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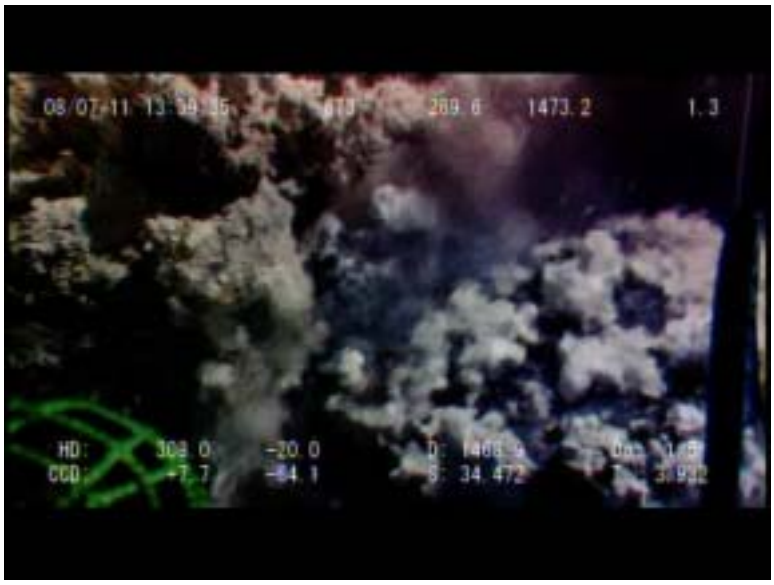
R/V *Natsushima*
Cruise Report

NT08-13

Blue Smoker



Hatoma Knoll
(Okinawa Trough)

2008/7/6 - 12

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

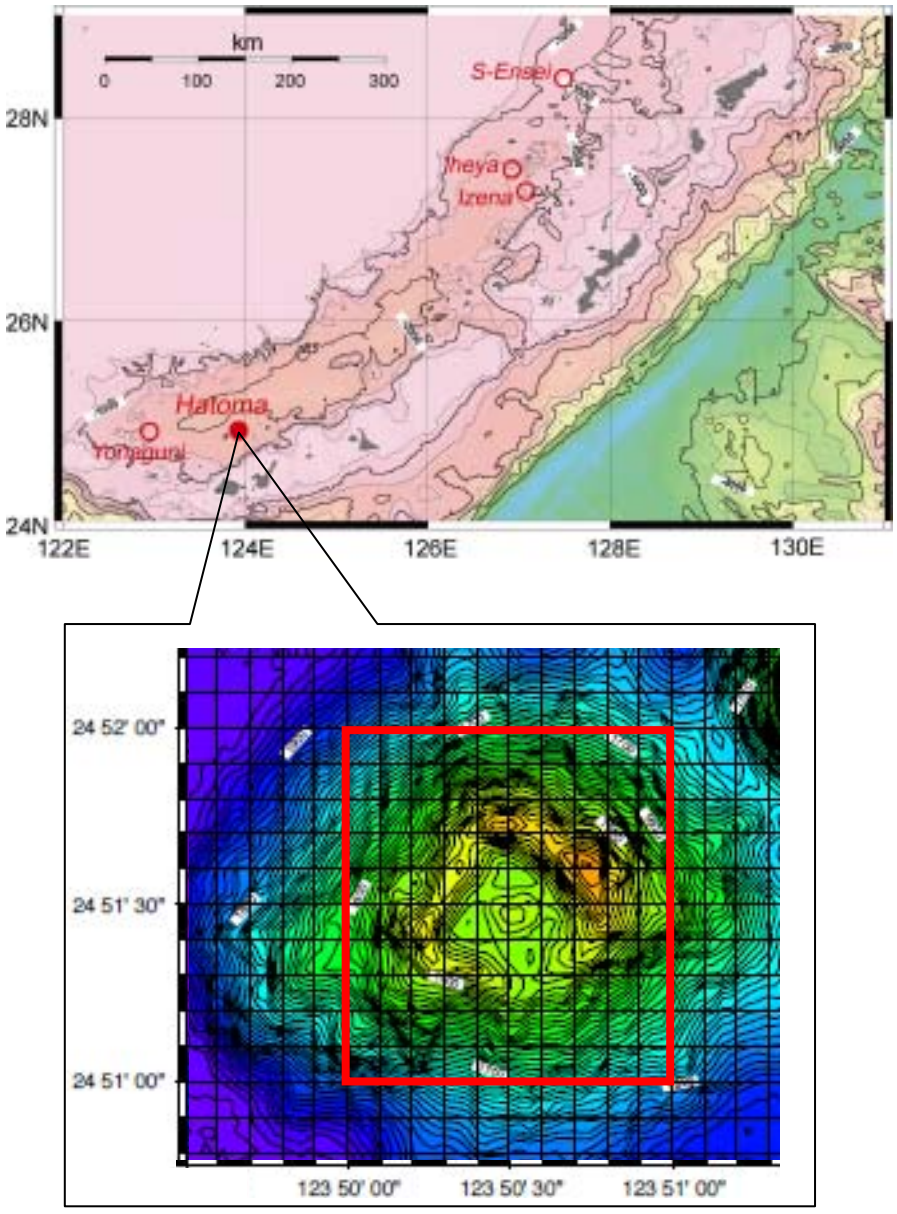
Notice on using

This cruise report is a preliminary documentation as of the end of the cruise. It may not be corrected even if changes on content (i.e. taxonomic classifications) are found after publication. It may also be changed without notice. Data on the cruise report may be raw or not processed. Please ask the PI(s) for the latest information before using. Users of data or results of this cruise are requested to submit their results to Data Integration and Analysis Group (DIAG), JAMSTEC.

Contents

1. Cruise Information

- Cruise number : NT08-13
- Ship name : R/V Natsushima
- Title of the cruise : Blue Smoker
- Title of proposal : In-situ experiments for re-creation of “blue smoker” at Hatoma Knoll
- Cruise period : 2008/7/6 - 12
- Port call : Ishigaki - Ishigaki
- Research area : Okinawa Trough



2. Researchers

● Chief Scientist : Tomohiro Toki (University of the Ryukyus)

● Representative of Science Party : Tomohiro Toki (University of the Ryukyus)

- List of Science party

Name	Affiliation	Assignment
Toshitaka Gamo	ORI	Hydrogen isotope / Trace metal
Shinsuke Kawagucci	ORI	Hydrogen isotope
Genta Teranishi	ORI	Trace metal
Yuji Sano	ORI	Helium isotope
Jun-ichiro Ishibashi	Kyushu Univ.	Mineralogy / Gas chemistry
Hiroki Nakano	Kyushu Univ.	Mineralogy
Urumu Tsunogai	Hokkaido Univ.	Carbon isotope of methane and ΣCO_2
Toshiro Yamanaka	Okayama Univ.	Sulfur isotope / DOC
Hironori Akashi	Okayama Univ.	DOC
Tamotsu Oomori	Univ. Ryukyu	Sedimentology
Daigo Iwata	Univ. Ryukyu	Gas chemistry
Shogo Ooshima	Univ. Ryukyu	Fluid chemistry
Kei Okamura	Kochi Univ.	Trace metal in hydrothermal plume
Akira Ijiri	JAMSTEC	Carbon isotope of DOC
Ken Takai	JAMSTEC	Cultivation
Takuro Nunoura	JAMSTEC	Phage ecology
Satoshi Nakagawa	JAMSTEC	Symbiont ecology
Hisako Hirayama	JAMSTEC	Ecology of methanotroph
Tomoo Watsuji	JAMSTEC	Symbiont ecology
Masahiro Yamamoto	JAMSTEC	Enzymology
Hiroko Makita	JAMSTEC	Symbiont ecology
Michinari Sunamura	Univ. Tokyo	Microbial ecology in hydrothermal plume
Naoko Nomura	Univ. Tokyo	Biomass estimation
Takeshi Yorisue	ORI	Paralvinella ecolgy
Shigeaki Kojima	ORI	Paralvinella ecolgy
Satomi Minamizawa	NME	Research support

3. Research

- Research

- Introduction

In August 2006, a clear smoker was newly observed with blue-colored at Gusuku site in Hatoma Knoll. We conducted emergently dive research by Shinkai6500 in March 2007 for clarification of formation of “blue smoker”. The blue smoker has not been observed since the first time.

Hydrothermal fluids contain a great amount of CO_2 at Hatoma Knoll. The CO_2 with in-situ venting temperature and pressure of Hatoma Knoll exists in super-critical condition. CO_2 in super-critical condition occur Rayleigh scattering in theory and laboratory experiments. Calculating intensity of the scattering of different wavelengths at various angles based on the theory, CO_2 with in-situ condition at Hatoma Knoll is blue-colored at the angle of 90 degree from light source to observer. Therefore, the blue smoker would be observed in the specific lighting, which *Shinkai* 6K shot Hyper-Dolphin 3K for TV program in August 2006.

Our objective is to verify the formation mechanism of the blue smoker at Hatoma Knoll. We observe the light through CO_2 venting at Hatoma Knoll, and compare the chemical composition of hydrothermal fluids with the previously reported values, as well as analyze chimneys to read the history of the activity in the hydrothermal system.

- Sampling

In-situ experiments for re-creation of blue smoker
Sampling hydrothermal fluids
Sampling chimneys
Sampling seawater
Collection of chemosynthesis organisms

- Methods

Search light
LED light
Vacuum sampler
WHATS
Bag sampler
Niskin sampler
In-situ large volume filtration system
In-situ larva collection system

- Results

During this cruise, we visited several vents classifying two groups based on the temperature range. At *Gusuku* (C-1、C-2、C-3、189-1) and *Oritori* site, hydrothermal fluids of high temperature around 300 deg. C were venting from active chimneys, which was venting CO_2 in super-critical condition. At *Chura* site, hydrothermal fluids were characterized by moderate temperature less than 200 deg. C, which was venting CO_2 after mixing with seawater.

We conducted in-situ re-creation experiment of blue smoker using two types of the light. Search light was held on the right arm. This light is normally attached to the front of Hyper-Dolphin 3K. We observed the light through venting fluids at various angles from Dive No.866 to No.870. Actually, this light was too strong to lighten fluids from 180 degree.

LED light was used in the experiment. This light is normally used as a CCD camera. It was specially fixed on the right arm from Dive No.871 to No.x873. The light was so feeble that we could observe the light through venting fluids from the opposite side. Additionally, the strength of the light was adjusted for alternative of changing the length of the light pass.

- Future study

Geochemistry

1. Optical review of the blue smoker and analysis of chemical composition of hydrothermal fluids

(Univ. Ryukyu)

Visual data of Hi-vision and CCD camera during the re-creation experiments will be reviewed and optically interpreted. We will analyze chemical and isotopic composition of hydrothermal fluids and dissolved gases.

2. Bio-available gas measurement for mixing zone water (ORI)

Hydrogen and methane concentrations and their isotope ratios will be analyzed for estimation of microbial metabolisms at hydrothermal mixing zone. The analyses will be carried out using a gas chromatograph and an isotope ratio mass spectrometer.

3. Organic geochemical study of hydrothermal fluid and plume emitted from Hatoma knoll hydrothermal field (Okayama Univ., JAMSTEC)

Dissolved organic carbon (DOC) and low-molecular weight volatile fatty acids in the hydrothermal fluids and the associated water samples (plume, shimmering water, etc.) will be analyzed. Furthermore, we will also determine the carbon isotopic compositions of the DOC.

4. Mineralization mechanism in Hatoma Knoll hydrothermal field (Kyushu Univ.)

Hydrothermal precipitates such as chimney and mound samples will be analyzed by microscopy, XRD, EPMA, microthermometry method for mineralogical and geochemical study.

Microbiology

1. Microbial ecosystem in Hatoma Knoll hydrothermal field (JAMSTEC, ORI, Univ. Tokyo)

Microbial communities associated with chimney structures, and water samples on vent fauna communities and hydrothermal plumes will be analyzed by culture-dependent and –independent analyses such as cultivation with serial dilution technique, 16S rRNA gene clone analysis and quantitative PCR, and activity measurements.

2. Phage ecology in Hatoma Knoll hydrothermal field (JAMSTEC)

By direct counting method, distribution of phage like particle in water samples on vent fauna communities and in hydrothermal plume will be analyzed. Furthermore, we will apply metagenomic approaches to phage ecology on vent fauna communities.

3. Host-symbiont relationship on Galatheidae crab (JAMSTEC)

In order to know the relationship between Galatheidae crab and exo-symbionts, we will try activity measurements with multiple substrates for exo-symbionts. Furthermore, biochemical study will be applied to host-symbionts interface.

4. Ecology of *Paralvinella* in larva stage (ORI)

In order to collect larva of *Paralvinella* sp., collected adults *Paralvinella* in bottle covered by mesh were released at their original habitat and will be retrieved in the cruise NT08-15 by the ROV Hyper Dolphin.

- Ship log

- Shipboard log

Date	Time	Description	Remarks	Position/Weather/ Wind/Sea condition (Noon)
06Jul08	13:00	Scietists embark on Natsushima		
	13:30-14:20	Carried out onboard education & training for scientist		
	15:00	Leave the ISHIGAKI port for research area	Head for Research Area	
	18:20	Arrived at reseach area		
	18:25	Released XBT	at 24-50.3108N, 123-50.5480E	
	18:42	Com'ced drifting		
	19:00-20:20	Scientific meeting		
07Jul08	5:45	Com'ced proceeding to dive point		12:00(GMT+9h)
	6:30	Arrived at dive point		24-51.5N,123-50.5E
	8:22	Launched HPD on the surface	HPD#866	Fine but cloudy
	9:27	HPD landed on sea bottom (D=1472m)	24-51.502N, 123-50.472E	SE-5(Fresh breeze)
	11:33	HPD left sea bottom (D=1474m)	24-51.498N, 123-50.479E	Sea slight
	12:12	HPD floated		
	12:26	Recovered HPD & finished her operation		
	13:50	Launched HPD on the surface	HPD#867	
	15:01	HPD landed on sea bottom (D=1191m)	24-51.508N, 123-50.475E	
	17:13	HPD left sea bottom (D=1191m)	24-51.497N, 123-50.463E	
	17:55	HPD floated		
	18:08	Recovered HPD & finished her operation		
	19:15-19:40	Scientific meeting		
	19:45	Com'ced drifting		
08Jul08	4:30	Com'ced proceeding to dive point		12:00(GMT+9h)
	6:30	Arrived at dive point		24-51.5N,123-50.5E
	8:06	Launched HPD on the surface	HPD#868	Cloudy
	13:00	HPD floated		East-5(Fresh breeze)
	13:15	Recovered HPD & finished her operation		Sea slight
	13:25	Suspended research work due to storage winch trouble & Com'ced proceeding to ISHIGAKI		
	16:00	Approached anchor point		
	16:50	Let go her starhed anchor		
	17:05	Launched working boat on the surface		
	17:45	Working boat return to ship		
	18:00	Up & down anchor & proceeded to drift area		
	18:00-18:20	Scientific meeting		
	19:00	Com'ced drifting		
09Jul08	6:30	Arrived at dive point		12:00(GMT+9h)
	8:11	Launched HPD on the surface		24-51.5N,123-50.5E
	9:12	HPD landed on sea bottom (D=1493m)	HPD#869	Fine but cloudy
	11:59	HPD left sea bottom (D=1475m)	24-51.450N, 123-50.482E	NNW-5(Fresh breeze)
	12:41	HPD floated	24-51.514N, 123-50.468E	Sea slight
	12:56	Recovered HPD & finished her operation		
	14:22	Launched HPD on the surface		
	15:42	HPD landed on sea bottom (D=1474m)		
	17:04	HPD left sea bottom (D=1479m)	HPD#870	
	15:28	HPD floated	24-51.505N, 123-50.83E	
	18:00	Recovered HPD & finished her operation	24-51.468N, 123-50.483E	
	19:30	Com'ced drifting		
	20:00-20:20	Scientific meeting		

- Shipboard log (*continued*)

Date	Time	Description	Remarks	Position/Weather/ Wind/Sea condition (Noon)
10Jul08	5:00	Proceeded to dive point		12:00(GMT+9h)
	6:30	Arrived at dive point		24-51.5N,123-50.5E
	8:18	Launched HPD on the surface		Fine but cloudy
	9:24	HPD landed on sea bottom (D=1493m)	HPD#871	NNW-4(Moderate breeze)
	11:16	HPD left sea bottom (D=1475m)	24-51.563N, 123-50.386E	Sea smooth
	11:57	HPD floated	24-51.609N, 123-50.350E	
	12:09	Recovered HPD & finished her operation		
	13:42	Launched HPD on the surface	HPD#872	
	14:46	HPD landed on sea bottom (D=1474m)	24-51.522N, 123-50.467E	
	17:01	HPD left sea bottom (D=1479m)	24-51.489N, 123-50.504E	
	17:42	HPD floated		
	17:55	Recovered HPD & finished her operation		
	19:30	Com'ced drifting		
	20:00-20:20	Scientific meeting		
11Jul08	3:00	Proceeded to dive point		12:00(GMT+9h)
	6:00	Arrived at dive point		24-51.5N,123-50.4E
	8:14	Launched HPD on the surface	HPD#873	Fine but cloudy
	9:21	HPD landed on sea bottom (D=1476m)	24-51.499N, 123-50.492E	ENE-2(Light breeze)
	13:56	HPD left sea bottom (D=1473m)	24-51.620N, 123-50.383E	Sea calm (Rippled)
	14:35	HPD floated		
	14:47	Recovered HPD & finished her operation		
	15:00	Complated NT08-13 research works & left research area for ISHIGAKI port		
	17:30	Approached anchor point		
	17:50	Let go her starhed anchor		
12Jul08	7:45	Let go her starhed anchor		
	9:00	Arrived at ISHIGAKI		The port of ISHIGAKI
	11:30	Scientists disembark from NATSUSHIMA		

● Dive report

- Dive Number : HPD#866
- Date : AM, July 7, 2008
- Payload
  1. WHATS (parallel)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. In-situ large filtration system
  5. Search light
  6. Sample box
  7. Turbidity meter

- List of events

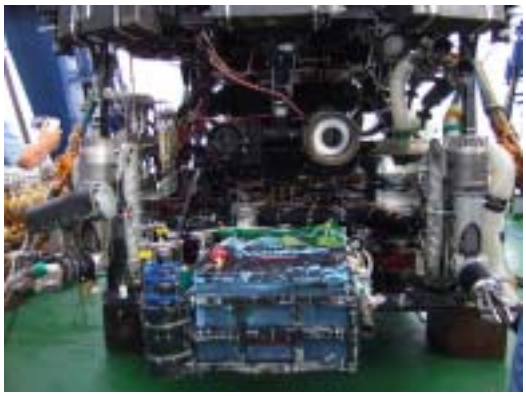
Time	Latitude	Longitude	Site	Depth (m)	Note
8:18					Starting operation
8:22					Taking water
8:33					Starting dive
9:27	24-51.502N	123-50.472E		1,472	Landing on the seafloor
9:41	24-51.498N	123-50.479E	C-2	1,474	Sampling active chimney (D866-R1) with Paralvinella (D866-B1)
9:45	24-51.498N	123-50.479E	C-2	1,474	Re-creation of the blue smoker using search light
10:45	24-51.498N	123-50.479E	C-2	1,474	Sampling fluid from Paralvinella colony using WHATS (D866-W1)
10:51	24-51.498N	123-50.479E	C-2	1,474	Sampling fluid from Paralvinella colony using WHATS (D866-W2)
11:01	24-51.498N	123-50.479E	C-2	1,474	Sampling fluid from Paralvinella colony using Bag sampler (D866-BW)
11:11	24-51.498N	123-50.479E	C-2	1,474	Sampling fluid from Paralvinella colony using in-situ large volume filtration system (D866-FW)
11:16	24-51.498N	123-50.479E	C-2	1,474	Sampling fluid from clear smoker using WHATS (D866-W3)
11:22	24-51.498N	123-50.479E	C-2	1,474	Sampling fluid from clear smoker using WHATS (D866-W4)
11:33					Leaving the seafloor
11:38	24-51.511N	123-50.485E		1,410	Sampling seawater using Niskin sampler (D866-N1)
11:39	24-51.508N	123-50.490E		1,350	Sampling seawater using Niskin sampler (D866-N2)
12:12					Coming to the surface
12:26					Recovery

- Dive Number : HPD#867
- Date : PM, July 7, 2008
- Payload
  1. WHATS (parallel)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. In-situ large filtration system
  5. Search light
  6. Sample box
  7. Turbidity meter
  8. Vacuum sampler (mobile × 2)
  9. In-situ larva collection system

- List of events

Time	Latitude	Longitude	Site	Depth (m)	Note
13:47					Starting operation
13:50					Taking water
14:02					Starting dive
15:02	24-51.508N	123-50.475E		1,475	Landing on the seafloor
15:12	24-51.501N	123-50.476E	C-2	1,470	Deploying in-situ larva collection system
15:14	24-51.501N	123-50.476E	C-2	1,470	Sampling chimney (D867-R1 and R2)
15:26	24-51.501N	123-50.476E	C-2	1,470	Sampling fluid from Paralvinella colony using in-situ large volume filtration system (D867-FW)
15:47	24-51.501N	123-50.476E	C-2	1,470	Sampling fluid from Paralvinella colony using WHATS (D867-W1)
15:57	24-51.501N	123-50.476E	C-2	1,470	Sampling fluid from Paralvinella colony using WHATS (D867-W2)
16:07	24-51.501N	123-50.476E	C-2	1,470	Sampling fluid from Paralvinella colony using Bag sampler (D867-BW)
16:58	24-51.501N	123-50.476E	C-2	1,470	Sampling fluid from clear smoker using Vacuum sampler (D867-
17:13					Leaving the seafloor
17:16	24-51.492N	123-50.468E		1,440	Sampling seawater using Niskin sampler (D866-N1)
17:17	24-51.497N	123-50.463E		1,420	Sampling seawater using Niskin sampler (D866-N2)
17:55					Coming to the surface
18:08					Recovery

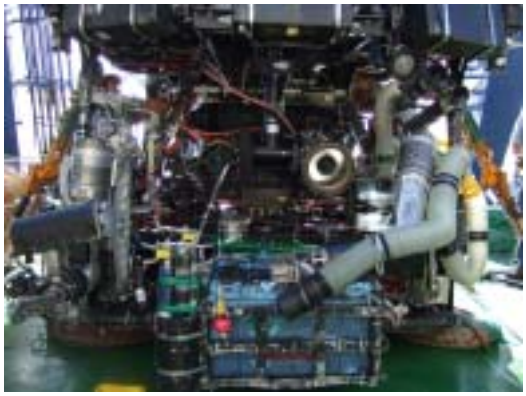
- Dive Number : HPD#868
- Date : AM, July 8, 2008
- Payload
  1. WHATS (tandem)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. Single canister
  5. Search light
  6. Sample box
  7. Turbidity meter
  8. Vacuum sampler (mobile × 2)



- List of events

Time	Latitude	Longitude	Site	Depth (m)	Note
8:03					Starting operation
8:06					Taking water
8:18					Starting dive
13:00					Coming to the surface
13:15					Recovery

- Dive Number : HPD#869
- Date : AM, July 9, 2008
- Payload
  1. WHATS (tandem)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. Single canister
  5. Search light
  6. Sample box
  7. Turbidity meter
  8. Vacuum sampler (mobile × 2)



- List of events

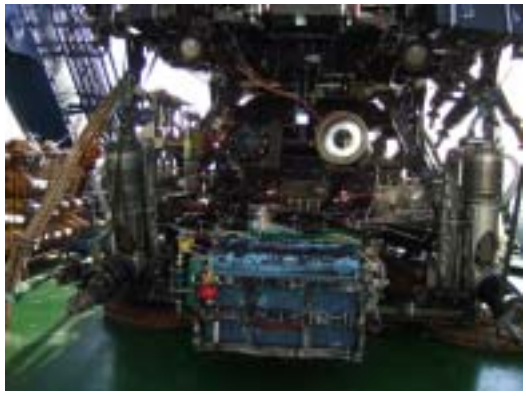
Time	Latitude	Longitude	Site	Depth (m)	Note
8:07					Starting operation
8:11					Taking water
8:23					Starting dive
9:12	24-51.450N	123-50.482E		1,493	Landing on the seafloor
9:36	24-51.480N	123-50.503E	Oritori	1,478	Sampling anhydrite chimney (D869-R1)
9:51	24-51.480N	123-50.503E	Oritori	1,478	Re-creation of the blue smoker using search light
10:23	24-51.480N	123-50.503E	Oritori	1,478	Sampling fluid from clear smoker using Vacuum sampler (D869-V
10:31	24-51.480N	123-50.503E	Oritori	1,478	Sampling fluid from clear smoker using Vacuum sampler (D869-V
10:47	24-51.480N	123-50.503E	Oritori	1,478	Sampling fluid from Bathymodiolus colony using Bag sampler (D869-BW)
10:49	24-51.480N	123-50.503E	Oritori	1,478	Sampling Bathymodiolus (D869-B3 and B4)
11:07	24-51.480N	123-50.503E	Oritori	1,478	Sampling Galatheidae (D869-B1)
11:28	24-51.514N	123-50.468E	C-2	1,475	Sampling fluid from Paralvinella colony using WHATS (D869-W1, W2, W3, and W4)
11:59					Leaving the seafloor
12:02	24-51.514N	123-50.468E		1,450	Sampling seawater using Niskin sampler (D869-N1 and N2)
12:41					Coming to the surface
12:56					Recovery

- Dive Number : HPD#870
- Date : PM, July 9, 2008
- Payload
  1. WHATS (parallel)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. Single canister
  5. Search light
  6. Sample box
  7. Turbidity meter

- List of events

Time	Latitude	Longitude	Site	Depth (m)	Note
14:18					Starting operation
14:22					Taking water
14:23					Starting dive
15:42	24-51.505N	123-50.483E	C-2	1,474	Landing on the seafloor
15:45	24-51.505N	123-50.483E	C-2	1,474	Sampling fluid from Galatheidae colony using WHATS (D870-W1)
15:48	24-51.505N	123-50.483E	C-2	1,474	Sampling fluid from Galatheidae colony using Bag sampler (D870-BW)
15:53	24-51.505N	123-50.483E	C-2	1,474	Sampling fluid from Galatheidae colony using WHATS (D870-W2)
16:24	24-51.497N	123-50.489E	C-2	1,473	Sampling Galatheidae (D870-B1 and B2)
16:39	24-51.468N	123-50.515E	Oritori	1,479	Sampling fluid from Bathymodiolus colony using WHATS (D870-W3)
16:48	24-51.468N	123-50.515E	Oritori	1,479	Sampling fluid from Bathymodiolus colony using WHATS (D870-W4)
17:02	24-51.468N	123-50.515E	Oritori	1,479	Sampling dead chimney (D870-R1)
17:04					Leaving the seafloor
17:06	24-51.486N	123-50.508E		1,460	Sampling seawater using Niskin sampler (D870-N1)
17:09	24-51.486N	123-50.508E		1,390	Sampling seawater using Niskin sampler (D870-N2)
17:47					Coming to the surface
18:00					Recovery

- Dive Number : HPD#871
- Date : AM, July 10, 2008
- Payload
  1. WHATS (parallel)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. In-situ large filtration system
  5. LED light
  6. Sample box
  7. Turbidity meter
  8. Vacuum sampler (fixed × 2)



- List of events

Time	Latitude	Longitude	Site	Depth (m)	Note
8:15					Starting operation
8:18					Taking water
8:29					Starting dive
9:24	24-51.563N	123-50.386E		1,516	Landing on the seafloor
9:39	24-51.594N	123-50.392E	Chura	1,504	Sampling sulfide chimney (D871-R1)
9:59	24-51.594N	123-50.392E	Chura	1,504	Sampling fluid from clear smoker using WHATS (D871-W1)
10:05	24-51.594N	123-50.392E	Chura	1,504	Sampling fluid from clear smoker using WHATS (D871-W2)
10:13	24-51.594N	123-50.392E	Chura	1,504	Sampling fluid from clear smoker using WHATS (D871-W3)
10:22	24-51.594N	123-50.392E	Chura	1,504	Sampling fluid from clear smoker using WHATS (D871-W4)
10:34	24-51.592N	123-50.400E	Chura	1,507	Sampling fluid from Galatheidae colony using in-situ large volume filtration system (D871-FW)
10:38	24-51.592N	123-50.400E	Chura	1,507	Sampling fluid from Galatheidae colony using Bag sampler (D871-BW)
11:14	24-51.609N	123-50.350E		1,452	Sampling bottom seawater using vacuum sampler (D871-V1)
11:15	24-51.609N	123-50.350E		1,452	Sampling bottom seawater using vacuum sampler (D871-V2)
11:16					Leaving the seafloor
11:20	24-51.615N	123-50.334E		1,400	Sampling seawater using Niskin sampler (D871-N1 and N2)
11:57					Coming to the surface
12:09					Recovery

- Dive Number : HPD#872
- Date : PM, July 10, 2008
- Payload
  1. WHATS (parallel)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. In-situ large filtration system
  5. LED light
  6. Sample box
  7. Turbidity meter
  8. Vacuum sampler (mobile × 2)

- List of events

Time	Latitude	Longitude	Site	Depth (m)	Note
13:38					Starting operation
13:42					Taking water
13:52					Starting dive
14:46	24-51.522N	123-50.467E	189-1	1,476	Landing on the seafloor
14:58	24-51.522N	123-50.467E	189-1	1,476	Sampling anhydrite chimney (D872-R1)
15:01	24-51.522N	123-50.467E	189-1	1,476	Re-creation of the blue smoker using LED light
15:17	24-51.522N	123-50.467E	189-1	1,476	Sampling fluid from clear smoker using WHATS (D872-W1)
15:29	24-51.522N	123-50.467E	189-1	1,476	Sampling fluid from clear smoker using WHATS (D872-W2)
15:41	24-51.512N	123-50.477E	C-2	1,476	Re-creation of the blue smoker using LED light
16:23	24-51.512N	123-50.477E	C-2	1,476	Sampling fluid from clear smoker using vacuum sampler (D872-
16:36	24-51.489N	123-50.504E	Oritori	1,479	Sampling fluid from Bathymodiolus colony using in-situ large volume filtration system (D872-FW)
16:37	24-51.489N	123-50.504E	Oritori	1,479	Sampling fluid from Bathymodiolus colony using WHATS (D872-W3)
16:44	24-51.489N	123-50.504E	Oritori	1,479	Sampling fluid from Bathymodiolus colony using WHATS (D872-W4)
16:49	24-51.489N	123-50.504E	Oritori	1,479	Sampling fluid from Bathymodiolus colony using Bag sampler (D872-BW)
17:01					Leaving the seafloor
17:02	24-51.482N	123-50.547E		1,475	Sampling seawater using Niskin sampler (D872-N1)
17:07	24-51.482N	123-50.547E		1,360	Sampling seawater using Niskin sampler (D872-N2)
17:42					Coming to the surface
17:55					Recovery

- Dive Number : HPD#873
- Date : July 11, 2008
- Payload
  1. WHATS (tandem)
  2. Bag sampler (20 L × 4)
  3. Niskin sampler (2.5 L × 2)
  4. Single canister
  5. LED light
  6. Sample box
  7. Turbidity meter
  8. Vacuum sampler (mobile × 4)

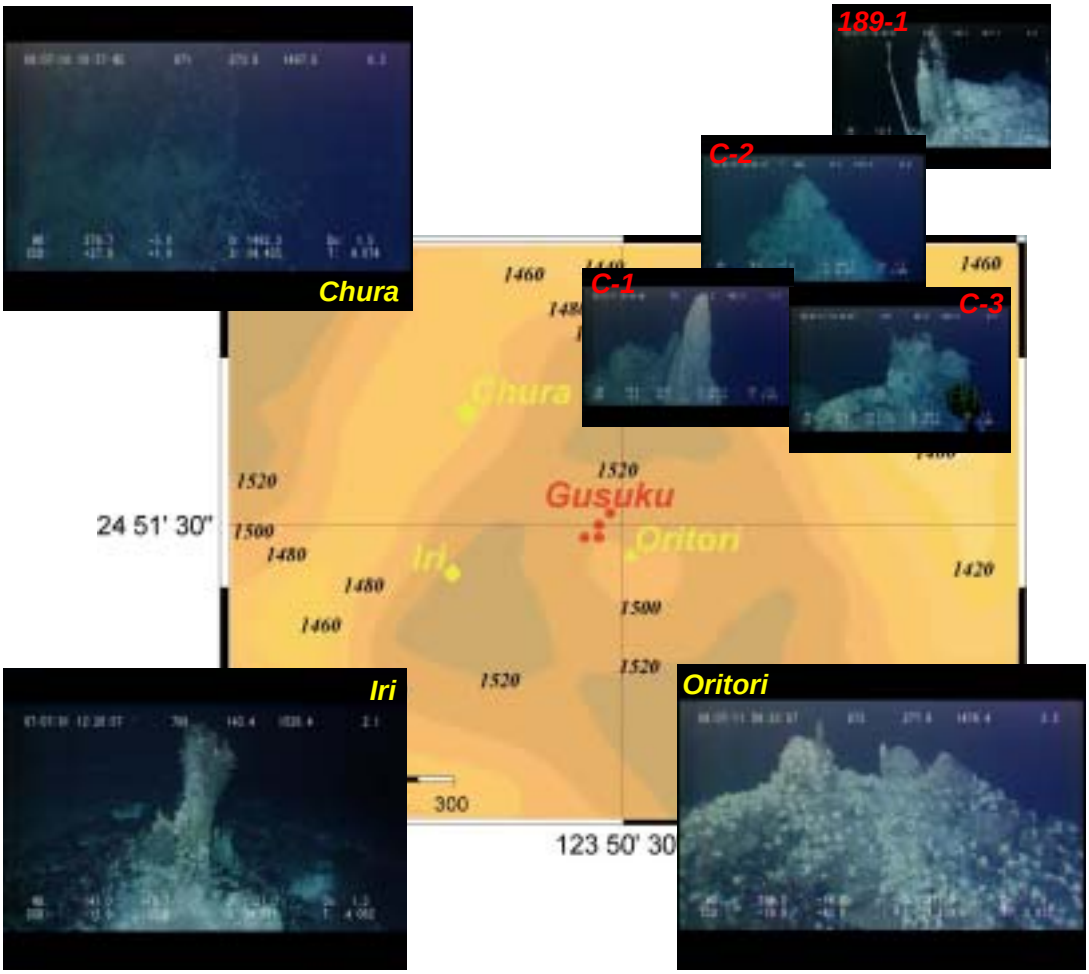
- List of events

Time	Latitude	Longitude	Site	Depth (m)	Note
8:11					Starting operation
8:14					Taking water
8:25					Starting dive
9:12	24-51.499N	123-50.492E		1,340	Sampling seawater using Niskin sampler (D873-N1)
9:13	24-51.499N	123-50.492E		1,360	Sampling seawater using Niskin sampler (D873-N2)
9:21	24-51.485N	123-50.496E	Oritori	1,476	Landing on the seafloor
9:25	24-51.485N	123-50.496E	Oritori	1,476	Re-creation of the blue smoker using LED light
9:50	24-51.493N	123-50.450E	C-1	1,483	Re-creation of the blue smoker using LED light
10:21	24-51.493N	123-50.450E	C-1	1,483	Sampling fluid from clear smoker using vacuum sampler (D873-
10:27	24-51.493N	123-50.450E	C-1	1,483	Sampling fluid from clear smoker using vacuum sampler (D873-
10:33	24-51.501N	123-50.466E	C-3	1,472	Re-creation of the blue smoker using LED light
11:00	24-51.501N	123-50.466E	C-3	1,472	Sampling fluid from clear smoker using vacuum sampler (D873-
11:14	24-51.510N	123-50.467E	C-2	1,472	Sampling fluid from Paralvinella colony using Bag sampler (D873-BW)
11:51	24-51.510N	123-50.467E	C-2	1,472	Sampling Paralvinella colony (D873-B1 and B7) with chinmey (D873-R1)
12:05	24-51.521N	123-50.467E	189-1	1,477	Sampling fluid from clear smoker using vacuum sampler (D873-
12:14	24-51.521N	123-50.467E	189-1	1,477	Sampling fluid from Galatheidae colony using WHATS (D873-W1, W2, W3, and W4)
12:53	24-51.521N	123-50.467E	189-1	1,477	Sampling Galatheidae (D873-B5 and B6)
12:58	24-51.521N	123-50.467E	189-1	1,477	Sampling sulfide (D873-R2 and R3)
13:56	24-51.620N	123-50.383E		1,473	Leaving the seafloor
14:35					Coming to the surface
14:47					Recovery

- Appendix

- List of sampling points

Site	Latitude	Longitude	Depth (m)	Max Temp. (deg. C)	Note
C-1	24-51.493N	123-50.460E	1,480	180.3	Clear smoker (Ese-gekiatsu, 59)
C-2	24-51.502N	123-50.471E	1,474	324.7	6K Marker, Paralvinella, Galatheidae, Bathymodiolus (EseEse-gekiatsu, 60)
C-3	24-51.501N	123-50.466E	1,472	327.5	Clear smoker (Shin-gekiatsu)
189-1	24-51.516N	123-50.483E	1,475		Pole, Galatheidae, Bathymodiolus (Geokiatsu, 58)
Oritori	24-51.486N	123-50.512E	1,475	301.4	E2, Galatheidae, Bathymodiolus
Chura	24-51.594N	123-50.392E	1,504	232.5	Clear smoker, Galatheidae, Bathymodiolus



- List of water samples

Date	Sample No.	Latitude	Longitude	Site	Depth (m)	Ave. Temp. (deg. C)	Note
2008.7.7	D866-W1	24-51.498N	123-50.479E	C-2	1,474	6.4 ± 0.9	*Paralvinella*
	D866-W2	24-51.498N	123-50.479E	C-2	1,474	11.6 ± 4.9	*Paralvinella*
	D866-W3	24-51.498N	123-50.479E	C-2	1,474	130 ± 92	Clear smoker
	D866-W4	24-51.498N	123-50.479E	C-2	1,474	296 ± 40	Clear smoker
	D866-BW	24-51.498N	123-50.479E	C-2	1,474		*Paralvinella*
	D866-FW	24-51.498N	123-50.479E	C-2	1,474		*Paralvinella*
	D866-N1	24-51.511N	123-50.485E		1,407		Seawater
	D866-N2	24-51.508N	123-50.490E		1,350		Seawater
	D867-W1	24-51.501N	123-50.476E	C-2	1,470	4.9 ± 0.7	*Paralvinella*
	D867-W2	24-51.501N	123-50.476E	C-2	1,470	6.3 ± 0.3	*Paralvinella*
	D867-V1	24-51.501N	123-50.476E	C-2	1,470		Clear smoker
	D867-BW	24-51.501N	123-50.476E	C-2	1,470		*Paralvinella*
	D867-FW	24-51.501N	123-50.476E	C-2	1,470		*Paralvinella*
	D867-N1	24-51.492N	123-50.468E		1,440		Seawater
	D867-N2	24-51.497N	123-50.463E		1,423		Seawater
2008.7.9	D869-W1	24-51.514N	123-50.468E	Oritori	1,475	5.8 ± 1.0	*Paralvinella*
	D869-W2	24-51.514N	123-50.468E	Oritori	1,475	5.8 ± 1.0	*Paralvinella*
	D869-W3	24-51.514N	123-50.468E	Oritori	1,475	5.8 ± 1.0	*Paralvinella*
	D869-W4	24-51.514N	123-50.468E	Oritori	1,475	5.8 ± 1.0	*Paralvinella*
	D869-V1	24-51.480N	123-50.503E	Oritori	1,478	297.9 ± 8.0	Clear smoker
	D869-V2	24-51.480N	123-50.503E	Oritori	1,478		Clear smoker
	D869-BW	24-51.480N	123-50.503E	Oritori	1,479		*Bathymodiolus*
	D869-N1	24-51.514N	123-50.468E		1,450		Seawater
	D869-N2	24-51.514N	123-50.468E		1,450		Seawater
	D870-W1	24-51.505N	123-50.483E	C-2	1,475		*Galatheidae*
	D870-W2	24-51.505N	123-50.483E	C-2	1,475		*Galatheidae*
	D870-W3	24-51.468N	123-50.515E	Oritori	1,479	7.1 ± 0.9	*Bathymodiolus*
	D870-W4	24-51.468N	123-50.515E	Oritori	1,479	8.2 ± 0.9	*Bathymodiolus*
	D870-BW	24-51.505N	123-50.483E	C-2	1,475		*Galatheidae*
	D870-N1	24-51.486N	123-50.508E		1,460		Seawater
	D870-N2	24-51.486N	123-50.508E		1,390		Seawater

- List of water samples (*continued*)

Date	Sample No.	Latitude	Longitude	Site	Depth (m)	Ave. Temp. (deg. C)	Note
2008.7.10	D871-W1	24-51.594N	123-50.392E	Chura	1,504	117 ± 76	Clear smoker
	D871-W2	24-51.594N	123-50.392E	Chura	1,504	196 ± 22	Clear smoker
	D871-W3	24-51.594N	123-50.392E	Chura	1,504	100 ± 61	Clear smoker
	D871-W4	24-51.594N	123-50.392E	Chura	1,504	91 ± 23	Clear smoker
	D871-V1	24-51.609N	123-50.350E		1,452		Bottom seawater
	D871-V2	24-51.609N	123-50.350E		1,452		Bottom seawater
	D871-BW	24-51.592N	123-50.400E	Chura	1,507		*Galatheidae*
	D871-FW	24-51.592N	123-50.400E	Chura	1,507		*Galatheidae*
	D871-N1	24-51.615N	123-50.334E		1,400		Seawater
	D871-N2	24-51.615N	123-50.334E		1,400		Seawater
	D872-W1	24-51.522N	123-50.467E	189-1	1,476		Clear smoker
	D872-W2	24-51.522N	123-50.467E	189-1	1,476		Clear smoker
	D872-W3	24-51.489N	123-50.504E	Oritori	1,479		*Bathymodiolus*
	D872-W4	24-51.489N	123-50.504E	Oritori	1,479		*Bathymodiolus*
	D872-V1	24-51.512N	123-50.477E	C-2	1,474	71 ± 13	Clear smoker
	D872-BW	24-51.489N	123-50.504E	Oritori	1,479		Bathymodiolus
	D872-FW	24-51.489N	123-50.504E	Oritori	1,479		Bathymodiolus
	D872-N1	24-51.489N	123-50.504E		1,475		Seawater
	D872-N2	24-51.482N	123-50.547E		1,370		Seawater
2008.7.11	D873-W1	24-51.521N	123-50.467E	189-1	1,477		*Galatheidae*
	D873-W2	24-51.521N	123-50.467E	189-1	1,477		*Galatheidae*
	D873-W3	24-51.521N	123-50.467E	189-1	1,477		*Galatheidae*
	D873-W4	24-51.521N	123-50.467E	189-1	1,477		*Galatheidae*
	D873-V1	24-51.493N	123-50.450E	C-1	1,483	131 ±53	Clear smoker
	D873-V2	24-51.493N	123-50.450E	C-1	1,483		Clear smoker
	D873-V3	24-51.501N	123-50.466E	C-3	1,472		Clear smoker
	D873-V4	24-51.521N	123-50.467E	189-1	1,477		Clear smoker
	D873-BW	24-51.510N	123-50.467E	C-2	1,472		*Paralvinella*
	D873-N1	24-51.499N	123-50.492E		1,340		Seawater
	D873-N2	24-51.499N	123-50.492E		1,360		Seawater

- List of rock samples

Date	Sample No.	Latitude	Longitude	Site	Depth (m)	Note
2008.7.7	D866-R1	24-51.498N	123-50.479E	C-2	1,474	active chimney
	D867-R1	24-51.501N	123-50.476E	C-2	1,470	sulfide
	D867-R2	24-51.501N	123-50.476E	C-2	1,470	sulfide, anhydrite
2008.7.9	D869-R1	24-51.480N	123-50.503E	Oritori	1,478	anhydrite chimney
	D870-R1	24-51.474N	123-50.512E	Oritori	1,479	dead chimney
2008.7.10	D871-R1	24-51.594N	123-50.392E	Chura	1,504	sulfide chimney including pyrite
	D872-R1	24-51.522N	123-50.467E	189-1	1,476	anhydrite chimney
2008.7.11	D873-R1	24-51.510N	123-50.467E	C-2	1,472	covered by Paralvinella
	D873-R2	24-51.521N	123-50.467E	189-1	1,478	sulfide with Galatheidae
	D873-R3	24-51.521N	123-50.467E	189-1	1,478	sulfide without Galatheidae

- List of biological samples

Date	Sample No.	Latitude	Longitude	Site	Depth (m)	Note
2008.7.7	D866-B1	24-51.498N	123-50.479E	C-2	1,474	*Paralvinella* sp.
	D866-B2	24-51.498N	123-50.479E	C-2	1,474	*Alvinocaris* spp.
	D866-B3	24-51.498N	123-50.479E	C-2	1,474	Monacanthidae
	D867-B1	24-51.501N	123-50.476E	C-2	1,470	*Alvinocaris* spp.
	D867-B2	24-51.501N	123-50.476E	C-2	1,470	*Lepetodrilus* sp.
2008.7.9	D869-B1	24-51.480N	123-50.503E	Oritori	1,479	*Shinkaia crosnieri*
	D869-B2	24-51.480N	123-50.503E	Oritori	1,479	*Alvinocaris* spp.
	D869-B3	24-51.480N	123-50.503E	Oritori	1,479	*Bathymodiolus* sp.
	D870-B1	24-51.497N	123-50.489E	C-2	1,473	*Shinkaia crosnieri*
	D870-B2	24-51.497N	123-50.489E	C-2	1,473	*Alvinocaris* spp.
	D870-B3	24-51.497N	123-50.489E	C-2	1,473	*Lepetodrilus* sp.
	D870-B4	24-51.497N	123-50.489E	C-2	1,473	*Provanna* sp.
	D870-B5	24-51.474N	123-50.512E	Oritori	1,479	Porifera
2008.7.10	D871-B1	24-51.594N	123-50.392E	Chura	1,504	*Lepetodrilus* sp.
	D871-B2	24-51.594N	123-50.392E	Chura	1,504	*Provanna* sp.
	D871-B3	24-51.594N	123-50.392E	Chura	1,504	*Provanna* sp.
	D871-B4	24-51.594N	123-50.392E	Chura	1,504	*Paralvinella* sp.
	D872-B1	24-51.522N	123-50.467E	189-1	1,476	*Paralvinella* sp.
	D872-B2	24-51.522N	123-50.467E	189-1	1,476	*Lepetodrilus* sp.
	D872-B3	24-51.522N	123-50.467E	189-1	1,476	*Provanna* sp.
2008.7.11	D873-B1	24-51.510N	123-50.467E	C-2	1,472	*Paralvinella* sp.
	D873-B2	24-51.521N	123-50.467E	189-1	1,478	*Alvinocaris* spp.
	D873-B3	24-51.521N	123-50.467E	189-1	1,478	Polynoidae gen.
	D873-B4	24-51.521N	123-50.467E	189-1	1,478	*Shinkaia crosnieri*

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NT08-13 Science Party