yes] / No	
~~Installation of air vent plug (FD only)~~		~~Yes / No~~	
Underwater cable connection		[Yes] / No	
Filling with purified water		[Yes] / No	
Removal of tube caps (number)		Yes (7) / No	
AFTER RECOVERY			
Tubing Condition		[Good] / Bad	
Flow meter counter at recovery		123949	
Estimated filtration volume (L)		37.2 L (y=0.0003x)	
Battery voltage (V) at recovery		7.0 V	
Remarks			
Filter image		 	
Filtration record			

Table 3-2-7. MASS PUMP setting and filtration results -7.

BEFORE DEPLOYMENT	
Deployment date (dd-mmm-yyyy)	25-SEP-2022
Location/Target depth (m)	Hoei Seamount/2000 m
Coordinate, Depth	30-45.9473N / 138-45.3800E, 2178 m
Cast (dive) number	FL004
Start time (hh:mm dd-mmm-yyyy)	23:00 25-SEP-2022
End time (hh:mm dd-mmm-yyyy)	06:00 26-SEP-2022

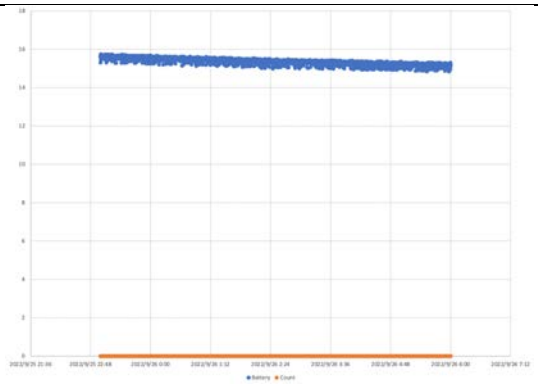
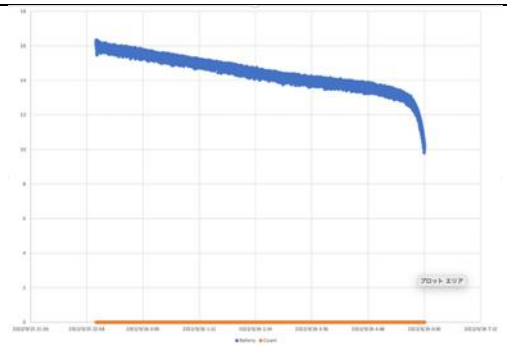
Duration (hh:mm)		07:00	
Pump ID/Controller ID		NO. (BP6)/No. (4)	
Time calibration		Yes / No	
Battery ID/voltage (V)		No. (15)/ 16.8V	
Flow meter counter at the time of setting		0	
Number of filters	6	Bait	NA
Filter ID(s)		L4P1, 2, 3, 4, 5, 6	
Inlet height from bottom (cm)		30 cm (Lower)	
Line cleaning (Washing reagent/duration)		Yes / No	
~~Installation of air vent plug (FD only)~~		~~Yes / No~~	
Underwater cable connection		Yes / No	
Filling with purified water		Yes / No	
Removal of tube caps (number)		Yes (7) / No	
AFTER RECOVERY			
Tubing Condition		Good / Bad	
Flow meter counter at recovery		0	
Estimated filtration volume (L)		0 L (y=0.0003x)	
Battery voltage (V) at recovery		15.2 V	
Remarks		Controller changed from #7 to #4	
Filter image		 	
Filtration record			

Table 3-2-8. MASS PUMP setting and filtration results -8.

BEFORE DEPLOYMENT			
Deployment date (dd-mmm-yyyy)		25-SEP-2022	
Location/Target depth (m)		Hoei Seamount/2000 m	
Coordinate, Depth		30-45.9473N / 138-45.3800E, 2178 m	
Cast (dive) number		FL004	
Start time (hh:mm dd-mmm-yyyy)		23:00 25-SEP-2022	
End time (hh:mm dd-mmm-yyyy)		06:00 26-SEP-2022	
Duration (hh:mm)		07:00	
Pump ID/Controller ID		NO. (BP6)/No. (7)	
Time calibration		[Yes] / No	
Battery ID/voltage (V)		No. (16)/ 16.8 V	
Flow meter counter at the time of setting		0	
Number of filters	Bait	Bait	NA
Filter ID(s)		L4P7, 8, 9, 10, 11, 12	
Inlet height from bottom (cm)		90 cm (Upper)	
Line cleaning (Washing reagent/duration)		[Yes] / No	
~~Installation of air vent plug (FD only)~~		~~Yes / No~~	
Underwater cable connection		[Yes] / No	
Filling with purified water		[Yes] / No	
Removal of tube caps (number)		Yes (7) / No	
AFTER RECOVERY			
Tubing Condition		[Good] / Bad	
Flow meter counter at recovery		0	
Estimated filtration volume (L)		0 L (y=0.0003x)	
Battery voltage (V) at recovery		10.2 V	
Remarks		Flowmeter trouble? The voltage decreased normally.	
Filter image			

Filtration record	

3.3. Niskin water sampling

Water samplings using Niskin bottles were conducted for monitoring of deep-sea biodiversity for marine protected area management. During this cruise, the Niskin bottles were equipped on *Shinka*i 6500 or lander system (Fig. X and XX), and water samplings were conducted at North of Suruga Bay and South Hoei Seamount. Waters were filtrated with Sterivex filters (listed in table ?).

Fig. 3.3.1. Niskin bottles on *Shinaki* 6500

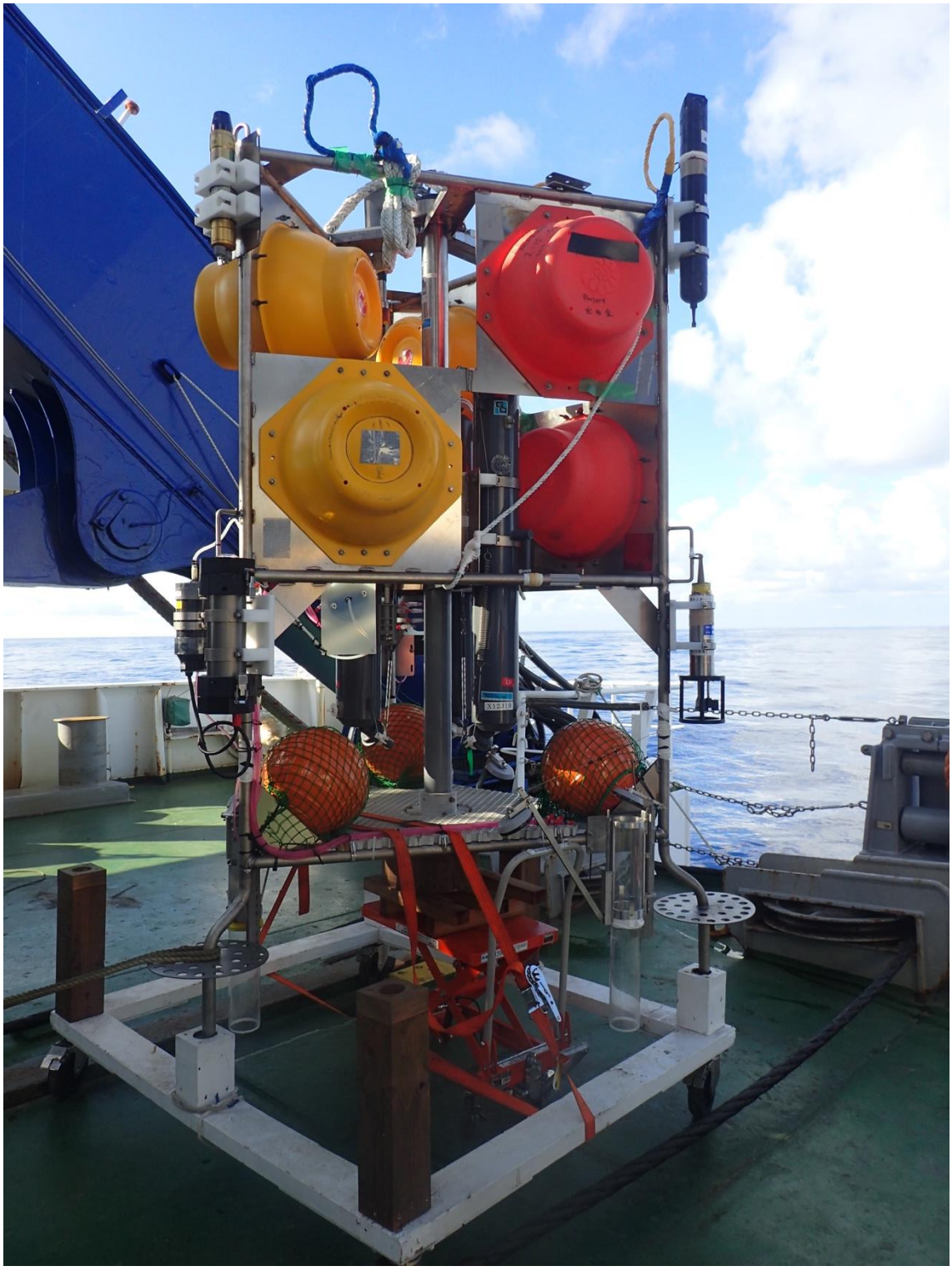


Fig. 3.3.2. Niskin bottles on lander system

Table 3.3.1. List of water samplings using Niskin bottles

Dive/Cast	Sampling date				Latitude (N)		Longitude (E)		Depth (m)	Location	Filter ID	Niskin no.	Filtered volume	Repository
6K#1649	2022	9	23	10:15	35	0.6052	138	39.3719	1360	Suruga Bay	YK22-6K1N1	1,4	17.29	JAMSTEC (Yoshida)
6K#1649	2022	9	23	10:15	35	0.6052	138	39.3719	1360	Suruga Bay	YK22-6K1N2	2,4	13.69	JAMSTEC (Yoshida)
6K#1649	2022	9	23	10:15	35	0.6052	138	39.3719	1360	Suruga Bay		2		Tokyo Univ. (Hamasaki)
FL003	2022	9	23	17:08	35	2.2727	138	37.8655	1200	Suruga Bay	YK22-L3N1	19,25,24	32.12	JAMSTEC (Yoshida)
FL003	2022	9	23	17:08	35	2.2727	138	37.8655	1200	Suruga Bay				Tokyo Univ. (Hamasaki)
6K1650	2022	9	25	11:17	30	45.9825	138	45.3832	2171	Hoei Seamount	YK22-6K2N1	1,3,4	22.53	JAMSTEC (Yoshida)
6K1650	2022	9	25	11:17	30	45.9825	138	45.3832	2171	Hoei Seamount		2		Tokyo Univ. (Hamasaki)
FL004	2022	9	26	8:04	30	45.9473	138	45.38	2178	Hoei Seamount	YK22-L4N1	19,25,24	31.97	
FL004	2022	9	26	8:04	30	45.9473	138	45.38	2178	Hoei Seamount				Tokyo Univ. (Hamasaki)

3.4. Baited camera deployment

A free-fall baited camera (POP: Predator Observation Platform) was operated during this cruise. Total weight of the camera is 103.7 kg in air and -9.7 kg in water. Detailed information on the camera system is shown in Table 3.4.1 and Figure 3.4.1. This camera was deployed in free fall to the seafloor, and after the observation was completed, it received an acoustic release command, dropped its weight, and floated to the surface. In addition to the species diversity of predators/scavengers, the population density of each species will be analyzed using the first arrival time of each species and the odor plume diffusion area estimated from the current profile at that time.

Two casts were conducted at Suruga Bay and Hoei Seamount (Table 3.4.2), and up to 13 hours of video footage was recorded during each cast.

Table 3.4.1. Equipment loaded on the camera.

Camera ID	POP1
Transponder	4E-4
ROV homer	35
Current profiler (Infinity-Deep)	94
CTD	9270 or
Radio Beacon	JS2164
Flasher	B02-038

Fig. 3.4.1. Baited camera and equipment

Table 3.4.2. Cast list of the baited camera during YK22-17 Leg 1

Cast No.	Location	Casting Date	Casting Time	Landing Time	Descent speed (m/m)	Landing Point Lat./Lon.		CTD Depth (m)	Recovery Date	Release command sending	Surfaced	Ascent speed (m/m)	Note
POP1-4	Suruga Bay	2022 9.22	11:15	11:58	28.85	35-02.1188N	138-40.2044E	1224	2022 9.23	15:08	15:47	31.34	
POP1-5	Hoei Seamount	2022 9.25	7:45	8:57	29.67	30-47.0757N	138-44.3481E	2138	2022 9.26	5:20	6:28	31.33	Timer Release

3.5. Free-fall lander deployment

■ Introductions

A free-fall lander system (hereafter referred to as "lander") was developed for inexpensive and simple monitoring of the seafloor environment. In this cruise, one day and night monitoring surveys were conducted using this system in Suruga Bay (at a water depth of around 1500m) and at Hoei seamount (at a water depth of around 2000m), one of the offshore natural environment conservation areas. The lander system was installed on the seafloor in free fall from the R/V YOKOSUKA. The weight attached to the lander system was detached by an acoustic detachment device, and the lander was lifted to the sea surface by the buoyancy of the lander for recovery. The location of installation on the seafloor was determined by checking the transponder response from the vessel. Detailed information on the lander installation is shown in Table 3.5.1 and the location of the lander is shown in Fig.3.5.1, respectively.

Table.3.5.1. information on the lander installation

Observation point	Suruga Bay		Houei seamount	
Location (Lat. and Long.)	35-2.2727N	138-37.8655E	30-45.9473N	138-45.3800E
Depth (m)	1190		2185	
Lander input time	2022/9/22 8:46		2022/9/25 17:11	
Installation Time	2022/9/22 9:19		2022/9/25 18:12	
Descent speed (m/min)	36.1 (1190m/33min)		35.8 (2185m/61min)	
start time of surfacing	2022/9/23 16:19		2022/9/26 7:11	
Lander surfacing time	2022/9/23 16:40		2022/9/26 7:48	
Surfacing speed (m/min)	56.7 (1190m/21min)		59.1 (2185m/37min)	
Installation period (hour)	31.0		13.0	

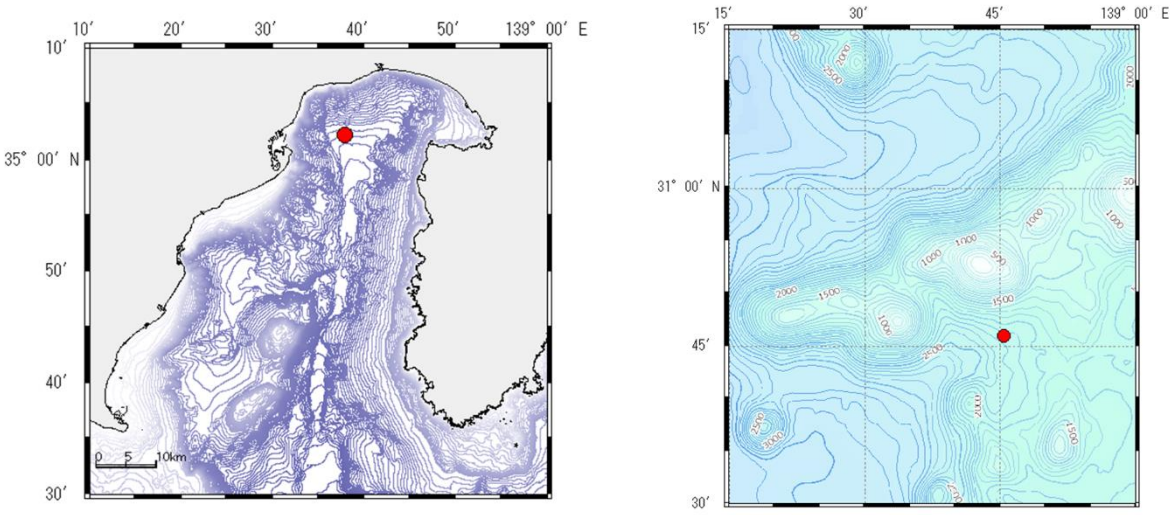


Fig. 3.5.1. Lander installation sites in Suruga Bay (left panel) and Hoei seamount (right panel)

■ Configuration of the Lander System

The lander system consisted of a 4K video camera and lights capable of interval filming, an ultrasonic Doppler current meter (Nortek, ADP-DW), a CTD (JFE Advantech, RINKO-Profiler), three Niskin water samplers (12L), two MASS pump filtration units, three core samplers (Asherah mud sampler), a flasher, an iridium beacon, and an ROV homer (Fig. 3.5.2).

Fig. 3.5.2. Configuration of the Lander System

The lander is installed by free-fall from the ship, and the weight (about 93 kg) is detached by a releaser (KAIYO DENSHI Co., Ltd., model: BX-1003) installed in the center of the lander to raise it to the sea surface. The total weight of the main body of the lander used this time was about 435kg, and the underwater weight was about 26 kg (both with weights). The buoyancy of the lander was estimated to be about 55 kg (upward) based on the results of the operational tests on the shore. In the field, the lander settling velocity was about 36 m/min and the surfacing velocity was about 58 m/min (Table 3.5.1).

In the lander used this time, the number of core samples that can be collected and the number of seawater filtration devices were successfully increased by changing the ultrasonic anemometer from a multilayer type to a single layer type and by adding 30 kg of buoyancy material (pressure-resistant buoy).

The observation settings for each environmental measurement device are as follows.

- Video camera: One-minute videos are acquired at 10-minute intervals
- Current direction and velocity: measured in continuous mode (1 second).
- CTD (water temperature, salinity, pressure, turbidity and DO): measured every 5 minutes
- Niskin water sampling: 6 to 8 hours after lander insertion (3 bottles)
- MASS pump filtration: 7 hours before retrieving the lander

Suruga Bay: September 23 from 08:00 to 15:00

Hoei Kaisan: from 23:00 on September 25 to 06:00 on September 26

- Core Sampling: at the time of landing the lander (3 core samples)

■ “Galvanic Timed Releases” System

The lander was newly equipped with three core samplers to enable mud sampling. For water sampling, “Galvanic Timed Releases” were used to simplify the setting of the water sampling trigger. The water sampling was set to be done 6 to 8 hours after the lander was deployed. The same "Galvanic Timed Releases" were used to collect the core sampler. The "Galvanic Timed Releases" used were the AA2 type from International Fishing Devices Inc (Fig. 3.5.3).

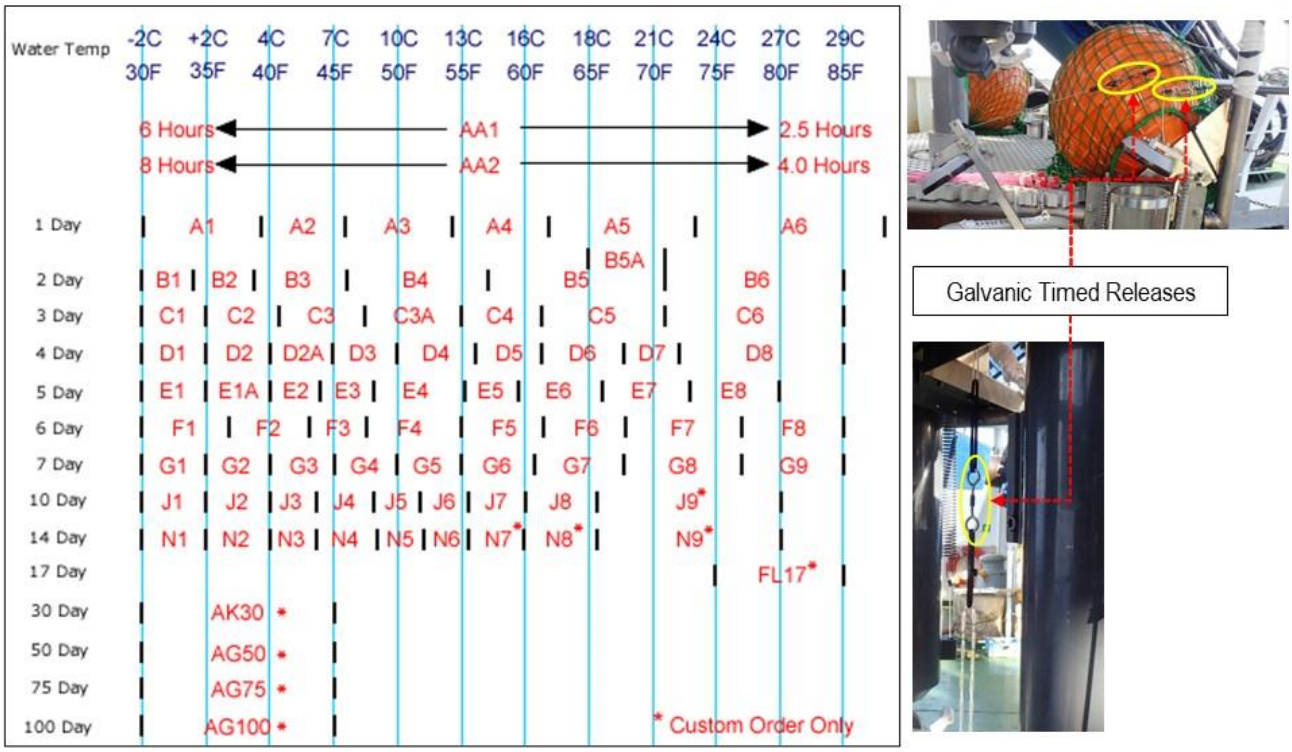


Fig. 3.5.3. The Time/Temperature Chart of Galvanic Timed Releases.

Galvanic releaser dissolves in about 8 hours when the water temperature is 35F (1.7°C) (Figure 3.5.3). It also dissolves in about 6 hours when the water temperature is 80F (26.7°C). Assuming that the galvanic releaser dissolves in proportion to the water temperature, the relationship between water temperature W and dissolution time t can be expressed as follows.

$$t = (101.7-W) / 12.5 \qquad (1)$$

■ Function of core sampling attached to the lander

The lander is performed by three core samplers attached to the foot of the main body at the time of bottom landing. After landing, the cores are inserted into the seafloor under the weight of the lander. The upper and lower covers are closed after 6 to 8 hours when the "Galvanic Timed Releases" dissolve. However, the lower cover remains stationary with the arm down on the seafloor, and the lower cover of the core sampler is closed to secure the sample as soon as the lander rises to the surface during retrieval (Fig. 3.5.4). The core sampling is shown in Fig. 3.5.5 (a) and (b). Note that this sampling mechanism may or may not be possible depending on the condition of the bottom sediment (mud, sand, rock, etc.).

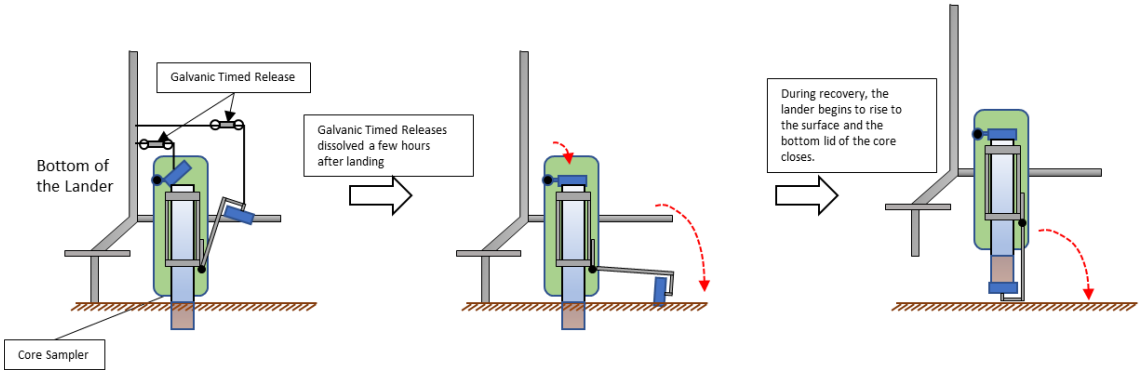


Fig. 3.5.4. Image of Lander Mud Extraction

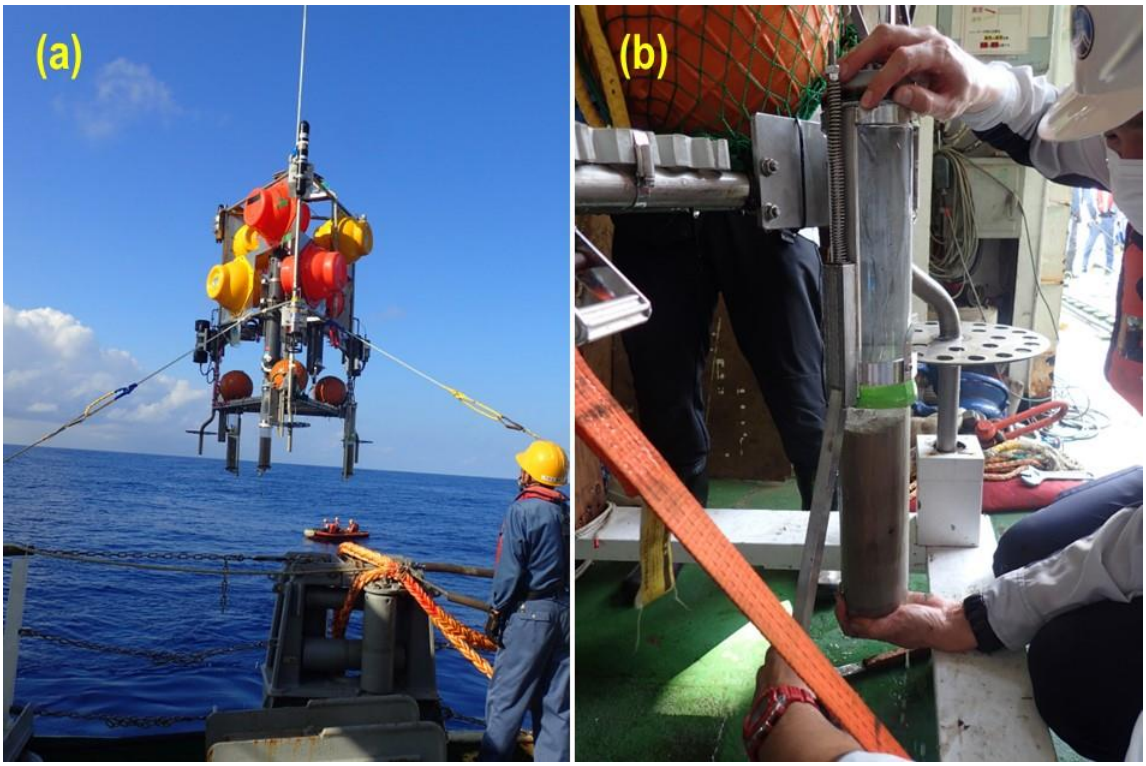


Fig. 3.5.5. Core sampling using Lander

Fig. 3.5.5 shows images of core sampling by the lander at Hoei seamount. All cores were successfully sampled (Fig. 3.5.5 (a)). Because the seafloor was muddy, it is estimated that about 30 cm of cores were sampled (Fig. 3.5.5 (b)). This result suggests that although this is a point

observation, it is effective when a submarine survey by ROV is not possible. Analysis of the core samples collected is currently underway.

■ Result of ADP-DW

Fig. 3.5.6 shows the flow measurement results obtained by ADP-DW in the inner part of Suruga Bay (Fig. 3.5.1) during the seafloor installation period. Fig. 3.5.6 (a) shows the temporal fluctuations of water depth and temperature, and Fig. 3.5.6 (b) shows the temporal fluctuations of current velocity and direction. The average water temperature was 3.27°C and the average current velocity was 0.09 m/s. A strong southward current (about 0.25 m/s) was observed around 13:00 on September 22 after landing on the bottom (Fig. 3.5.6 (b)). A slight increase in water temperature was observed during the rising tide (Fig. 3.5.6 (a)). The ADP-DW was mounted so that the sensor was about 30 cm above the top of the lander, and the blanking distance was 0.5 m.

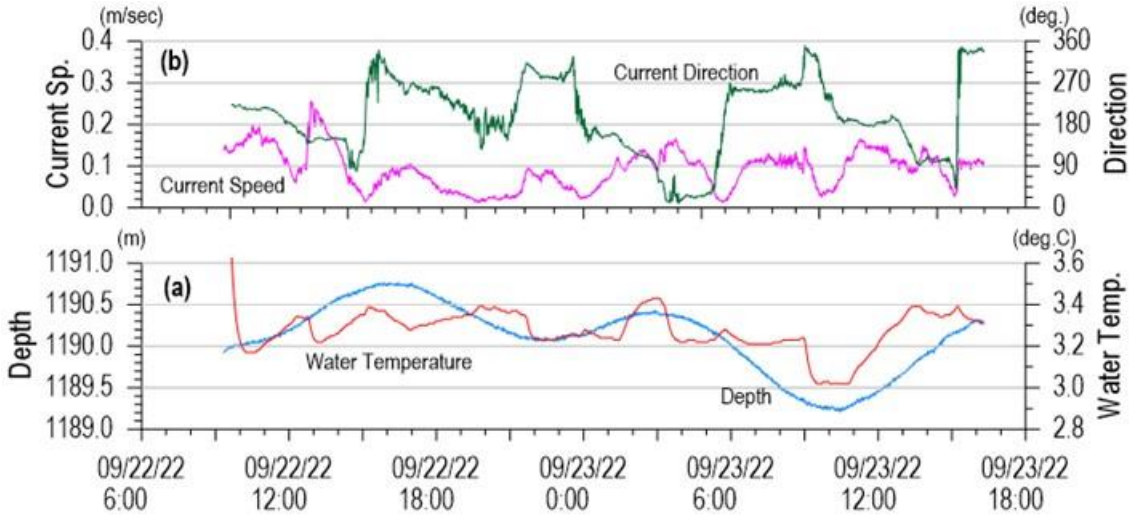


Fig. 3.5.6. Results of current measurements using an ultrasonic current meter (ADP-DW) at the deep-sea floor of Suruga Bay.
(a) Time series of depth (blue line) and water temperature (red line).
(b) Time series of current velocity (purple line) and current direction (green line).

Fig. 3.5.7 shows the flow measurement results obtained by ADP-DW at the Hoei seamount (Fig. 3.5.1), similar to Fig. 3.5.6. Fig. 3.5.7 (a) shows water depth and temperature, and Fig. 3.5.7 (b) shows current velocity and direction. The mean water temperature was 2.31°C and the mean current velocity was 0.05 m/s. From the temporal variation of the flow direction, it was inferred that the westward flow was dominant during the low tide and the eastward flow was dominant during the high tide (Fig. 3.5.7 (b)). Analysis of the flow regime is currently underway.

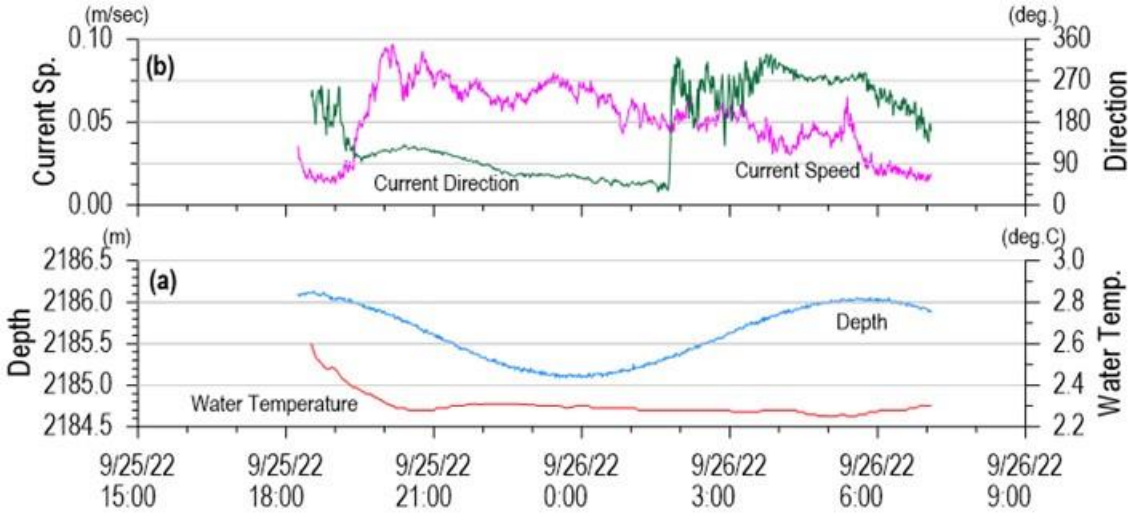


Fig. 3.5.7. Results of current measurements using an ultrasonic current meter (ADP-DW) at the deep-sea bottom of the Hoei seamount.

(a) Time variation of Depth (blue line) and water temperature (red line).

(b) Temporal variation of current velocity (purple line) and direction (green line)

■ Results of CTD measurements attached to the lander
(environmental sensors: water temperature, salinity, pressure, turbidity and DO)

Fig. 3.5.8 shows the measurement results of environmental data using RINKO Profiler in the inner part of Suruga Bay (Fig. 3.5.1) during the seafloor installation period. Fig. 3.5.8 (a) shows the fluctuations in water depth and density, Fig. 3.5.8 (b) shows the fluctuations in water temperature and salinity, and Fig. 3.5.8 (c) shows the fluctuations in turbidity and DO. The horizontal axis indicates time. In Fig. 3.5.8 (c), a high turbidity and somewhat high density seawater intrusion was observed at 13:00 on September 22. This coincided with the time when a strong southward flow was observed in Fig. 3.5.6 (b). This result can be inferred to be either the roll-up of suspended sediments near the seafloor due to the strong current or the effect of high turbidity coastal water.

On the other hand, from around 9:00 to 12:00 on September 23, the inflow of high-temperature, slightly low-salinity seawater was observed (Fig. 3.5.8 (b)), and at the same time, turbidity and DO increased (Fig. 3.5.8 (a)). Analysis of the seafloor environment is currently under scrutiny.

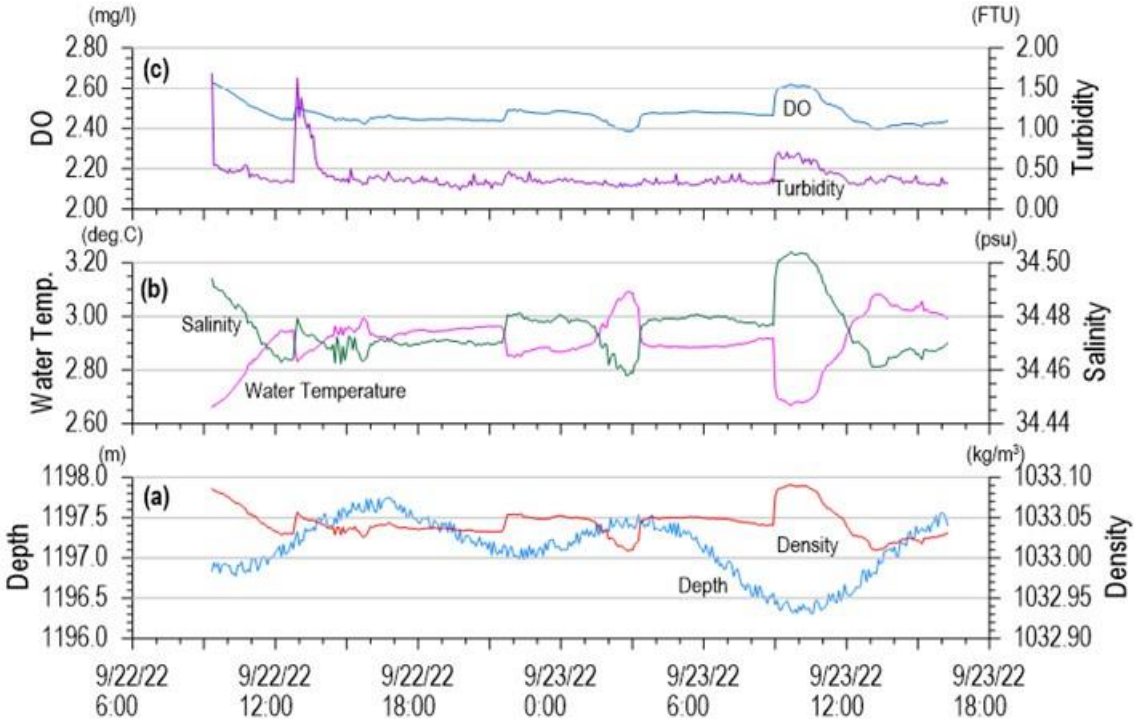


Fig.3.5.8. Results of environmental measurements using RINKO Profiler at the deep-sea floor of Suruga Bay.
(a) Time series of Depth (blue line) and Density (red line)
(b) Time series of water temperature (pink line) and salinity (green line)
(c) Time series of turbidity (purple line) and DO (blue line)

Similarly, Fig. 3.5.9 shows the environmental data measured by the RINKO Profiler at the deep-sea floor of the Hoei seamount (Fig. 3.5.1) during the seafloor installation period. At around 20:00 on September 25, low-temperature and high DO seawater was observed entering the vicinity of the observation site (Fig. 3.5.9 (c)). The predominant current at this time was a

southeastward current (Fig. 3.5.7 (b)). The relationship between near-seafloor currents and variations in environmental factors will continue to be investigated.

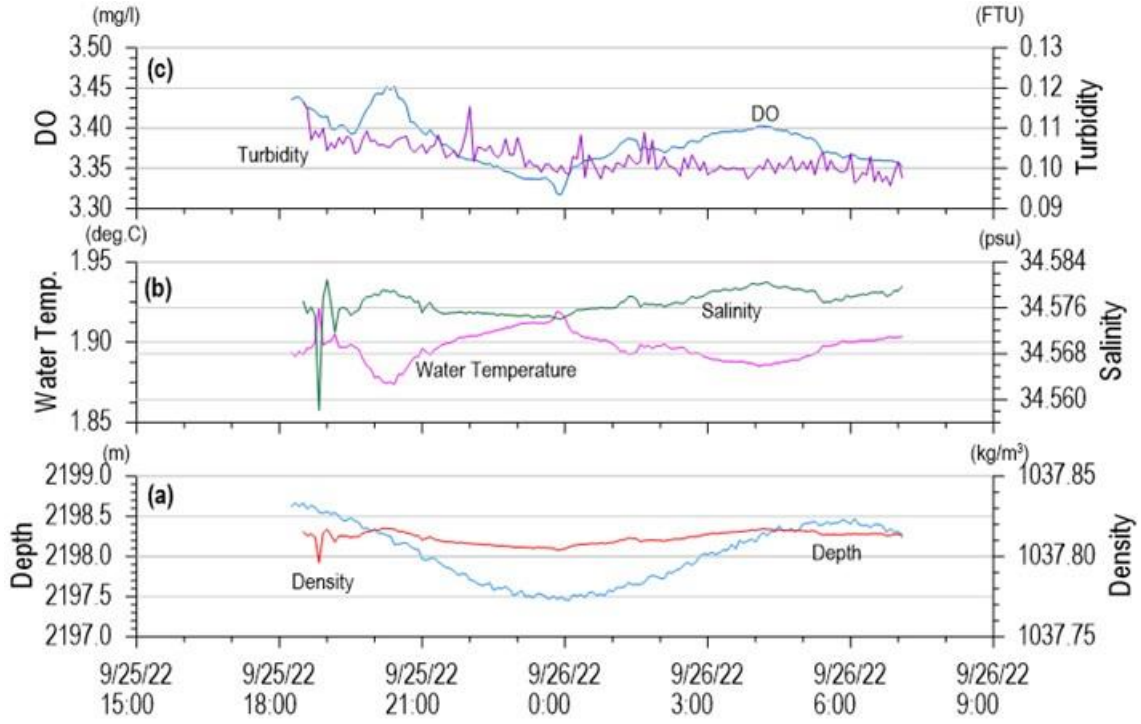


Fig. 3.5.9. Results of environmental measurements using the RINKO Profiler at the deep-sea floor of the Hoei seamount.
(a) Time series of Depth (blue line) and Density (red line)
(b) Time series of water temperature (pink line) and salinity (green line)
(c) Time series of turbidity (purple line) and DO (blue line)

■ Capture image of video camera on Lander system

Seafloor video images from the video camera attached to the lander were acquired as follows.

In the inner part of Suruga Bay, 101 frames of video (one-minute video at 10-minute intervals) were acquired from 9:20 on September 22 to 2:00 on September 23, 2022. However, after 2:00 a.m. on September 23, no seafloor video could be acquired due to a malfunction of the equipment. The cause of this problem is currently under investigation. On the other hand, 81 frames of video (one-minute images at 10-minute intervals) were acquired at the Houei seamount between 18:20 on September 25 and 7:40 on September 26, 2022. Fig. 3.5.10 shows an example of captured images of seafloor video acquired in the inner part of Suruga Bay. Fig. 3.5.11 is likewise an example of a captured image of the seafloor at Houei seamount.

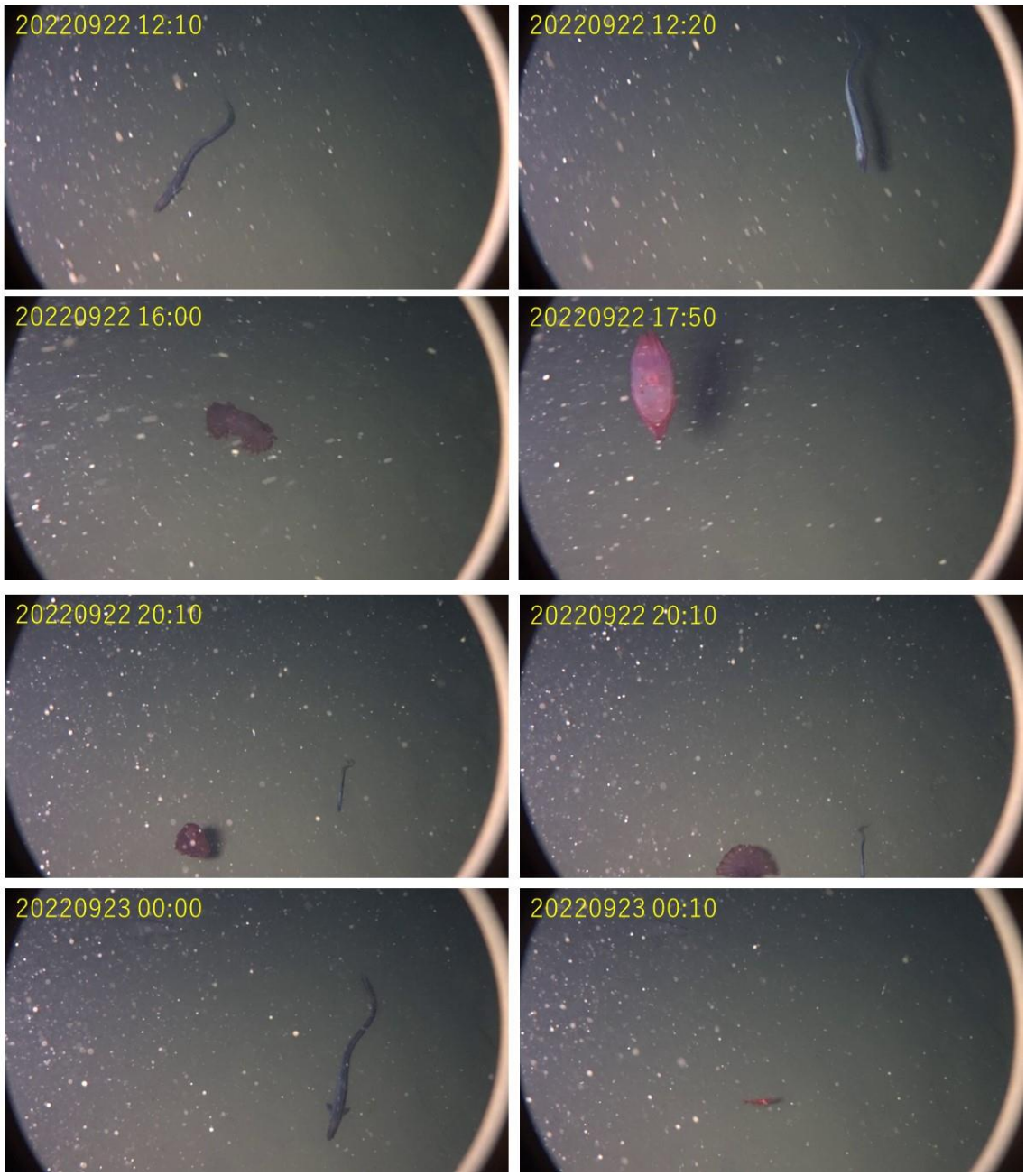


Fig. 3.5.10. Capture image of video camera on Lander system at Suruga Bay

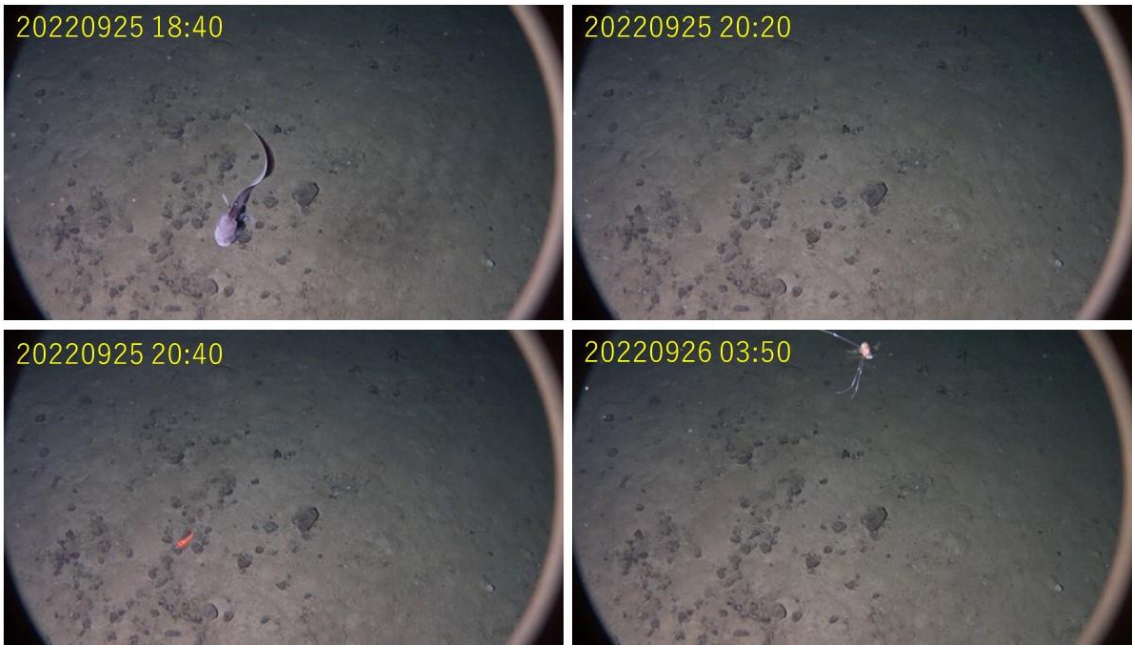


Fig. 3.5.11. Capture image of video camera on Lander system at Houei seamount

■ Water sampling with Niskin water sampler

To simplify the setting of the trigger in the water sampler, Galvanic Timed Release was used. Although the water sampling using the Galvanic Timed Release does not provide an exact time, the approximate time of sampling can be estimated from the on-site water temperature. Fig. 3.5.12 shows the Galvanic Timed Release set in the Niskin water sampler. During this survey, water sampling was successfully conducted in Suruga Bay and Hoei Seamount.

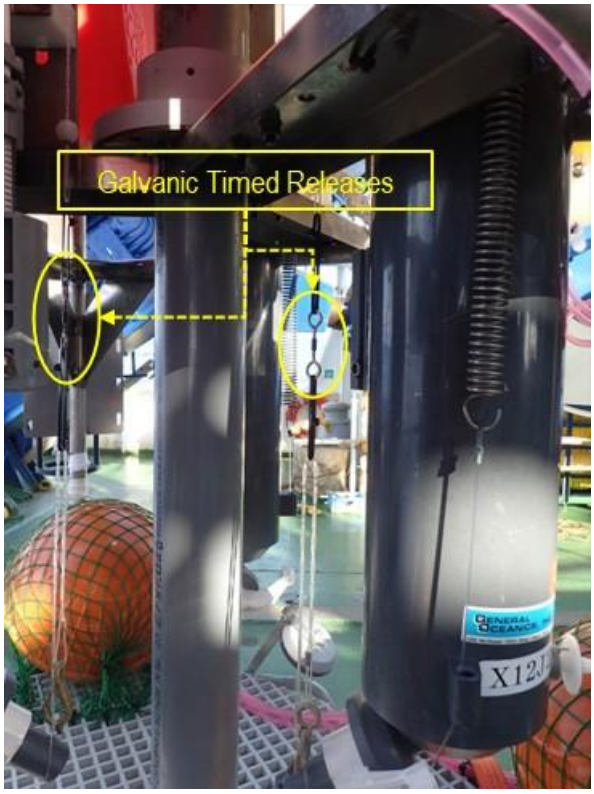
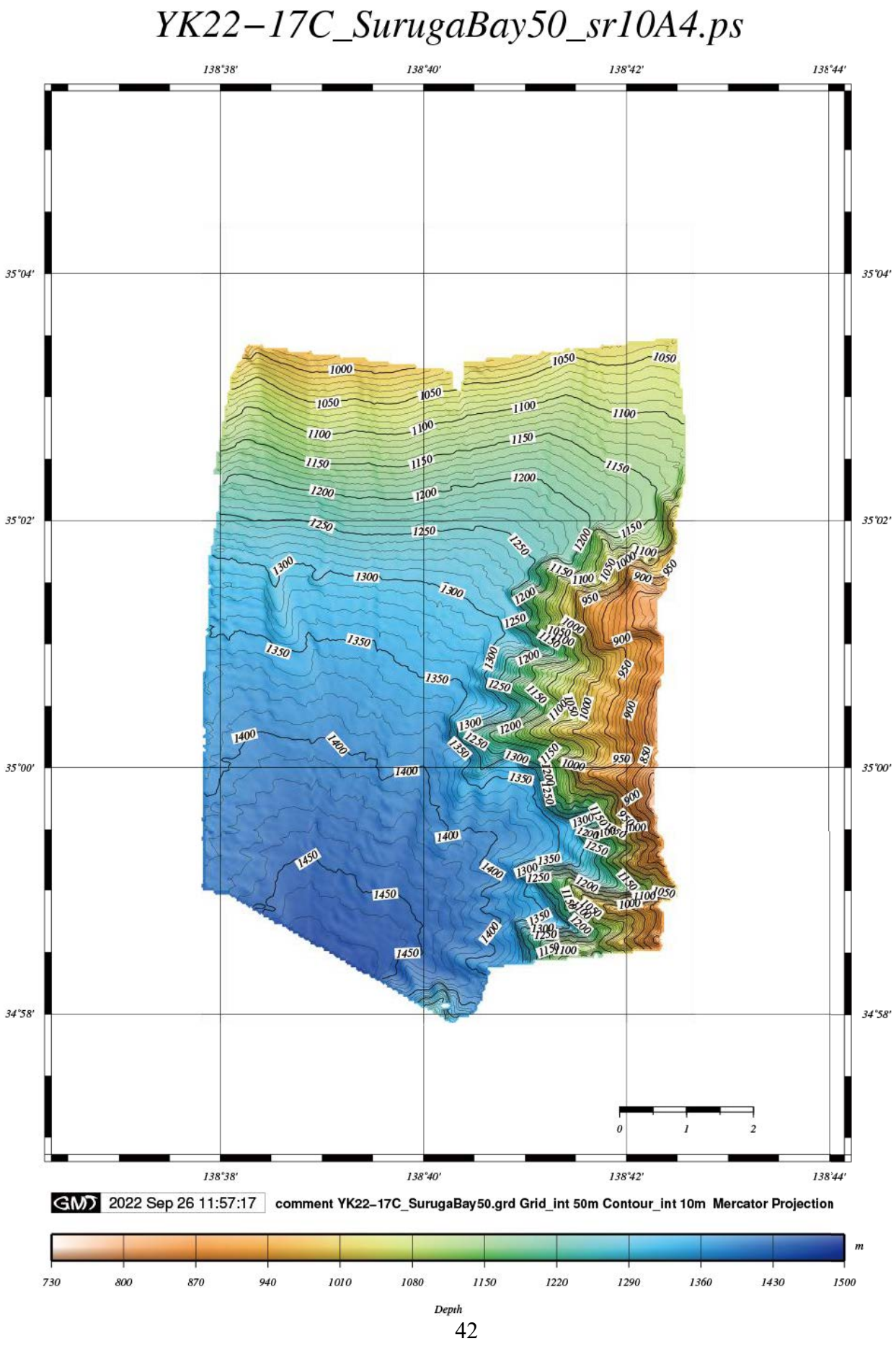


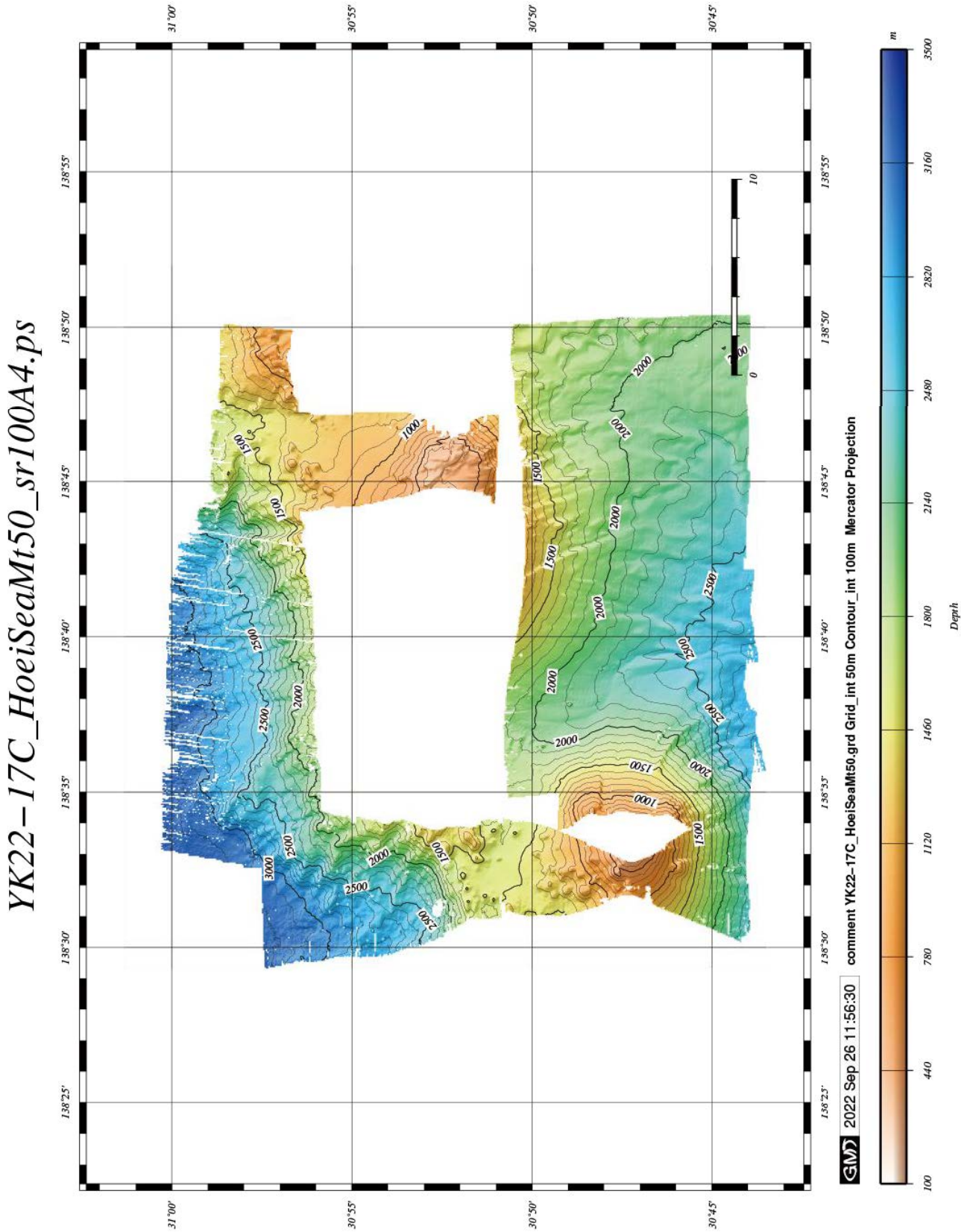
Fig. 3.5.12. Galvanic Timed Release set in a Niskin water sample.

3.6. Geophysical survey results

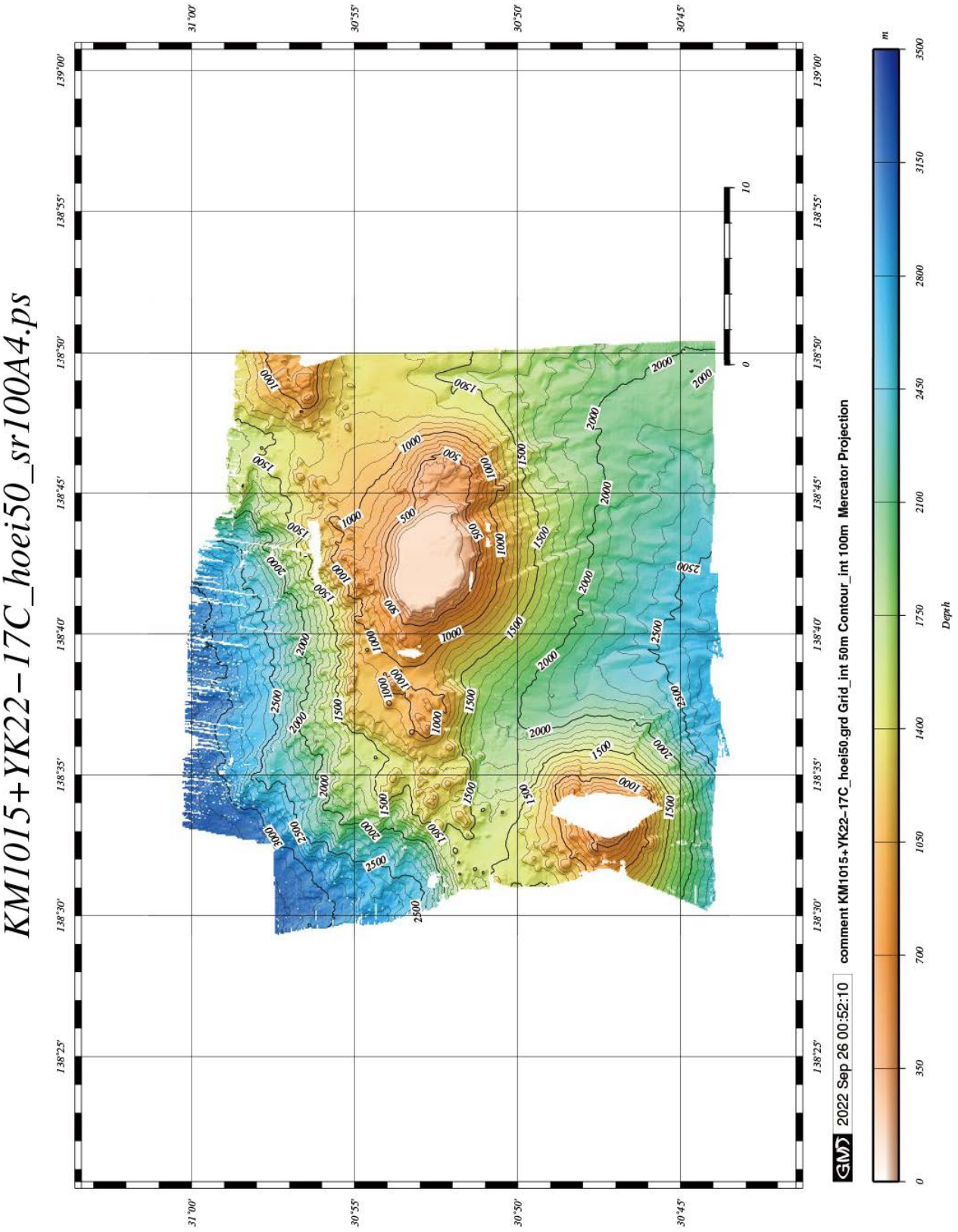
Suruga Bay



Hoei Seamount



Hoei Seamount (combined with the previous map)



4. Acknowledgements

We thank the captain and crew of the R/V *Yokosuka* and the operation team of HOV *Shinkai 6500* for organizing the cruise and conducting the diving research and sampling. We also thank marine technicians from Nippon Marine Enterprises for research support and ground stuff from Japan Agency for Marine-Earth Science and Technology for all the procedures to establish this cruise. This cruise was supported by the Environment Research and Technology Development Fund (JPMEERF20S20700) of the Environmental Restoration and Conservation Agency of Japan.

5. Notice on Using