doi : 10.17596/0002992

Hyper-Dolphin/Natsushima

Cruise Report

NT 13-05

Izu Islands Area and Sagami BayMarch

14 –21, 2013

Contents

Participants

Research group

Shinji Tsuchida Japan Agency for Marine-Earth Science and Technology

Shuichi Shigeno Japan Agency for Marine-Earth Science and Technology

Hiroshi Miyake Kitasato University

Tomoyuki Komai Natural History Museum and Institute, Chiba

Jimin Lee KIOST

Kentaro Amemiya Tokyo Sea Life Park

Toshiyuki Yamaguchi Kanagawa University

Koji Inoue The University of Tokyo

Toshihiro Nagasaki The University of Tokyo

Tomoko Koito College of Biosciences and Resources, Nihon University

Kazuki Tsuzawa College of Biosciences and Resources, Nihon University

Suguru Nemoto Enoshima marine corporation

Akira Usui Dept. Geology, Kochi University

Kei Okamura Kochi Core Center, Kochi University

Hikari Hino Dept. Geology, Kochi University

Shota Nitahara Tokyo University of Pharmacy and Life Science

Shusuke Machida Nippon Marine Enterprise

2-2.Operation team of the Hyper Dolphin

Operation Manager	Homare Wakamatsu
2nd Submersible staff	Katsushi Chiba
2nd Submersible staff	Yosuke Chida
2nd Submersible staff	Teppei Kido
2nd Submersible staff	Atsushi Takenouchi
2nd Submersible staff	Ryo Saigo
3rd Submersible staff	Daichi Urata

2-3.Captain and crew of the R/V NATSUSHIMA

Captain	Eiko Ukekura

Chief Officer	Akihisa Tsuji
2nd Officer	Isao Maeda
3rd Officer	Hiroharu Omae
Chief Engineer	Hiroyuki Shibata
1st Engineer	Kmio Matsukawa
2nd Engineer	Morihiko Murakami
3rd Engineer	Naoomi Uemura
Chief Radio officer	Masamoto Takahashi
2nd Electronic Operator	Hiroki Ishiwata
3rd Electronic Operator	Tastuhiro Takakuwa
Boat Swain	Yasuyoshi Kyuki
Able Seaman	Yoshitsugu Fujii
Able Seaman	Kazumi Ogasawara
Able Seaman	Takumi Yoshida
Able Seaman	Nao Isjizuka
Sailor	Hideo Ito
Sailor	Ogawa Yoshihiro
No.1 Oiler	Junji Mori
Oiler	Tatsuomi Chino
Oiler	Masaki Tanaka
Oiler	Kota Aizawa
Oiler	Keiya Taniguchi
Chief Steward	Sueto Sakaki
Steward	Tatsunari Onoue
Steward	Yukihide Chikuba
Steward	Akihide Saito
Steward	Mizuki Nakano

Cruise Summary

1. Cruise Information

● Cruise ID: NT13-05

● Name of vessel: R/V Natsushima

● Title of the cruise: NT13-05 Research cruise of biodiversity, symbiosis, and iron/manganese oxide at hydrothermal vent sites in Izu-Bonin Arcs using ROV Hyper-dolphin 3000

● Chief scientist [Affiliation]: Shinji Tsuchida [JAMSTEC]

● Representative of the Science Party [Affiliation]: Shinji Tsuchida [JAMSTEC]

○ Title of proposal: Studies on biodiversity and early life history of vent associated animals in Izu, Bonin and Mariana Arcs.

● Representative of the Science Party [Affiliation]: Koji Inoue [Atmosphere and Ocean Research Institute, The University of Tokyo]

○ Title of proposal: Studies on the role of thiotaurine in symbiosis.

● Representative of the Science Party [Affiliation]: Akira Usui [Dept. Geology, Kochi University]

○ Title of proposal: Processes and Environments of Low-temperature Hydrothermal Iron and Manganese Deposits

● Cruise period: Mar 14-21 2013

● Ports of call: JAMSTEC

● Research area: Izu Islands Area and Sagami Bay

2. Overview of the Observation

● Overview of the observation

This cruise includes above three proposals explored the Sagami Bay for three dives, and Omurodashi for three dives, Myojin, and Bayonnaise Knolls for each one dive. Overviews of each proposals are described respectively.

"Studies on biodiversity and early life history of vent associated animals in Izu, Bonin and Mariana Arcs"

Shinji Tsuchida, Shuichi Shigeno (JAMSTEC), Tomoyuki Komai (Natural History Museum and Institute, Chiba), Hiroshi Miyake (Kitasato University), Kentaro Amemiya (Tokyo Sea Life Park), Jimin Lee (KIOST), and Toshiyuki Yamaguchi (Kanagawa University)

In the previous studies, vent associated communities were known from more than thirteen vent fields in Izu, Bonin to Mariana Arcs ranged from 350 to 1600m depths. In this cruise, a new vent associated community was found from the caldera of Omurodashi in 200m depth. This extended the known geological and vertical distribution of vent community in the Izu, Bonin and Mariana Arcs further 250km in north and the 150m in shallow. The faunal data set would be crucial to understand the biogeological distribution patterns and biodiversity.

In this exploration, three dives of Hyper-Dolphin were carried out along with the track lines of the HD#1408 & 1409, which found the active vent sites in this caldera at the first time. During the dives, we observed simmering and active venting (111°C at the highest) from the aperture on the gravel bottom in the northwest and central area of the caldera (Fig.1). Around the vents, limpets with the black shell and xenograpsid crabs inhabited on the gravel bottom. We, also, collected a small patch of tubeworms, palaemonid shrimp, small lancelets, small mussels, and so on. We will analyze the community structure comparing with other vent fauna in the Izu, Bonin, and Mariana Arcs. Ecological traits such as early life history, growth, reproduction, etc. on the xenograpsid crabs will be studied.

“Studies on the role of thiotaurine in symbiosis”

Koji Inoue, Toshihiro Nagasaki (Atmosphere and Ocean Research Institute, The University of Tokyo), Yuya Makiguchi, Kazuki Tsuzawa, Tomoko Koito (College of Biosciences and Resources, Nihon University), and Suguru Nemoto (Enoshima marine corporation)

It has been suggested that *Bathymodiolin* mussels store sulfides as thiotaurine, a safe substance generated by the reaction of hypotaurine and sulfides. It is also presumed that sulfides released from thiotaurine by the reverse reaction are supplied to symbionts. However, this hypothesis has not been proved experimentally.

In this study, we examine whether thiotaurine can in fact be the source of sulfide for the chemosynthesis of the symbiont by injecting it into the mussels and comparing the amount of symbiotic bacteria with the control group. In addition, we try to identify the hypotaurine synthesis pathway by injecting possible

precursors such as cysteine to the mussels. Moreover, we try to test the reaction of the heart movement when the mussels are exposed to sulfide by electrocardiography (ECG).

In this cruise, we sampled the mussel *Bathymodiolus septemdierum* at Myojin Knoll in Izu-Bonin Area. Using the mussels, we tried to establish the method of injection into the mussels, and injected thiotaurine into some mussels during the cruise (Fig. 2). We will repeat the injection several times after the cruise and compare the amount of the symbionts by quantitative real-time PCR. We also collected mussels from three different colonies, where we also measured sulfide level and temperature using sensors. We dissected the mussels immediately after the dive. We will examine the correlation between environmental factors and the expression level of genes involved in hypotaurine accumulation. Moreover, some live mussels will be reared in The University of Tokyo (UT), and Enoshima Aquarium and used for the examination of hypotaurine synthesis pathway in UT, ECG measurement in Nihon University, and some other experiments.

"Processes and Environments of Low-temperature Hydrothermal Iron and Manganese Deposits"

Akira Usui, Kei Okamura (Kochi University), Shota Nitahara (Tokyo University of Pharmacy and Life Science), Hikari Hino (Kochi University)

We dove with the Hyper-Dolphin 3K installed with multi-chemical sensors, continuous water sampler, and on-site thermometer at a small peak of the Myojin Knoll, where possible low-temperature hydrothermal mineralization has been inferred and the two small traps were settled on the sea floor in 2001 for a long-year exposure experiment at a low-temperature hydrothermal vent area. This dive #HPD1494 was a very lucky and memorable moment when we finally found and retrieved the long-lived traps after only one-hour search at the site after 12-year exposure (Fig. 3).

The sampled rocks and manganese oxide deposits suggest a probable modern hydrothermal activity which forms wide-spread deposition of manganese oxides around the area.

We will analyze the recovered rocks, sediments, sea water, and the measured physicochemical parameters during the dive. The Fe-Mn deposits will be mineralogically and geochemically described, the waters be analyzed for chemical components, and one-site physicochemical data will be analyzed in terms of modern hydrothermal activity. The sediments and sea waters will be studied with molecular biology techniques (ex. DNA analysis) and microstructure of microbial activity. We inoculated the samples into media for ammonia oxidizing bacteria and Mn oxidizing bacteria. Our goal is to chracterize

the microbial community on hydrothermal and hydrogenetic manganese deposits. We will have to revisit the area with ROV or subs to conclude the possible modern hydrothermal activity.

Shipboard log

日付 Date	時間 Local Time	内容 Note	本船位置／気象／海象 Position/Weather/Wind/Sea condition
14-Mar-13		**Sail out, proceeding to research area, HPD#1490@Off-Hatsushima**	03/14 12:00 (UTC+9h)
	08:00	Let go all shore lines & left YOKOSUKA for research area(SAGAMI・WAN)	35-01.1N 139-13.6E
	08:30-09:00	Briefing with HPD Team.	SAGAMI WAN
	09:00-09:30	Carried out shipboard education & training for scientists.	Cloudy
	11:20	Arrived at dive point.	NE-4(Moderate breeze)
	11:25	XBT Rereased XBT at <35-01.2516N, 139-15.8674E>	3(Slight)
	12:28	Hoisted up H.P.D.	1(Low swell sea)
	12:33	H.P.D Launched.	Visibly:7'
	12:44	H.P.D dove and started her operation #1490.	
	13:20	H.P.D landed on the sea bottom (D=940m).	
	16:57	H.P.D left the sea bottom (D=904m).	
	16:57	H.P.D floated.	
	17:13	Recovered H.P.D and finished her operation.	
	19:00-19:30	Scientific meeting.	
15-Mar-13		**HPD#1491, HPD#1492@Omuro-Dashi**	03/15 12:00 (UTC+9h)
	05:30	Arrived at research area(Omuro-Dashi)	38-32.9N 139-26.5E
	06:00	Released XBT at <34-38.4367N, 139-31.1457E>	Omuro-Dashi

	08:08	Hoisted up H.P.D.	Fine but cloudy
	08:13	H.P.D Launched.	NE-3(Gentle breeze)
	08:24	H.P.D dove and started her operation #1491.	3(Slight)
	08:35	H.P.D landed on the sea bottom (D=133m).	1(Low swell sea)
	10:17	H.P.D left the sea bottom (D=148m).	Visibly:8'
	10:38	H.P.D floated.	
	10:55	Recovered H.P.D and finished her operation.	
	12:55	Hoisted up H.P.D.	
	12:59	H.P.D Launched.	
	13:13	H.P.D dove and started her operation #1492.	
	13:29	H.P.D landed on the sea bottom (D=195m).	
	17:02	H.P.D left the sea bottom (D=148m).	
	17:18	H.P.D floated.	
	17:35	Recovered H.P.D and finished her operation.	
	18:00-18:30	Scientific meeting.	
16-Mar-13		**HPD#1493@Myoujin-Shou**	03/16 12:00 (UTC+9h)
	08:30	Arrived at research area(Myoujin-Shou)	32-06.3N 139-52.1E
	08:45	Released XBT at <32-06.8156N, 139-51.7644E>	Myoujin-Shou
	09:08	Hoisted up H.P.D.	Fine but cloudy
	09:13	H.P.D Launched.	NW-5(Fresh breeze)
	09:27	H.P.D dove and started her operation #1493.	4(Moderate)
	10:28	H.P.D landed on the sea bottom (D=1340m).	1(Low swell sea)

	16:05	H.P.D left the sea bottom (D=1224m).	Visibly:8'
	16:40	H.P.D floated.	
	16:57	Recovered H.P.D and finished her operation.	
	17:10	Left above area for Beyonese Knoll.	
	18:00-18:30	Scientific meeting.	
	18:19-18:43	Carried out MBES mapping survey.	
	18:47	Released XBT	
	19:04-19:57	Carried out MBES mapping survey.	
17-Mar-13		**HPD#1494@Beyonese Knoll**	03/17 12:00 (UTC+9h)
	08:11	Hoisted up H.P.D.	31-58.9N 139-40.2E
	08:15	H.P.D Launched.	off South of Aogashima
	08:27	H.P.D dove and started her operation #1494.	Fine but cloudy
	09:14	H.P.D landed on the sea bottom (D=1108m).	North-2(Light breeze)
	16:10	H.P.D left the sea bottom (D=918m).	2(Smooth)
	16:36	H.P.D floated.	1(Low swell sea)
	16:51	Recovered H.P.D and finished her operation.	Visibly:8'
	17:00	Left above area for SAGAMI WAN.	
	18:00-18:30	Scientific meeting.	
18-Mar-13		**HPD#1495@Off-Hatsushima**	03/18 12:00 (UTC+9h)
	09:45	Arrived at research area(SASGAMI WAN)	35-06.4N 139-12.8E
	09:56	Rereased XBT at <35-06.6078N, 139-13.2110E>	SAGAMI WAN
	10:15	Hoisted up H.P.D.	Overcast
	10:19	H.P.D Launched.	SW-5(Fresh breeze)
	10:32	H.P.D dove and started her operation #1495.	3(Slight)

	11:12	H.P.D landed on the sea bottom (D=850m).	1(Low swell sea)
	13:05	H.P.D left the sea bottom (D=832m).	Visibly:5'
	13:32	H.P.D floated.	
	13:53	Recovered H.P.D and finished her operation.	
	14:10	Com'ced proceeding to ITO&ATAMI OKI.	
	15:45	Com'ced drifting.	
	19:21	Com'ced shifting to SSW-ward.	
	22:30	Finished shifting.	
19-Mar-13		**HPD#1496@Off-Hatsushima**	03/19 12:00 (UTC+9h)
	06:00	Arrived at dive point.	35-04.1N 139-12.7E
	08:08	Hoisted up H.P.D.	SAGAMI WAN
	08:25	H.P.D Launched.	Fine but cloudy
	08:25	H.P.D dove and started her operation #1496.	NE-1(Light air)
	09:08	H.P.D landed on the sea bottom (D=1070m).	2(Smooth)
	16:02	H.P.D left the sea bottom (D=618m).	1(Low swell sea)
	16:23	H.P.D floated.	Visibly:8'
	16:38	Recovered H.P.D and finished her operation.	
	18:00	Scientific meeting.	
	18:15	Com'ced drifting here.	
	20:00-20:30	Shifted to South-ward.	
	22:30-23:45	Shifted to NE-ward.	
20-Mar-13		**HPD#1497@Omuro-Dashi**	03/20 12:00 (UTC+9h)
	03:00	Com'ced proceeding to #1497 dive point.	34-32.7N 139-26.7E
	06:00	Arrived at Omuro-Dashi #1497 dive point.	off south of Izu-Oshima

	06:37	Hoisted up H.P.D.	Overcast
	06:41	H.P.D Launched.	SSE-3(Gentle breeze)
	06:52	H.P.D dove and started her operation #1497.	2(Smooth)
	07:03	H.P.D landed on the sea bottom (D=185m).	1(Low swell sea)
	13:01	H.P.D left the sea bottom (D=197m).	Visibly:6'
	13:16	H.P.D floated.	
	13:33	Recovered H.P.D and finished her operation.	
	13:50	Left research area for off Kurihama.	
	18:00	Scientific meeting.	
	17:30	Com'ced drifting.	
21-Mar-13		**Scientists disembarked at YOKOSUKA, Completed NT13-05**	
	08:00	Com'ced proceeding to YOKOSUKA.	
	09:00	Arrived at YOKOSUKA. Then completed NT13-05.	

Dive Reports

Dive Report HD#1490

Date: March 14, 2013

Site: Off Hatsushima, Sagami Bay **Depth:** 900-935m

Landing (Lat., Long., Time, Depth): 35°00.961'N, 139°13.428'E, 08:33, 900m

Leaving (Lat., Long., Time, Depth): 35°00.942'N, 139°13.387'E, 10:17, 904m

Operation Manager: Homare Wakamatsu, **Pilot:** Atsushi Takenouchi & Yosuke Chida

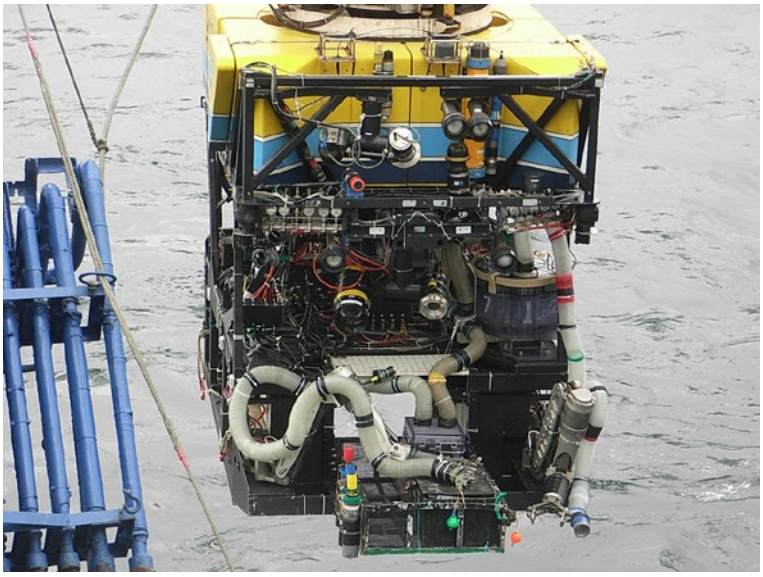
Theme: Studies on the role of thiotaurine in symbiosis

Purpose:

1. Sampling of deep-sea mussels.
2. Sampling of animals in methane seeps.
3. Sampling sediment to know the meio-fauna.

Payload Equipment:

Slurp gun, single canister, seven bottle canister, sample boxes (large & small), Niskin water sampler (x2), MBARI corer (x3), scoop sampler



Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Core sampling	13:36	935	Sediment	35°00.921'N/139°13.400'E
Animal sampling	14:22	902	Munnopsids and tubeworm	35°00.938'N/139°13.381'E
Animal sampling	15:23	904	Vesicomyid clam	35°00.945'N/139°13.389'E
Core sampling	15:54	857	Sediment	35°00.960'N/139°13.335'E
Core sampling	15:54	857	Sediment	35°00.960'N/139°13.335'E
Animal sampling	16:27	904	Bathymodiolin mussels	35°00.942'N/139°13.387'E

Dive Summary

Hyper-Dolphin #1490 started to descend to a point of 900m depth on the steep slope of Off Hatsushima (12:44 pm). After landed on the sandy bottom, sediment core was sampled at a position where no seep-specific animal was observed. Then the vehicle climbed up the slope. We found a mosaic colony of seep-specific organisms, where we collected Munnopsid crustacea and tubeworms. Near the point, we also found some vesicomyid clams and collected them. The vehicle moved to shallower points where a large colony of vesicomyids has been recorded, and two sediment cores were sampled at the rim of the colony. Finally, the vehicle went back to the mosaic colony and collected mussels. After mussel collection, we left the bottom.

Written by Koji Inoue

Dive Report HD#1491

Date: March 15, 2013

Site: Omurodashi, Izu-Bonin Area **Depth:** 133-198m

Landing (Lat., Long., Time, Depth): 34°32.877'N, 139°26.854'E, 08:33, 133m

Leaving (Lat., Long., Time, Depth): 34°32.868'N, 139°26.712'E, 10:17, 148m

Operation Manager: Homare Wakamatsu, **Pilot:** Yosuke Chida & Ryo Saigo

Theme: Studies on the biodiversity and early life history of vent-associated animals in Izu-Bonin to Mariana Island Arcs.

Purpose:

1. Searching a vent field inside the caldera of Omurodashi.
2. Sampling and observing of animals on the Omurodashi..
3. Sampling sediment to know the meio-fauna.

Payload Equipment:

Slurp gun, single canister, seven bottle canister, sample box, Niskin water sampler (x2), thermometer (self-memory type), MBARI corer (x3)

Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Core sampling	09:44	198	Sediment	34°32.823'N/139°26.720'E

Dive Summary

Hyper-Dolphin #1491 started to descend to the northwest slope of caldera in Omurodashi (8:24 am). We landed on the sandy bottom, 198m depth, and observed a lot of sharks at this point. Sediment coring was difficult to sample because of soft sandy sediment. We collected sediment by scooping using MBARI corer. Then, we turned the head to west vent sites which were found by HPD#1408 and #1409. On the way to the site, we could not to move by strong current. We left the bottom and tried to recover the *Hyper-Dolphin* and move to the site by Natsushima.

Written by Shinji Tsuchida

Dive Report HD#1492

Date: March 15, 2013

Site: Omurodashi, Izu-Bonin Area **Depth:** 133-198m

Landing (Lat., Long., Time, Depth): 34°32.852'N, 139°26.505'E, 13:29, 195m

Leaving (Lat., Long., Time, Depth): 34°32.780'N, 139°26.501'E, 17:02, 197m

Operation Manager: Homare Wakamatsu, **Pilot:** Ryo Saigo & Yosuke Chida

Theme: Studies on the biodiversity and early life history of vent-associated animals in Izu-Bonin to Mariana Island Arcs.

Purpose:

1. Searching a vent field inside the caldera of Omurodashi.
2. Sampling and observing of animals on the Omurodashi..
3. Sampling sediment to know the meio-fauna.

Payload Equipment:

Slurp gun, single canister, seven bottle canister, sample box, Niskin water sampler (x2), thermometer (self-memory type), MBARI corer (x3)

Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Core sampling	14:05	195	Sediment	34°32.819'N/139°26.515'E
Animal sampling	14:40	196	Macro benthos	34°32.802'N/139°26.505'E
Animal sampling	15:10	197	Macro benthos	34°32.800'N/139°26.502'E
Animal sampling	15:34	197	Macro benthos	34°32.787'N/139°26.499'E
Animal sampling	15:38	197	Macro benthos	34°32.787'N/139°26.499'E
Animal sampling	15:48	197	Tubeworm	34°32.787'N/139°26.499'E
Animal sampling	16:22	196	Macro benthos	34°32.780'N/139°26.501'E
Animal sampling	16:50	196	Macro benthos	34°32.780'N/139°26.501'E
Core sampling	17:02	196	Sediment	34°32.780'N/139°26.501'E

Dive Summary

Hyper-Dolphin #1492 started to descend to the northwest of the caldera in Omurodashi (13:29 pm). We landed on the sandy bottom, 195m depth, and observed a lot of sharks at this point same as #1491 dive. About 30 m down to south, we found the marker 1408-1 deployed the last year. Further 20m down to south, hydrothermal venting from a small chimney was found on the sandy bottom. At this point, we sampled a sediment core by scooping for meio fauna studies. Also, we found another active venting and vent-associated animals. Crabs and black limpets were successfully sampled by the suction motor connected to the seven-bottle canister. A couple of meters far from the point, several small clusters of tube worms attached on the rock were found and captured by the manupirator. Around 10m south from the last point, we found a larger chimney with active venting covered partially by white filamentous bacteria and tried to collect animal samples on the surface of chimney by the slurp gun. At this point, sediment core was sampled and then ascended back to the sea surface.

Written by Shinji Tsuchida

Dive Report HD#1493

Date: March 16, 2013

Site: Myojin Knoll, Izu-Bonin Area **Depth:** 1224-1340m

Landing (Lat., Long., Time, Depth): 32°06.264'N, 139°51.978'E, 10:28, 1,340m

Leaving (Lat., Long., Time, Depth): 32°06.213'N, 139°52.172'E, 16:05, 1,224m

Operation Manager: Homare Wakamatsu, **Pilot:** Ryo Saigo & Daichi Urata

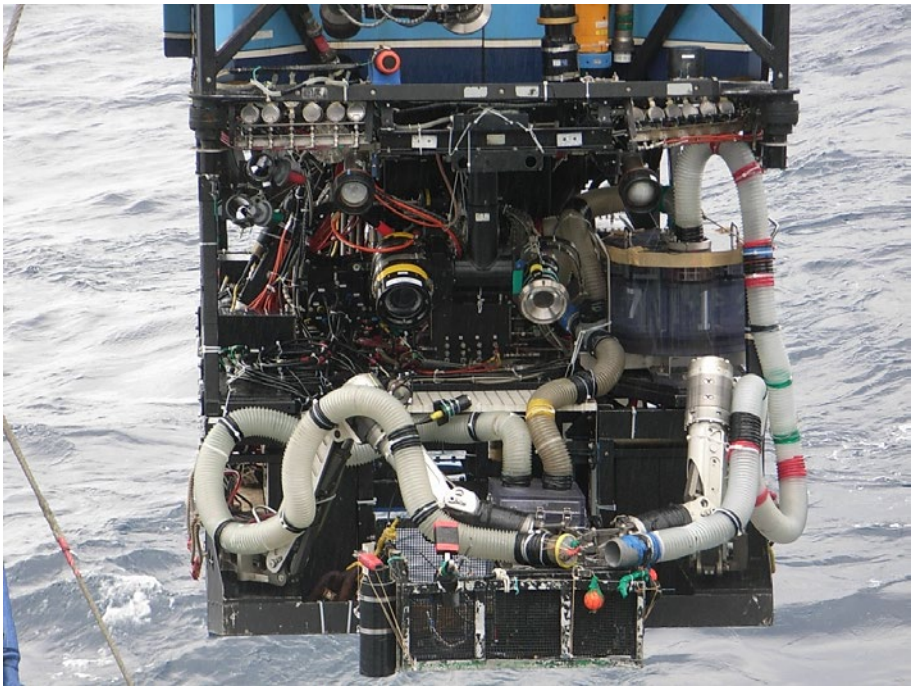
Theme: Studies on the role of thiotaurine in symbiosis.

Purpose:

1. Sampling of deep-sea mussels and measurement of sulfide level and temperature of their habitat.
2. Sampling of animals in hydrothermal vent area.

Payload Equipment:

Slurp gun, single canister, seven bottle canister, sample box, online thermometer, sulfide sensor (self-memory type), Niskin water sampler (x2), thermometer (self-memory type)



Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Animal sampling	12:33	1285	Bathymodiolin mussels	32°06.274'N/139°52.107'E
Animal sampling	12:41	1285	Bathymodiolin mussels	32°06.274'N/139°52.107'E
Animal sampling	15:48	1224	Bathymodiolin mussels, Polynoid worms, crabs	32°06.213'N/139°52.172'E
Marker	15:48	1224	H1493	32°06.213'N/139°52.172'E

Dive Summary

Hyper-Dolphin #1493 started dive toward the start point at 1340m in the southeast part of the Myojin Knoll caldera. After settled, we drove the vehicle to eastward seeking for mussel colonies. We could find some small colonies but not large ones before noon. Around noon, we found closely-located two small colonies. We measured temperature and sulfide level of each colony, and collected several mussels from the colonies separately. Then we headed the vehicle to southward and finally found a large colony. After temperature and sulfide measurement, we collected mussels for laboratory experiments. We also collected some polynoid worms, polychaetes and crabs. After setting a marker H1493, we left the bottom.

Written by Koji Inoue

Dive Report HD#1494

Date: March 17, 2013

Site: Western Peak, the Myojin Knoll, Izu-Bonin Area **Depth:** 900-1108m

Landing (Lat., Long., Time, Depth): 31°58.332'N, 139°40.438'E, 10:28, 1,108m

Leaving (Lat., Long., Time, Depth): 31°59.273'N, 139°40.643'E, 16:05, 918m

Operation Manager: Homare Wakamatsu, **Pilot:** Ryo Saigo & Daichi Urata

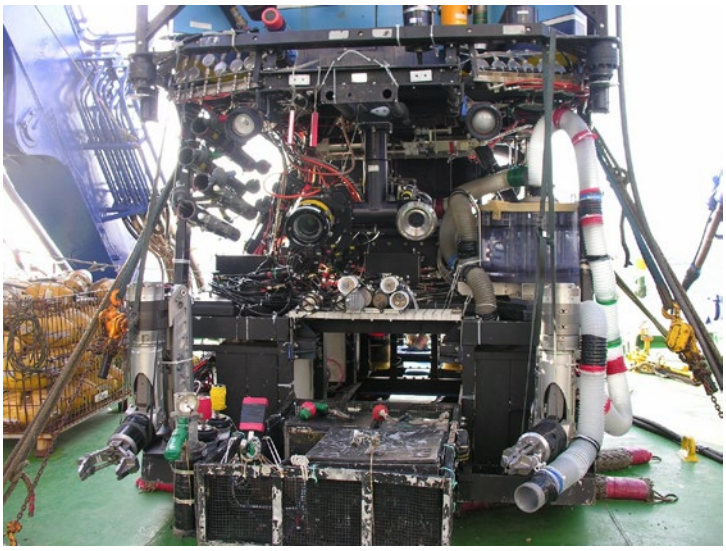
Theme: Geological, physicochemical and microbiological environments of low-temperature hydrothermal manganese deposits.

Purpose:

1. To retrieve the manganese traps settled during 6K#611 in 2001.
2. To measure physicochemical parameters around the possible low-temperature vents; C-T-D, pH, Turbidity, H2S, ORP.
3. To take samples of rocks, sediments, and sea water for microbiological, chemical, and mineralogical analyses.

Payload Equipment:

Automatic (self-memory) chemical sensors for pH-ORP-H_2S and C-T-D-Turbidity, Automatic water sampler (24), On-line thermometer (real-time), Corers (2 MBARIs and 1M type), Sample boxes with lids, Niskin water samplers (4), Slurp gun (single canister)



Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Sampling rocks	10:26	1028	Hydrothermal Mn sandstone	31°58.646'N/139°40.342'E
Sampling rocks	11:10 -11:11	995	Limestone and volcanic rocks	31°58.710'N/139°40.262'E
Retrieving traps & water bottle	13:02 -13:05	918- 920	Trap bottle after 12-year exposure	31°58.847'N/139°40.007'E
Sampling rocks	13:09	920	Pumice, Mn-stained	31°58.869'N/139°40.008'E
Sampling rocks	13:09	920	Pumice, Mn-stained	31°58.869'N/139°40.008'E
Sampling animals	15:55	981	Sponge	31°59.260'N/139°40.467'E
Sampling bottle water	16:09	915	Water in bottle	31°59.273'N/139°40.643'E
Chemical measurement	Every second			Entire ROV operation
Sampling Waters	Every 6min.			Entire ROV operation

Dive Summary

We dove with the Hyper-Dolphin 3K at the western peak of the Myojin Knoll, where possible low-temperature hydrothermal mineralization has been expected and the two small traps were settled on the sea floor in 2001 for a long-year exposure experiment at a low-temperature hydrothermal vent area.

This dive #1494 a very lucky and memorable moment when we finally find and retrieve the traps using only 1 hour search at the possible site after 12 year exposure. The measurement data, sampled rocks and manganese oxide deposits suggest a probable modern low-temperature hydrothermal activity somewhere in the area.

Written by Akira Usui

Dive Report HD#1495

Date: March 18, 2013

Site: Off Hatsushima, Sagami Bay **Depth:** 831-851m

Landing (Lat., Long., Time, Depth): 35°06. 400'N, 139°12.910'E, 08:33, 850m

Leaving (Lat., Long., Time, Depth): 35°06.215'N, 139°12.815'E, 10:17, 832m

Operation Manager: Homare Wakamatsu, **Pilot:** Teppei Kido & Atsushi Takenouchi

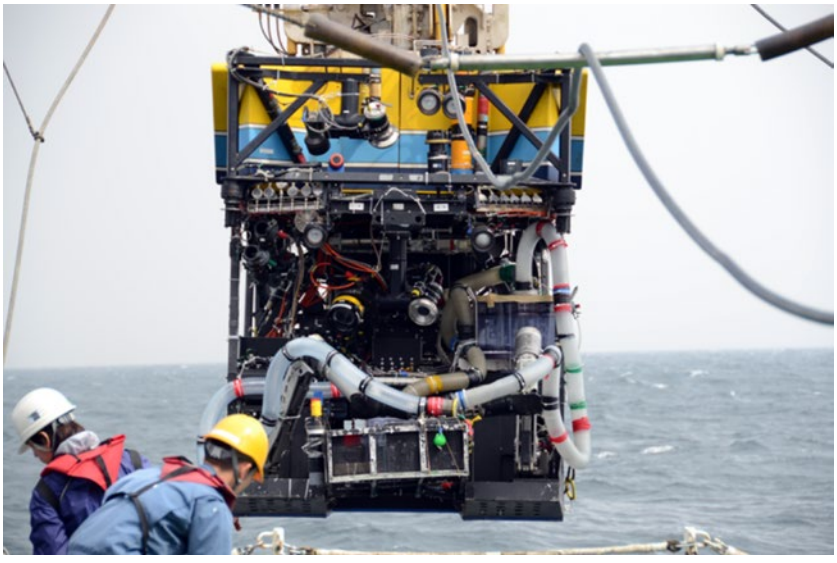
Theme: Studies on the biodiversity and early life history of vent-associated animals in Izu-Bonin to Mariana Island Arcs.

Purpose:

1. Sampling and observing of benthic animals.
2. Sampling sediment to know the meio-fauna.
3. Water sampling to survey the environmental factors

Payload Equipment:

Slurp gun, single canister, seven bottle canister, single canister, sample boxes (large), Niskin water sampler (x2), MBARI corer (x3), marker



Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Niskin sampling	11:09	831	Sea water	35°06.400'N/139°12.910'E
Animal sampling	11:43	851	Macro benthos	35°06.393'N/139°12.915'E
Core sampling	12:54	835	Sediment	35°06.220'N/139°12.823'E
Animal sampling	13:03	832	Macro benthos	35°06.215'N/139°12.815'E

Dive Summary

Hyper-Dolphin #1495 started to descend to the southeast of Manazuru at the deep-sea canyon around 850m depth. At the depth of 831m, 20m altitude from the bottom, we collected water sample by Niskin sampler. Then, we landed to the bottom at 850m depth and sampled core by MBARI corer. About 20m in south, a shrimp *Nematocaricinus* sp. was collected by the slurp gun. We moved climbing up on the deep-sea canyon more than 300m from the point, and landed again for sampling sediment by MBARI and benthic animals by slurp gun. Unfortunately, sea condition became bad for the operation, and the dive was finished and ascended to the surface at 832m depth.

Written by Shinji Tsuchida

Dive Report HD#1496

Date: March 19, 2013

Site: Off Hatsushima, Sagami Bay **Depth:** 618-1070m

Landing (Lat., Long., Time, Depth): 35°04. 303'N, 139°13.268'E, 09:08, 1070m

Leaving (Lat., Long., Time, Depth): 35°04.142'N, 139°11.858'E, 16:02, 618m

Operation Manager: Homare Wakamatsu, **Pilot:** Atsushi Takenouchi & Yosuke Chida

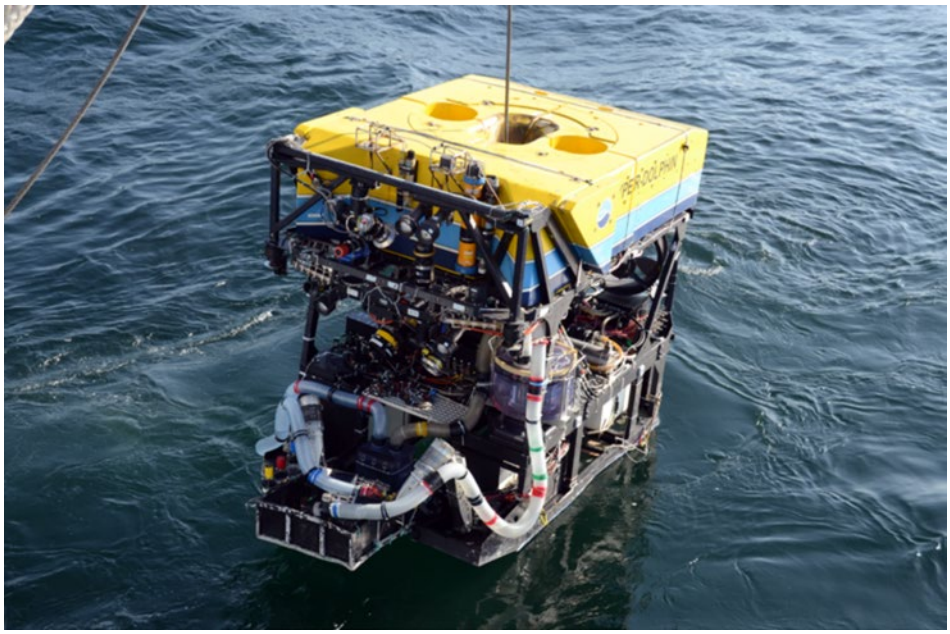
Theme: Studies on the biodiversity and early life history of vent-associated animals in Izu-Bonin to Mariana Island Arcs.

Purpose:

1. Sampling and observing of benthic animals.
2. Sampling sediment to know the meio-fauna.
3. Water sampling to survey the environmental factors

Payload Equipment:

Slurp gun, single canister, seven bottle canister, single canister, sample boxes (large), Niskin water sampler (x2), MBARI corer (x3), marker



Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Niskin sampling	09:07	1061	Sea water	35°04.303'N/139°13.268'E
Core sampling	09:23	1070	Sediment	35°04.303'N/139°13.268'E
Core sampling	10:11	1043	Sediment	35°04.222'N/139°13.068'E
Animal sampling	10:36	1031	Crab	35°04.192'N/139°12.979'E
Animal sampling	12:09	944	Shrimp	35°04.157'N/139°12.632'E
Animal sampling	12:42	914	Shrimp	35°04.146'N/139°12.520'E
Animal sampling	13:30	861	Shrimp	35°04.154'N/139°12.355'E
Animal sampling	13:52	845	Shrimp	35°04.142'N/139°12.313'E
Animal sampling	14:14	831	Shrimp	35°04.138'N/139°12.275'E
Animal sampling	14:17	826	Shrimp	35°04.136'N/139°12.265'E
Animal sampling	14:27	812	Shrimp	35°04.141'N/139°12.235'E
Animal sampling	15:12	703	Fish	35°04.126'N/139°12.016'E
Animal sampling	15:24	693	Fish	35°04.121'N/139°11.986'E
Animal sampling	15:49	651	A rock with animals	35°04.136'N/139°11.904'E
Core sampling	16:02	618	Sediment	35°04.142'N/139°11.858'E
Niskin sampling	16:05	586	Sea water	35°04.154'N/139°11.842'E

Dive Summary

Hyper-Dolphin #1496 started to descend to the northeast off Hatsushima at the deep-sea canyon around 1070m depth. At the depth of 1061m, 10m altitude from the bottom, we collected water sample by Niskin sampler. Then, we landed to the bottom at 1070m depth and sampled core by MBARI corer. About 800m

in southwest from the point, *Paralomis* crab was collected by slurping and put it in the box. We moved climbing up on the deep-sea canyon more than 200m from the point, and sampled a shrimp *Nematocarcinus* sp. by the slurp gun. Further 600m in west a shrimp *Nematocarcinus* sp. was collected again by the slurp gun. And we climbed up the canyon to the west during 600m moving, from 900m to 800m depths, several shrimps *Lebbeus* sp. and *Gryphocrangon* sp. were captured by the slurp gun. At 703m and 693m depths, two individuals of fishes were sampled by the slurp gun. A rock with animals was collected by the manipulator at the 651m depth. About 100m in west we sampled a sediment by MBARI corer. Then, this dive was finished and ascended to the surface. About 30m altitude we collected seawater by the Niskin sampler.

Written by Shinji Tsuchida

Dive Report HD#1497

Date: May 20, 2013

Site: Omurodashi, Izu-Bonin Area **Depth:** 185-200m

Landing (Lat., Long., Time, Depth): 34°32.884'N, 139°26.402'E, 07:03, 185m

Leaving (Lat., Long., Time, Depth): 34°32.718'N, 139°26.738'E, 10:17, 197m

Operation Manager: Homare Wakamatsu, **Pilot:** Ryo Saigo & Teppei Kido

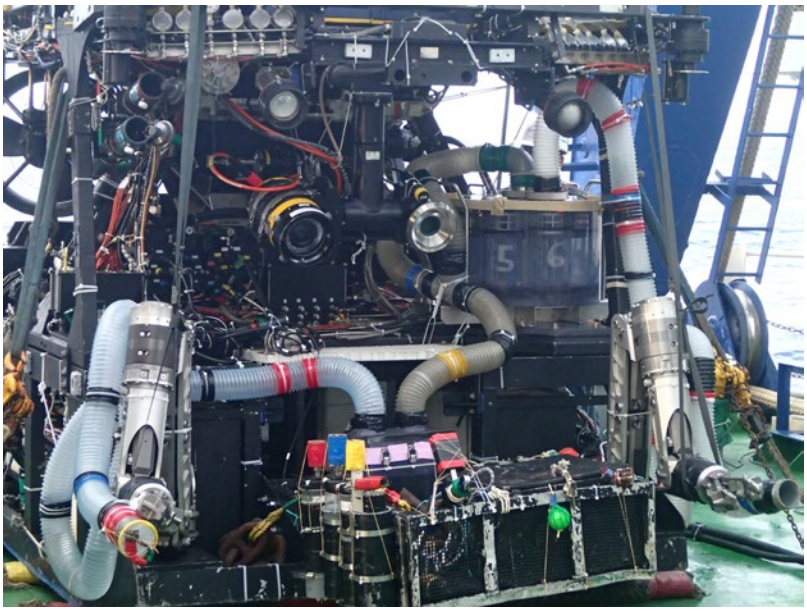
Theme: Studies on the biodiversity and early life history of vent-associated animals in Izu-Bonin to Mariana Island Arcs.

Purpose:

1. Searching a vent field inside the caldera of Omurodashi.
2. Sampling and observing of animals on the Omurodashi..
3. Sampling sediment to know the meio-fauna.
4. Measurement of temperature and H_2S concentration of vent fluid

Payload Equipment:

Slurp gun, single canister, seven bottle canister, sample box (x2), Niskin water sampler (x2), thermometer, H2S meter, MBARI corer (x3), Kumade sampler, Marker buoy.



Sampling Points and Markers:

Events	*Time*	*Depth (m)*	*Sample*	*Lat./ Long.*
Measurement of Temperature	07:40	195	T=16.0℃	34°32.834'N/139°26.520'E
Core sampling	07:52	195	Sediment (Yellow)	34°32.834'N/139°26.520'E
Core sampling	07:59	195	Sediment (Blue)	34°32.834'N/139°26.520'E
Measurement of Temperature	08:23	197	T=111℃	34°32.804'N/139°26.501'E
Measurement of Temperature	09:16	197	T=23.2℃	34°32.788'N/139°26.485'E
Measurement of H_2S	09:24	197		34°32.788'N/139°26.485'E
Animal sampling in #1 bottle	09:35	197	Tubeworms, crabs	34°32.788'N/139°26.485'E
Animal sampling in #2 bottle	09:41	197	Tubeworms, crabs	34°32.788'N/139°26.485'E
Animal sampling in #3 Canister	09:53	197	Tubeworms, crabs	34°32.788'N/139°26.485'E
Animal sampling in #4 bottle	09:59	197	Tubeworms, crabs	34°32.788'N/139°26.485'E
Animal sampling in small box	10:47	197	*Lyrocteis imperatoris*	34°32.750'N/139°26.573'E
Animal sampling in #5 bottle	11:00	197	*Lyrocteis imperatoris*	34°32.745'N/139°26.584'E
Animal sampling in small box	11:07	197	*Lyrocteis imperatoris*	34°32.739'N/139°26.607'E
Rock sampling	11:44	200	Rock	34°32.713'N/139°26.714'E
Animal sampling in #6 bottle	11:45	200	crabs	34°32.713'N/139°26.714'E
Animal sampling in canister	12:05	200	crabs	34°32.704'N/139°26.714'E
Core sampling	12:29	197	sediment	34°32.719'N/139°26.738'E

Animal sampling in canister	12:58	197	Crabs	34°32.714'N/139°26.739'E
Water sampling by NISKIN	12:58	197	Water (Red and Green)	34°32.714'N/139°26.739'E
Setting H1497 Marker Buoy	13:05	196	H1497	34°32.718'N/139°26.738'E

Dive Summary

Hyper-Dolphin #1497 started to descend to the northwest slope of caldera in Omurodashi (6:52 am). We landed on the sandy bottom at 195m depth. Then we went to vent field to mesure temperature and H2S of vent fluid and to collect *Lamellibrachia satsuma* and *Xenograpusu* crab. Maximun temperature was 111 °C. Temperature at a place where *Lamellibrachia satuma* lived was 23.2 °C. After collecting *L. satsuma* and *Xenograpusu* crabs, we looked for other vent site. Along the way, Benthic ctenophore, Lyrocteis imperatoris was observed and collected. At last we found active vent mound and collected many *Xenograpusu* crabs in large size we needed.

Written by Hiroshi Miyake