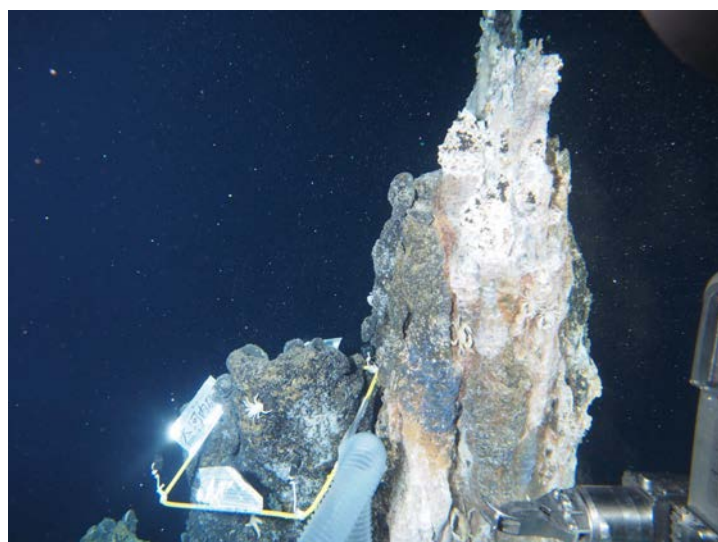




R/V Yokosuka & DSV Shinaki6500 Cruise Report YK22-05

**Episode III: basic investigation for translocation of
chemosynthetic populations in deep-sea hydrothermal systems
and JAMSTEC's educational exploration for new generations and
talents in Ocean**



March 8, 2022 from JAMSTEC Yokosuka – March 12, 2022 Off

JAMSTEC - March 16, 2021 to JAMSTEC Yokosuka

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

Acknowledgements

We are grateful to Captain Mr. T. Adachi, Chief Officer Mr. T. Shirayama and Chief Engineer Mr. K. Funae for their safe navigation and their skillful handling of “R/V Yokosuka”. Great thanks are due to Shinkai6500 Operation Manager Mr. K. Chiba and Shinkai6500 operation team for their operations in sampling. We thank all the JAMSTEC persons who have supported us and this cruise. Finally, we would like to appreciate all the persons who have encouraged directly or indirectly this cruise.

CONTENTS

Acknowledgements	2
Contents	3
Cruise information	4
List of participants	5
Captain and crew of the R/V YOKOSUKA	7
“Shinkai 6500” Operation Team	8
 I. Cruise summary	 9
 II. Introduction	 10
 III. Explanatory note	 13
1. Manned Research Submersible “Shinkai 6500”	13
2. Research Vessel “Yokosuka”	14
 IV. Dive report	 15
Shinkai6500#1616 (MIYAZAKI, J)	16
Shinkai6500#1617 (CHEN, C)	19
Shinkai6500#1618 (WATANABE, H)	23
Shinkai6500#1619 (TAKAI, K)	26

Cruise information

Cruise ID: YK22-05

Vessel: Yokosuka

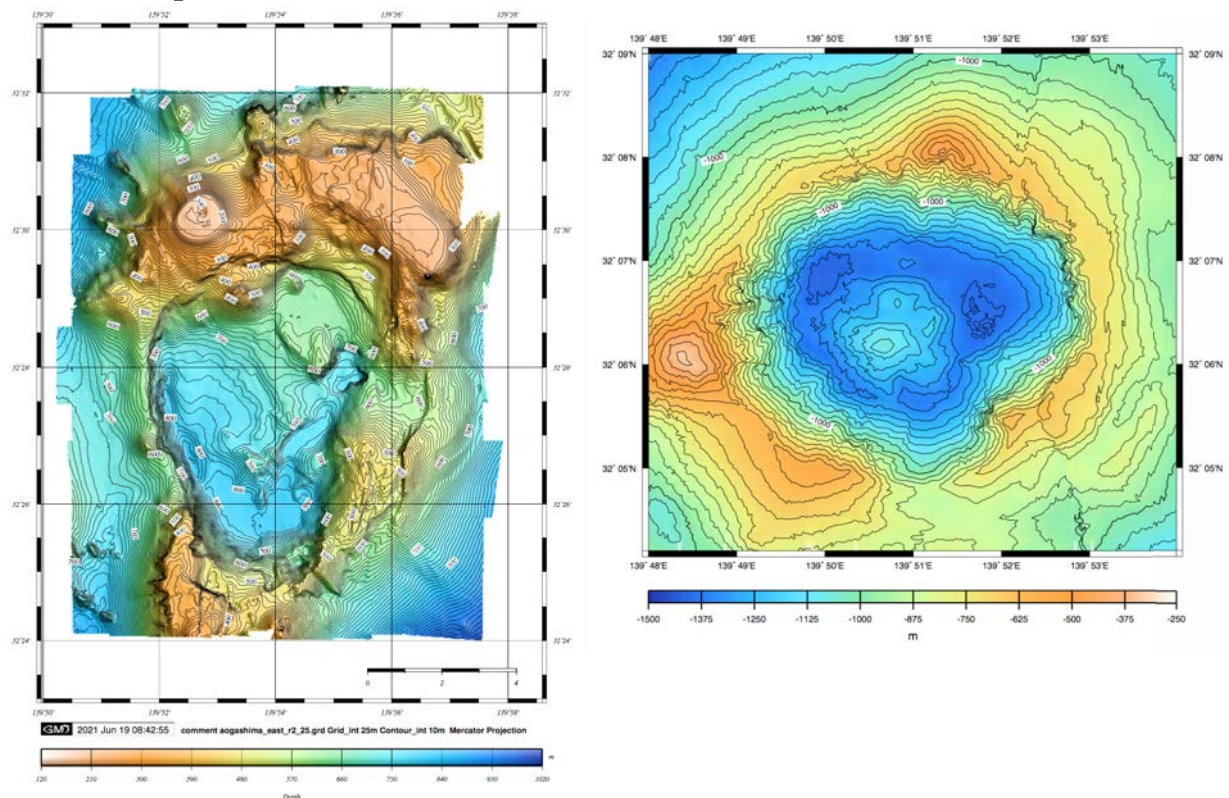
Title of the cruise: ‘GACHINKO’ Cruise Episode III: basic investigation for translocation of chemosynthetic populations in deep-sea hydrothermal systems and JAMSTEC’s educational exploration for new generations and talents in Ocean

Cruise period: March 8 – March 16, 2022

Ports of call: JAMSTEC Yokosuka – JAMSTEC Yokosuka, Japan

Research area: Higashi-Aogashima Knoll, and Myojin Knoll

Research map:



General topographic map of Higashi-Aogashima Knoll (left) and Myojin Knoll (right).

List of Participants

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Captain and crew of the R/V YOKOSUKA

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2nd Officer	KJISA, T.
3rd Officer	NOZAWA, T.
Jr. 3rd Officer	MORIYA, D.
Chief Engineer	FUNASE, K.
1st Engineer	SHIRAKATA, K.
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3rd Engineer	NONAKA, S.
Chief Radio Officer	KOMAKI, Y.
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Quarter Master	HIRAI, S.
Quarter Master	SAGA, T.
Sailor	OISHI, Y.
Sailor	NAKANISHI, R.
Sailor	INOUE, S.
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Steward	KUROSAKI, C.
Steward	SHIRAISHI, Y.

“Shinkai6500” Operation Team

Operation Manager	CHIBA, K.
Deputy Op. Manager	MATSUMOTO, K.
1st Submersible Staff	KONDO, T.
1st Submersible Staff	ISHIKAWA, A.
2nd Submersible Staff	UEKI, H
2nd Submersible Staff	SUZUKI, K.
2nd Submersible Staff	SAIGO, R.
2nd Submersible Staff	ONISHI, T.
2nd Submersible Staff	IJIMA, S.
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3rd Submersible Staff	SATO, K.
3rd Submersible Staff	MATSUSAKA, M.

I. CRUISE SUMMARY

In YK22-05 cruise, we conducted a total of 4 Shinkai6500 dives in the Higashi-Aogashima Knoll, Myojin Knoll, and Off Hatsushima, Sagami Bay. One of the cruise foci was the preliminary investigation for the future artificial translocation and immigration of hydrothermal vent-endemic chemosynthetic animal populations. In this cruise, we tried to look for the potential post-immigration colony environments of the *Alviniconcha* population in the Suiyo Seamount in neighboring hydrothermal fields of the Izu-Ogasawara Arc and Sagami Bay.

In the last cruises (YK19-10 and YK21-04), we found the dense colonies of *Alviniconcha adamantis* in the Suiyo Seamount vent field and the physico-chemical conditions of the colony. In addition, we found that the *Alviniconcha* individuals in Suiyo Seamount could survive through the 24 h translocation at the time of translocation under different physical and chemical conditions (between the original colony and the outer ridge seafloor) and could successfully recolonize in the original habitats. The subsequent transcriptomic analyses of gill symbionts in the translocated (after 24h) and relocated individuals (after 19 months) indicated that the translocation and relocation affected the expression extent and pattern of enzymes related with energy metabolisms of the symbionts. These observations and results strongly suggested that the Suiyo Seamount *Alviniconcha* holobiont could cope with environmental change of physical and chemical conditions during the translocation and relocation at the molecular level. Thus, it seems possible that the Suiyo Seamount *Alviniconcha* individuals can be translocated to the appropriate habitats of the hydrothermal fields near the Suiyo Seamount, if needed in the future.

As the next stage of research, we tried to look for colony environments similar to that of the Suiyo Seamount *Alviniconcha* population in neighbor hydrothermal fields of the Izu-Ogasawara Arc, as potential target localities for translocation. This was the main objective of this cruise.

During the YK22-05 cruise, the physical and chemical conditions of chemosynthetic animal colonies in the hydrothermal fields of the Higashi-Aogashima Knoll (6K#1617), Myojin Knoll (6K#1616 and 6K#1618) and Off Hatsushima, Sagami Bay (6K#1619), were investigated. *In situ* measurements of dissolved oxygen (DO) content, H₂, H₂S and CH₄ concentrations were conducted during the dive surveys but the detail analyses will be conducted in onshore laboratory later.

Another main focus of this cruise was JAMSTEC's educational exploration for new generations and talents in Ocean. Eight selected elite undergraduate students from 74 applicants were onboard and 4 of them experienced Shinkai6500's dives with the well-experienced researchers. All the students joined the onboard research activities. We hope that these experiences will serve as triggers for their growth during undergraduate and graduate studies and will have great impacts on their future directions and carrier paths.

II. INTRODUCTION

General backgrounds & Scientific objectives

Suiyo Seamount hydrothermal system was discovered by seafloor observation of Shinkai2000 in 1991 (Kasuga and Kato, 1992). After the first discovery, many dives of human occupied vehicle (HOV) and remotely operative vehicle (ROV) have been conducted. Remarkable scientific achievements are isolation of many of new extremophilic microorganisms endemic to this hydrothermal field (Takai and Horikoshi, 1999; Takai et al., 2006) and shallow scientific drilling expeditions and their post-drilling multidisciplinary research (e.g., Higashi et al., 2004; Kato et al., 2009). In addition, the deep-sea hydrothermal systems in the Izu-Ogasawara Arc are now known to have excellent potentials for the future exploration of seafloor hydrothermal mineral deposits (Marumo et al., 2008).

The macrofaunal communities in the Suiyo Seamount have been not so interested in as compared to the microbial communities and hydrothermal fluid and mineral chemistry (Kojima, 2002). In the early stage of research, several predominant chemosynthetic animals such as mussels and crabs were described (Miyazaki et al., 2004; Desbruyeres et al., 2006), while the detail distribution and genetic diversity of the macrofaunal populations were not reported. In 2007, the first individual of *Alviniconcha* sp. was found and recovered (Fujiwara et al., 2013; Johnson et al., 2015). The only individual was used for the taxonomy and characterization of symbionts. Then, it seemed likely that the emerging “lucky” individual was arrested and the Suiyo Seamount would remain without *Alviniconcha* sp. for certain period. However, in 2011, several tens of *Alviniconcha* individuals were photographed, and this result strongly suggested that the *Alviniconcha* populations were surely immigrated into the Suiyo Seamount. It is still uncertain how and where the *Alviniconcha* population was naturally immigrated from its host hydrothermal system(s).

The Suiyo Seamount population was the only *Alviniconcha* population found in Japanese EEZ so far. The present and past submarine hydrothermal systems in the Izu-Ogasawara Arc including the Suiyo Seamount are among the possible target places for the future exploration of submarine hydrothermal mineral resources. If the future exploration will be conducted in the Suiyo Seamount, the chemosynthetic macrofaunal populations, especially *Alviniconcha* population, will encounter the hard danger for the extinction. If the Suiyo Seamount *Alviniconcha* population can be artificially translocated and immigrated into the adjacent hydrothermal systems as it was immigrated from some hydrothermal systems in the western Pacific, it may escape from the extinction.

The challenges of artificial translocation and immigration have several approaches. One of the most plausible ways is use of eggs and infants, but it does not yet reach the in situ experiments and needs much more onshore and in situ preliminary investigations. Another possible way is the tentative translocation and relocation of adults.

In the last cruises (YK19-10 and YK21-04), we found the dense colonies of Suiyo Seamount *Alviniconcha* population and the physico-chemical conditions of the colony. In addition, we found that the Suiyo Seamount *Alviniconcha* individuals could survive through the 24 h translocation at the time of translocation under different physical and chemical conditions (between the original colony and the outer ridge seafloor) and could successfully re-colonize in the original habitats. The subsequent transcriptomic analyses of gill symbionts in the translocated (after 24h) and relocated individuals (after 19 months) indicated that the translocation and relocation affected the expression extent and pattern of enzymes related with energy metabolisms of symbionts. These observations and results strongly suggested that the Suiyo Seamount *Alviniconcha* holobiont could cope with environmental change of physical and chemical conditions during the translocation and relocation at the molecular level. Thus, it seems possible that the Suiyo Seamount *Alviniconcha* individuals can be translocated to the appropriate habitats of the hydrothermal fields near the Suiyo Seamount if needed in the future.

As the potential candidates of translocation and immigration for Suiyo Seamount *Alviniconcha* population, we can pick up several hydrothermal environments in the Izu-Bonin Arc. Higashi-Aogashima Knoll (Iizasa et al., 2018), Myojin Knoll (Iizasa, 1997), Kaikata Seamount (Naka et al., 1989) and even in the Off Hatsushima, Sagami Bay (Masuzawa et al., 1992), are the most plausible targets. Thus, in this cruise, we conducted the preliminary survey of hydrothermal activities and habitat mapping of chemosynthetic populations and physical and chemical properties of hydrothermal fluids and their habitats in the above mentioned hydrothermal fields of the Izu-Ogasawara Arc.

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III. EXPLANATORY NOTE

1. Manned Research Submersible “Shinkai 6500”

Mission of “Shinkai 6500”

“Shinkai 6500” is able to operate surveys and observations down to the depth 6500 meters with one scientist and two pilots. During the operation, “Shinkai 6500” finds her position by two ways; Long Base Line system (LBL) and Super Short Base Line system (SSBL). The LBL system needs three bottom-mounted transponders to be deployed in the survey area. “Shinkai 6500” locates her own position by herself in real time and the mother ship determines the position of “Shinkai 6500” based on the position of transponders. The SSBL system does not require any transponder but the accuracy of the position is inferior to LBL system and “Shinkai 6500” cannot determine her own position.

Specifications

Length:	9.5m
Width:	2.7m
Height:	3.2m
Weight in air:	25.8t
Maximum operation depth:	6500m
Complement:	3 (2 pilots and 1 researcher)
Inner radius of pressure vessel:	2.0m
Normal dive time:	8 hours
Life support duration:	129 hours
Payload:	150kg (weight in air)
Under water speed:	0-2.0 knots (Emergency: 2.5 knots)
Observation instruments:	Pan-tilt-zoom color video camera Fixed-view color video camera 35mm still camera CTD sensors Gamma ray spectrometer CTFM sonar Video-image transmission system
Operating devices:	2 manipulators 2 retractable baskets

2. Research Vessel “Yokosuka”

Mission of “Yokosuka”

- 1) Operate submersible “Shinkai 6500”
- 2) Operate underway-geophysical equipments;
 - Multi Narrow Beam Echo Sounder (Sea Beam 2112.04)
 - Gravity meter (Type S-63)
 - Ship-borne three-components magnetometer (Type SFG-1212)
 - Proton magnetometer (Typ STC10)

Research Facilities

In wet laboratory, a fumigation chamber, Milli-Q water purification system, -80°C and -20°C freezer, incubator and rock saw are equipped. In addition, “Yokosuka” has on-board video editing system for digital video image.

Specifications

Length:	105.22m
Breadth:	16.0m
Height:	7.3m
Draft:	4.5m
Gross tonnage:	4439t
Cruising speed:	about 16kts
Cruising range:	about 9000mile

IV. DIVE REPORTS

6K#1616 DIVE (Myojin Knoll)

6K#1617 DIVE (Higashi-Aogashima Knoll)

6K#1618 DIVE (Myojin Knoll)

6K#1619 DIVE (Off Hatsushima)

Dr. MIYAZAKI, J., and Ms. SAKAMOTO, M.

Dr. CHEN, C., and Mr. SHIMA, A.

Dr. WATANABE, H., and Ms. SUNAMI, S.

Dr. TAKAI, K., and Ms. TAKAHATA, K.

Dive Report: Shinaki6500#1616

Date: March 9, 2022

Site: Myojin knoll

Landing: 10:07; 32°6.2933'N, 140°52.0858'E, D=1318 m

Leaving: 14:45; 32°6.2331'N, 140°52.1487'E, D=1232 m

Observer: Junichi Miyazaki (JAMSTEC), Mana Sakamoto (JAMSTEC/Ehime Univ.)

Objectives:

The objectives of this dive were to sample chimney structures, hydrothermal fluids, sediments and animals.

Finding *Alviniconcha* was performed as an additional objective.

Dive summary:

10:07, we landed on the rocky seafloor in front of dead chimney with. The temperature of ambient seawater at the bottom was 3.9 °C. We started pump flow using standard solution (Red: H₂ and CH₄).

We headed to the Daimyojin chimney site. Keeping altitude at 30 m, we found chimney with 40 m height. We went down along the chimney and then we arrived at the first target. We tried to sample sediments using MBARI (Red), but we obtained only 5 cm core sample. Therefore, we moved 5m to south. In this point, we found shells of dead mussels. We tried to sample sediments using MBARI (Yellow), and we obtained 15 cm core sample. Next, we went back to the Daimyojin chimney.

We looked for the vent mostly erupting hydrothermal fluid, and we found that at middle of the Daimyojin chimney. We first tried to sample chimney structure and then we obtained chimney too large chimney structure to put into sample box (bout 1 m of chimney structure). The top of obtained chimney structure was broken during the set into sample box. After that we sample hydrothermal fluids from the vent. 271°C was recorded as a maximum temperature during the sampling fluids into No.1 bottle of WHATS-III sampler and 263°C was recorded as a maximum temperature during the sampling fluids into No.2 bottle. During the fluid sampling, we found *Paralvinella* invertebrates by watching No.2 Camera. Therefore, after finishing fluid sampling, we moved to the *Paralvinella* point and then measured DO. Finally, we sampled *Paralvinella* into No.1 chamber of multiple canister (however, after the dive, there were no animals in this chamber).

After operation at the Daimyojin chimney, we headed to northeast to go to animal colony site. On the way to the animal colony site, we found several white fringe-like structures. We approached one of them and found *Paralvinella* polychaetes on that. Therefore, we first measured DO by DO sensor. Then we sampled the structure and put it into *in situ* fixation box.

Next, we went up hill and we found large animal colony including barnacles and mussels. During this movement, we could not identify *Alviniconcha* snails. We landed in front of mussel colony then sampled mussels into No.2 and 3 chambers of multiple canister. Although all missions of this dive were complete, more than 30 min was remained until the left time. I challenged operation of manipulator. I tried to sample chimney structure and succeeded.

After the operation for leaving the bottom, we left the bottom at 14:45.

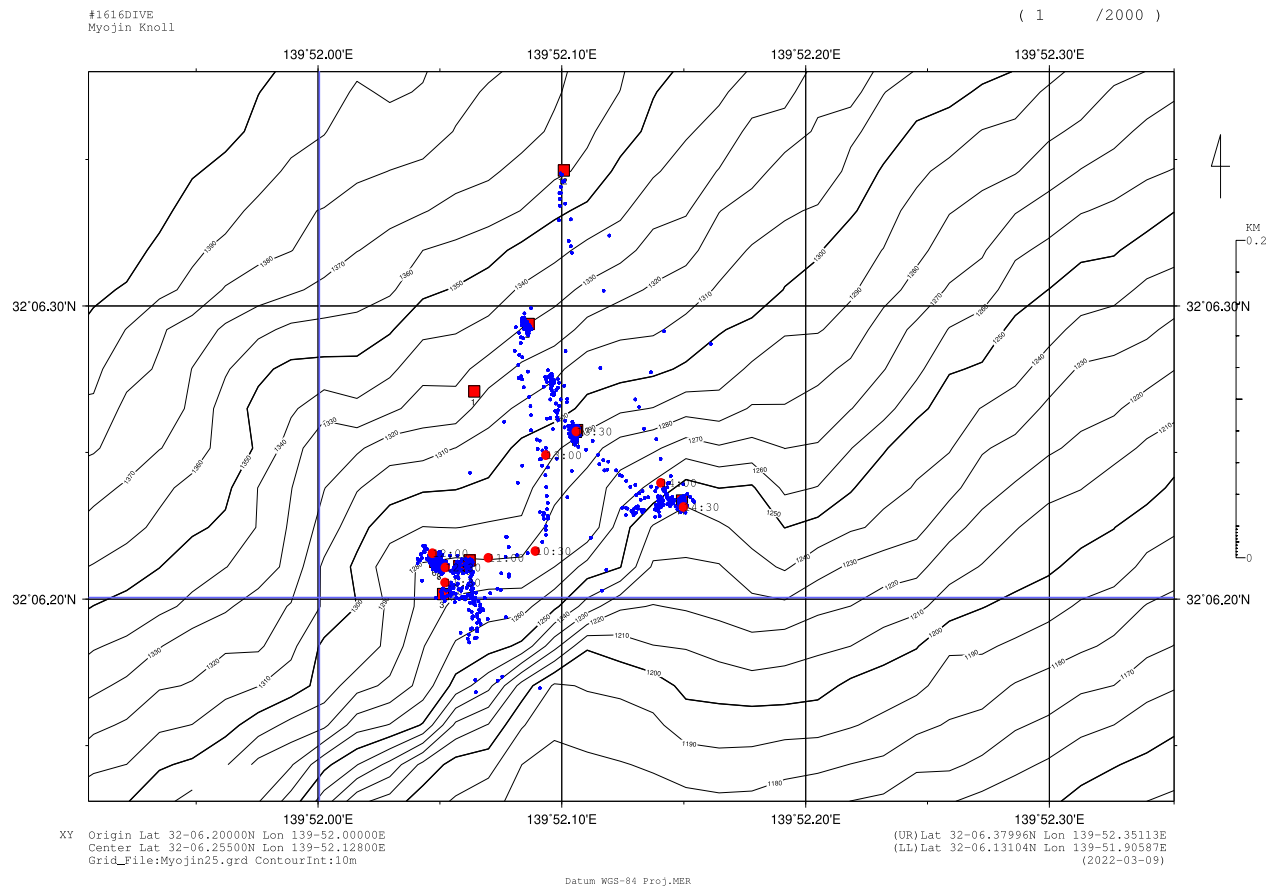
Payloads:

- WHATS-III
- Suction sampler with multiple canister
- DO meter
- Temperature sensor
- MJ water sampler
- H₂ and H₂S sensors {Multi sensor}
- METS sensor
- *In situ* fixation box filled with RNA later.
- Sample box (Black)
- 6k marker #244
- MBARI sampler [Red, Yellow]

Event list:

10:07	32°6.2933'N, 139°52.0858'E	D=1318	Landing
10:39	32°6.2012'N, 139°52.0508'E	D=1248	Finding "Daimyojin chimney".
10:53	32°6.2106'N, 139°52.0574'E	D=1269	MBARI (Red) sampling
11:02	32°6.2126'N, 139°52.0616'E	D=1271	MBARI (Yellow) sampling
12:20	32°6.2122'N, 139°52.0476'E	D=1247	Sampling chimney structure Sampling fluids [W1 & W2]
12:38	32°6.2110'N, 139°52.0498'E	D=1248	Measuring DO
12:44	32°6.2108'N, 139°52.0496'E	D=1248	Sampling polychaetes
13:37	32°6.2571'N, 139°52.1057'E	D=1279	Measuring DO & Sampling Rock
14:34	32°6.2331'N, 139°52.1487'E	D=1232	Sampling mussels and chimney structure
14:45	32°6.3456'N, 139°52.1003'E	D=1195	Left Bottom

Dive track of 6K#1616



Dive Report: Shinkai6500 #1617

Date: March 12, 2022

Site: Central Cone site, Higashi-Aogashima, Izu-Ogasawara Arc

On bottom: 09:47; 32°26.2533'N, 139°54.0042'E, D=800 m

Leave bottom: 14:48; 32°26.2395'N, 139°53.9497'E, D=785 m

Observer: Chong Chen (JAMSTEC)

Objectives:

The objective of *Shinkai 6500* Dive #1617 was to explore the chemosynthetic ecosystem of the Central Cone site, Higashi-Aogashima vent field and to reveal the zoological and microbial community composition as well as fluid chemistry. We aimed to collect 1) Vent animals, 2) Animal colony water with *in situ* data from dissolved oxygen, H₂, H₂S, and methane sensors, 3) Vent chimney, and 4) Hydrothermal vent fluid.

Dive summary:

During *Shinkai 6500*'s descent to the seafloor, the sensor-side peristaltic pump was started at low speed and measurements of METS methane sensor as well as full depth temperature probe were started. Measurement of the UNISENS multi-sensor was already started before *Shinkai 6500*'s deployment. Communication with the WHATS-III system was checked and confirmed.

DSV *Shinkai 6500* landed on the seafloor at 800 m (09:47) deep southeast of the Central Cone active venting site, where the substrate was sand and rubble. We immediately headed towards the base of the main chimney ('Ao-Oni Chimney'). During that time, we saw many animals typical of normal seafloor such as sea urchins, squat lobsters, and *Fulgoraria* volute snails, in addition to frequent fishes. We attempted to locate an animal colony dominated by *Neoverruca* barnacles and sponges previously visited by ROV *Hyper-Dolphin* in 2021, but had some trouble finding it. We decided to go around the chimney clockwise to find it, but soon (10:21) we found a cluster of small chimneys (~5 m tall) previously visited also by ROV *Hyper-Dolphin*. From the location of this chimney, we were able to estimate the relative location of the animal colony, and we travelled around the chimney in a clockwise fashion until we reached it (10:41).

At the animal colony, we first collected *Neoverruca* barnacles on sulfide crusts using the manipulator into the biobox (10:58). Then we moved to a fresh *Neoverruca* colony where we carried out sensor measurements and collected colony water of *Neoverruca* into Miyajun-type 8 tube sampler (Green) (11:35). Then, we collected additional *Neoverruca* individuals living on sulfide crusts and also a piece of crust covered by sponges. Next, we sampled meiofauna into the first chamber of the suction sampler's rotary sampler lined with 31 µm plankton, and continued to sample glass sponges, scale worms, and other macrofauna into the second and third chambers

lined with 1 mm mesh (11:59). After that, we left the animal colony to head to the top of the Ao-Oni Chimney in order to sample vent fluid and vent chimney.

We reached the top of the Ao-Oni Chimney around 12:30, and we managed to stabilise next to the tip at the approximate altitude of 42 m. There, we collected some chimney pieces (12:36), and we broke off the tip of the Ao-Oni Chimney in order to reveal fluid pathway for fluid sampling. However, the pathways revealed were narrow and only yielded a maximum temperature of 200°C. We decided to look for another area to sample vent fluid, and soon located a large orifice (about 10 cm in diameter). We managed to successfully collect hot fluid into two WHATS-III bottles (highest temperature = 262°C for bottle 1 (13:19) and 245°C for bottle 2 (13:27)). Then, we left the top of Ao-Oni Chimney to look for *Paralvinella* colony.

We could not find large *Paralvinella* colony, and only found a small chimney with about 10 individuals near the base of Ao-Oni Chimney. We collected the *Paralvinella* into chamber number 4 of the rotary sampler (13:54). Then, we attempted to collect more chimney pieces from this small chimney, and successfully collected one piece (14:13). Then, we spent about 20 minutes to look for larger *Paralvinella* colony but could not locate one. As such, we steamed away from Ao-Oni Chimney at 14:30 and left the bottom at 14:48.

Payloads:

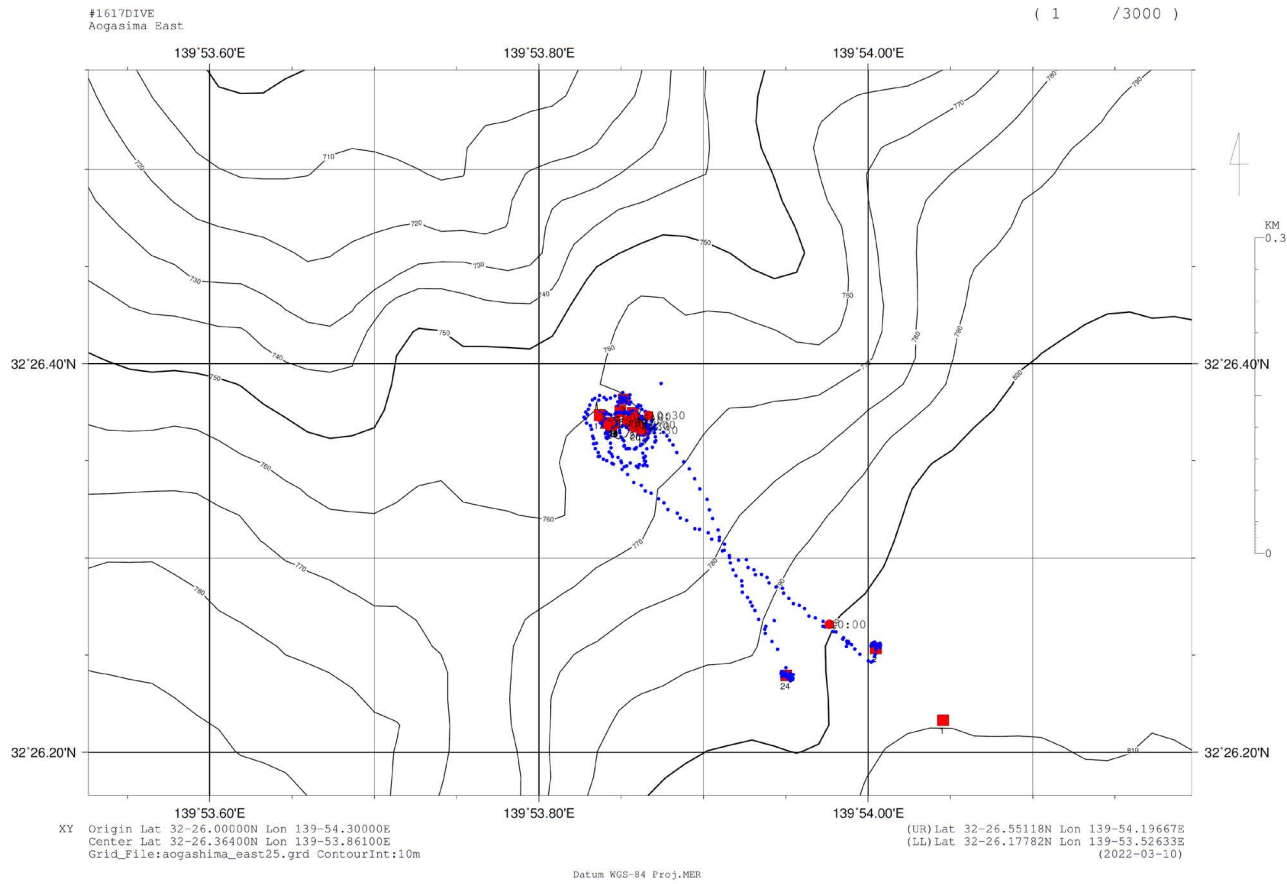
- Suction sampler
- Multi-rotary chambers for suction sampler
- *In situ* fixation box (Large) used as a biobox
- Chimney box
- Full depth temperature probe
- MiyaJun-type 8 tubes water sampler x 2 (Green, Red)
- WHATS-III
- METS methane sensor
- UNISENS multi-sensor (H₂ x 2, H₂S x 2)
- Peristaltic pump x 2 (for WHATS-III and for sensor line)

Event list:

Time	Lat	Long	Depth (m)	Event
0947	32-26.2533N	139-54.0042E	800	Landing
1021	32-26.3813N	139-53.8511E	756	Finding Chimney
1041	32-26.3693N	139-53.8409E	754	Finding Chimney
1058	32-26.3686N	139-53.8434E	755	Sampling Rocks(2)
1108	32-26.3695N	139-53.8411E	754	Mesurement DO(1)
1116	32-26.3692N	139-53.8439E	754	Retry mesurement DO(1)

1118	32-26.3691N	139-53.8451E	754	Mesurement DO(2)
1120	32-26.3691N	139-53.8451E	754	Mesurement DO(3)
1123	32-26.3691N	139-53.8451E	754	Mesurement Sensor(1)
1126	32-26.3691N	139-53.8451E	754	Mesurement Sensor(2)
1130	32-26.3691N	139-53.8451E	754	Mesurement Sensor(3)
1135	32-26.3691N	139-53.8451E	754	Sampling Water(MJ Green)
1138	32-26.3691N	139-53.8451E	754	Sampling Barnacle,Sponge
1143	32-26.3691N	139-53.8451E	754	Samping meiofauna(canister1)
1146	32-26.3691N	139-53.8451E	754	Sampling animals(canister2)
1159	32-26.3732N	139-53.8365E	754	Sampling animals(canister3)
1207	32-26.3753N	139-53.8489E	744	Sampling animal
1236	32-26.3657N	139-53.8628E	716	Sampling Chimney
1319	32-26.3679N	139-53.8588E	716	Sampling WHATS-1(262°C)
1327	32-26.3684N	139-53.8581E	716	Sampling WHATS-2(245°C)
1354	32-26.3741N	139-53.8564E	747	Sampling <i>Paralvinella</i> (canister4)
1413	32-26.3741N	139-53.8564E	747	Sampling Chimney
1448	32-26.2395N	139-53.9497E	785	Left bottom

Dive Track of Shinkai6500 #1617



Dive Report: Shinaki6500#1618

Date: March 13, 2022

Site: Myojin knoll

Landing: 11:00; 32°6.2708'N, 139°52.0661'E, D=1311 m

Leaving: 15:40; 32°6.3002'N, 139°52.0458'E, D=1188 m

Observers: Hiromi Watanabe (JAMSTEC), Sako Sunami (JAMSTEC/Tohoku Univ.)

Objectives:

The objectives of *Shinkai6500* Dive # 1618 was to 1) locate “Gachinko Ep#3 (Sanki)” marker to Dai-Myojin chimney and 2) characterize faunal communities and their biogeochemical parameters in hydrothermal vent field in Myojin Knoll.

Dive summary:

During the descent to the seafloor, peristaltic pumps, thermometer and METS sensor were started. At 11:00, we landed on the rocky seafloor surrounded by dead chimneys that were attached by soft corals and sea anemones and headed to Dai-Myojin big chimney.

At the Dai-Myojin chimney, *Shinkai6500* was settled at about a few meters below its top, and “Gachinko Ep#3 (Sanki)” quadrat marker with signatures and messages of 3rd generation of Gachinko fighters was located on a dead part of the chimney which covered with *Neoverruca* barnacles (11:39, D = 1244 m). We could find a few *Bathymodiulus* mussels, *Munidopsis* squat lobsters and an asteroid on the chimney. We tried to find out high-temperature chimney with black color, and finally we settled near the location where the chimney and water was collected in the #1616 dive (12:22, D = 1248 m). The chimneys were too fragile to be collected by *Shinkai6500*'s manipulator, and only a small piece of the chimney was collected into the box. The temperature of the fluid emitted from the vent which hosted the collected chimney was about 270 °C and the water was collected by pumping middle speed into WHATS water sampler bottles#1 and 2 (12:40, D = 1249 m). We headed north-east and landed on a quiet bottom covered with sediment below a colony site where many faunal assemblages were previously discovered.

At 13:49, we found a colony of *Paralvinella* polychaetes, *Bathymodiulus* mussels, *Neoverruca* barnacles, and *Gandalfus* crabs. The colony might not enough to characterize the animal habitats, however, we attempted to collect animals and waters at this colony. DO and temperature on *Bathymodiulus* (13:41 – 13:45) and *Neoverruca* (13:46 – 13:49) colonies was measured after pre-adaptation of the sensor to the environment (13:38 – 13:40). The multisensor measurement (13:53 – 14:02) was carried out after setting of the flow line of the water sampling system to flow the water slowly to multisensor and METS sensor. The temperature of *Bathymodiulus* and *Neoverruca* were both 4.4°C, which was comparable to the

ambient water. The temperature on *Paralvinella* was a bit higher (7.3 °C), and the water above the small colony was collected into MJ water sampler (Green) after multisensor measurement (14:28 – 14:40). *Paralvinella* colony was collected with its basal rock into *in situ* fixation box (14:53). We attempted to collect one more rocks with *Paralvinella* colony, however, the pieces of the rocks were dropped out. *Neoverruca* (canister#1 and 2) and *Paralvinella* (canister#3 - 5) were collected by suction sampler (15:30). *Shinkai6500* left the bottom at 15:40, and peristaltic pumps, thermometer and METS sensor were turned off during the ascending.

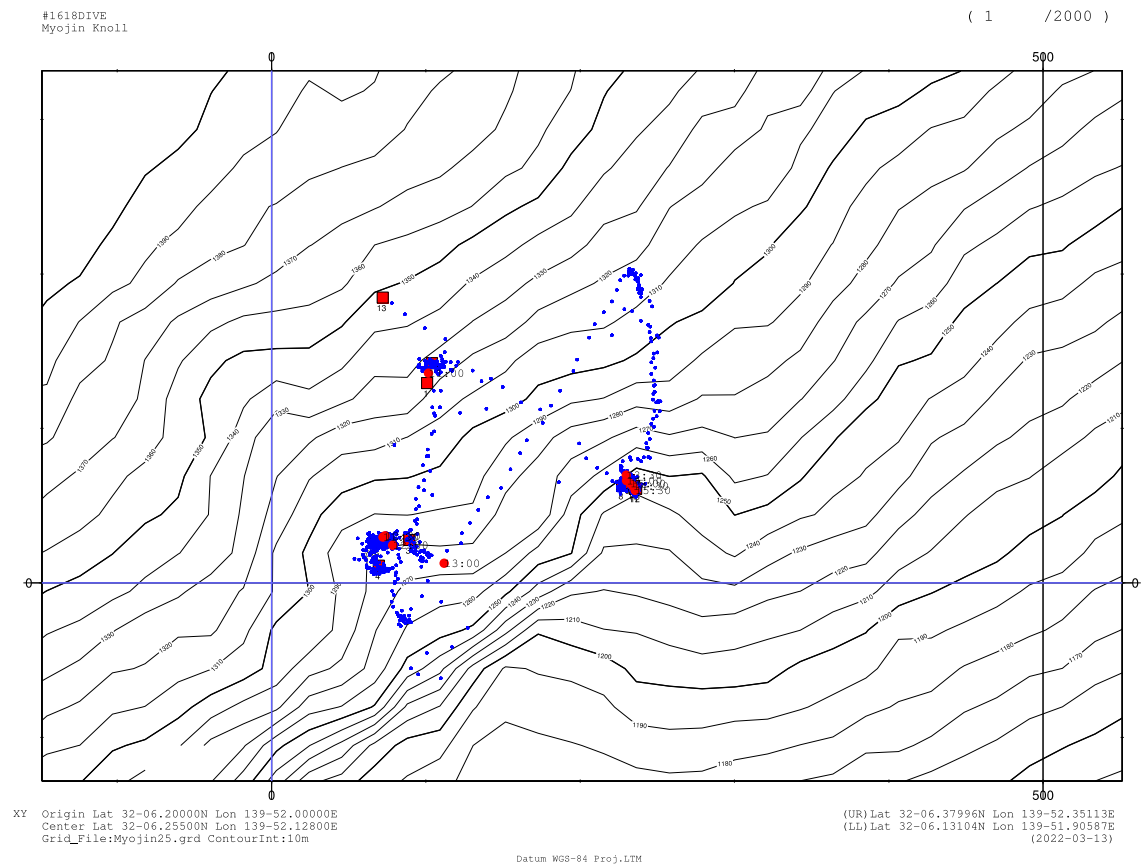
Payloads:

- WHATS-III
- Suction sampler with multiple canister
- DO meter
- Temperature sensor
- MJ water sampler (Green and Red)
- H₂ and H₂S sensors {Multi sensor}
- METS sensor
- *In situ* fixation box filled with RNA later.
- Sample box (Black)
- Gachinko Ep#3 (Sanki) quadrat marker

Event list:

11:00	32°6.2776'N, 139°52.0661'E	D=1311	Landing
11:16	32°6.2156'N, 139°52.0568'E	D=1244	Finding "Dai-Myojin chimney".
11:39	32°6.2062'N, 139°52.0442'E	D=1244	Set "Gachinko Ep#3 (Sanki)" marker
12:22	32°6.2148'N, 139°52.0439'E	D=1248	Sampling chimney
12:36	32°6.2145'N, 139°52.0428'E	D=1236	Sampling fluid (WHATS#1)
12:40	32°6.2144'N, 139°52.0432'E	D=1249	Sampling fluid (WHTS#2)
13:49	32°6.2340'N, 139°52.1445'E	D=1236	Measuring DO
14:18	32°6.2367'N, 139°52.1472'E	D=1235	Multisensor measurement, sampling barnacles (canister#1 and 2)
14:53	32°6.2346'N, 139°52.1495'E	D=1233	Multisensor and DO measurement, sampling fluid (Green)
15:17	32°6.2336'N, 139°52.1498'E	D=1233	Sampling <i>Paralvinella</i> (canister#3 and 4)
15:30	32°6.2331'N, 139°52.1503'E	D=1229	Sampling <i>Paralvinella</i> (canister#5)
15:40	32°6.3002'N, 139°52.0458'E	D=1188	Left the bottom

Dive track of 6K#1618



Dive Report: Shinaki6500#1619

Date: March 19, 2021

Site: Off Hatsushima field, Sagami Bay

Landing: 9:54; 35°0.8899N, 139°13.4539E, D=999 m

Leaving: 12:14; 32° 35°0.9108N, 139°13.4739E, D= 965 m

Observer: Ken Takai (JAMSTEC) and Kaho Takahata

Objectives:

The objectives of this dive are sampling various chemosynthetic animals and measurement of their colony waters.

Dive summary:

We landed at slope at a depth of 999m at a distance of 50 m southeast from mussels' colonies. It was very steep slope and a number of northwest-southeast-direction gaps were found. After we moved several tens meter northwest to the mussels' colony, we found outcrops along the gaps. The top several tens centimeter of the outcrop was filled with dead shells including mussels and clams, which suggested the relative long-time and large scale colonization continued around this area.

Finally, we arrived at a mussels' colony and the colony was inhabited not only by mussels but also by many other macrofaunas such as tube worms, clams and others. In addition, we could find apparent partition of colony with different animals. First, we measured the dissolved oxygen (DO) concentration, temperature and H₂ and H₂S concentrations of a clam colony and then, of a *Alaysia* and *Lamellibrachia* colony. The temperature of tube worm colony was 0.1 °C higher than the ambient seawater (3.1 °C) and a H₂S sensor had a certain reaction. Many individuals of *Alaysia* and *Lamellibrachia* were corrected in the sample box. Then, we moved about 1 m forward to the *Bathymodiollus* colonies and measured the temperature and H₂ and H₂S concentrations. In the *Bathymodiollus* colonies, the colony water was sampled with MJ sampler. Next we sampled the colony water by suction sampler (Box 1) with a relatively slow flow rate and sampled the mussels' individuals by suction sampler (Box 2&3) with a maximum flow rate.

At that time, we knew that we had not enough time to continue our dive. Thus we returned to the *Alaysia* and *Lamellibrachia* colony and sampled many of the individuals in the RNALater fixation box and also sampled several individuals of clam in the normal sample box. It was actually the last operation of our dive.

Payloads:

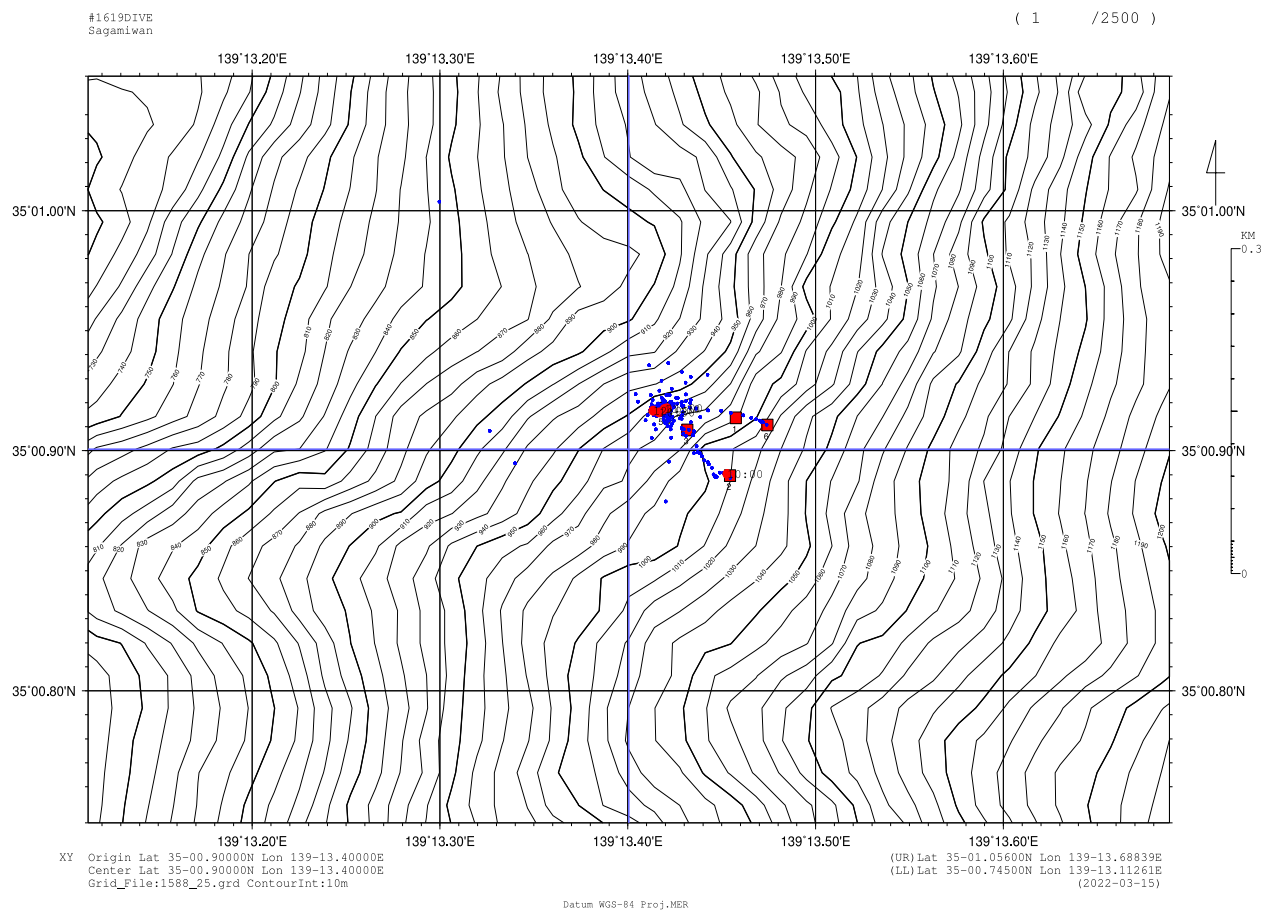
- Suction sampler with multi-chamber
- Sample box
- *In situ* fixation box (containing 12L of RNALater)

- Scoop
- Temperature probe
- MiyaJun-type 8 tubes water sampler
- METS methane sensor
- UNISENS multi-sensor
- Peristaltic pump x 2 (for WHATS-III and for sensor line)
- MBARI push core x 2
- WHATS-III

Event list:

0955	35°0.8899N, 139°13.4539E	999m	Landed bottom
1008	35°0.9087N, 139°13.4312E	959m	Found dead mussels and clams shells
1138	35°0.9174N, 139-13.4195E	955m	Found mussels' tubeworms' clams' and others' colonies. Many operations here
1205	35°0.9163N, 139-13.4178E	956m	Sampled clam individuals (Final operation)
1214	35°0.9108N, 139-13.4739E	965m	Left bottom

Dive track of 6K#1619



Notice on Using

This cruise report is a preliminary documentation as of the end of cruise.

This report is not necessarily corrected even if there is any inaccurate description (i.e. taxonomic classifications).

This report is subject to be revised without notice. Some data on this report may be raw or unprocessed. If you are going to use or refer the data on this report, it is recommended to ask the Chief Scientist for latest status.

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

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