doi : 10.17596/0002751

RV Kaimei Cruise Report

KM16-04

Operation training of the ROV Hyper-Dolphin and ROV KM-ROV

Off Hatsushima, Izu-Ogasawara, and Suruga Bay

June, 30th-July, 5th, 2016

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

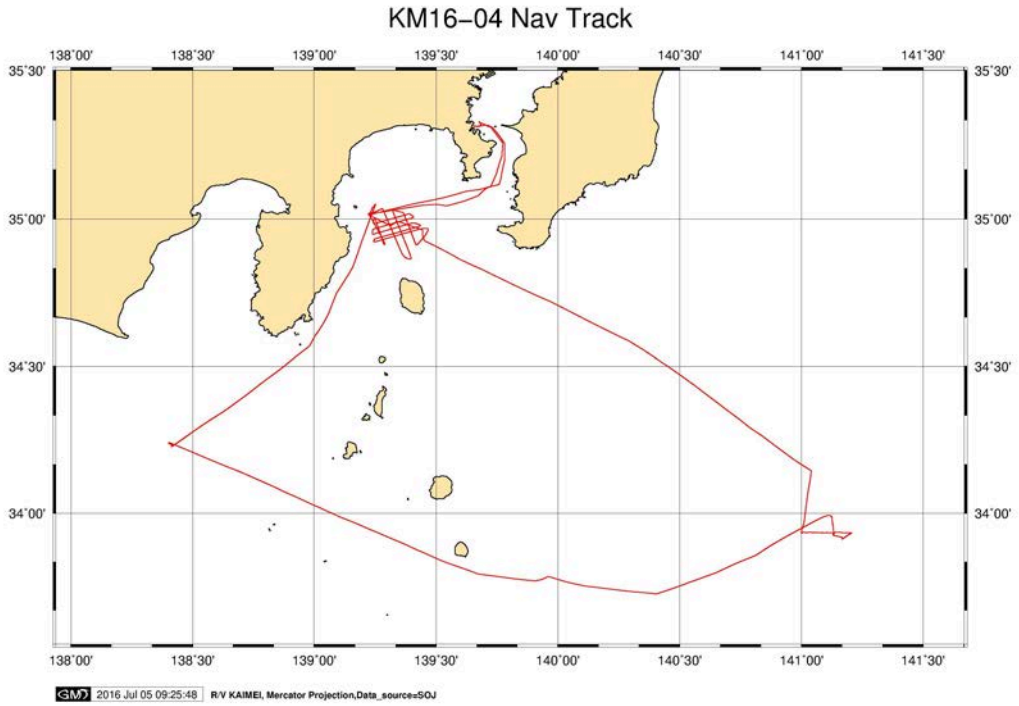
Contents

Acknowledgements

We are grateful to Captain Mr. Satoshi Susami, Chief Officer Mr. Tatsuo Adachi, Chief Engineer Mr. Kazuhiko Kaneda, and Chief Radio Operator Mr. Yoichi Inoue for their safe navigation and their skillful handling of "R/V Kaimei". Great thanks are due to Commander Mr. Tomoe Kondo and "Hyper-Dolphin/KM-ROV" operation team for their operations in sampling. We also thank Mr Mitsuteru Kuno, Mr. Toshimasa Nasu, and Mr. Kouichi Inagaki in Nippon Marine Enterprises, Ltd., for their attentive supports. Finally, we would like to appreciate all the person who supported directly or indirectly this cruise.

1. Cruise Information

1) Cruise ID, Name of Vessel: KM16-04 R/V Kaimei
2) Title of the Cruise: “Operation training of ROV Hyper-Dolphin and ROV KM-ROV”
3) Cruise Period: June 30, 2016 ~ July 5, 2016
4) Port Call: from JAMSTEC (June 30, 2016) to JAMSTEC (July 5, 2016)
5) Research Area: Off Hatsushima, Izu-Ogasawara, and Suruga Bay



Cruise track of R/V Kaimei (KM16-04)

6) Cruise Log (JST)

日付 Date	時間 Local Time	内容 Note	特記事項 Description	本船位置／気象／海象 Position/Weather/Wind/Sea condition
30-Jun-16		**Sail out & started KM16-04 and HPD dive #1991.**		6/30 12:00 (JST)
	09:00	Let go all shore line & left YOKOSUKA for research area.	SAGAMI BAY	OFF East HATSUSHIMA
	10:00-10:45	Carried out education and training for scientist.		35-02.2'N、139-20.0'E
	12:10	Arrived at research area.	OFF HATSUSHIMA	Overcast
	12:13	Released XBT.		SSW-2(Light breeze)
	14:04	Hoisted up HPD.		1(Calm)
	14:27	Launched HPD then it dove and com'ced her operation.	Dive No.1992	1(Low swell sea)
	15:01	HPD landed on the sea bottom.	Depth = 907m	Visibly: 6'
	16:17	HPD left the sea bottom.	Depth = 857m	
	16:53	Hoisted up HPD		
	16:59	Recovered HPD and finished avobe operation.		
	17:20-17:40	Carried out KONPIRA prey.		
	17:30	Com'ced proceeded to next dive point.	IZU OGASAWARA	
	18:30-18:45	Scientist meeting.		
01-Jul-16		**HPD dive ＃1992**		7/1 12:00 (JST)
	05:50	Arrived at research area.	IZU OGASAWARA	OFF East MIKURAJIMA
	05:54	Released XBT.		33-57.4'N、141-04.8'E
	06:19-07:27	Carried out MBES mapping survey.		Mist
	09:40	Hoisted up HPD.		WSW-3(Gentle Breeze)

	10:04	Launched HPD then it dove and com'ced her operation.	Dive No.1993	2(Sea smooth)
	12:21	HPD landed on the sea bottom.	Depth = 4,407m	1(Low swell sea)
	14:17	HPD left the sea bottom.	Depth = 4,412m	Visibly: 2'
	16:36	Hoisted up HPD.		
	16:41	Recovered HPD and finished avobe operation.		
	17:00	Com'ced proceeded to next dive point.	OFF HATSUSHIMA	
	18:30-18:45	Scientist meeting.		
02-Jul-16		**KM-ROV dive #15**		7/2 12:00 (JST)
	06:50	Arrived at research area.	OFF SURUGA BAY	OFF South OMAEZAKI
	06:55	Released XBT.		34-14.0'N、138-25.0'E
	09:24	Hoisted up KM-ROV.		Fine but cloudy
	09:38	Launched KM-ROV then it dove and com'ced her operation.	Dive No.15	WSW-4(Moderate breeze)
	11:27	KM-ROV landed on the sea bottom.	Depth = 2,992m	3(Sea slight)
	13:22	KM-ROV left the sea bottom.	Depth = 2,989m	1(Low swell sea)
	15:29	Hoisted up KM-ROV.		Visibly: 5'
	15:40	Recovered KM-ROV and finished avobe operation.		
	16:30-22:40	Carried out proceeded to next dive point.	OFF HATSUSHIMA	
	18:30-18:45	Scientist meeting.		
03-Jul-16		**KM-ROV dive #16 & #17**		7/3 12:00 (JST)
	08:24	Hoisted up KM-ROV.		OFF South-East HATSUSHIMA
	08:42	Launched KM-ROV then it dove and com'ced her operation.	Dive No.16	35-01.0'N、139-13.3'E
	09:23	KM-ROV landed on the sea bottom.	Depth = 880m	Fine but cloudy
	11:19	KM-ROV left the sea bottom.	Depth = 863m	SW-6(Strong breeze)
	11:54	Hoisted up KM-ROV.		4(Sea moderate)
	12:04	Recovered KM-ROV and finished avobe operation.		1(Low swell sea)

	13:32	Hoisted up KM-ROV.		Visibly: 7'
	13:44	Launched KM-ROV then it dove and com'ced her operation.	Dive No.17	
	14:20	KM-ROV landed on the sea bottom.	Depth = 868m	
	15:45	KM-ROV left the sea bottom.	Depth = 862m	
	16:14	Hoisted up KM-ROV.		
	16:21	Recovered KM-ROV and finished avobe operation.		
	17:19	Com'ced SBP survey.		
	19:00-19:15	Scientist meeting.		
04-Jul-16		**KM-ROV dive #18**		7/4 12:00 (JST)
	04:59	Finished SBP survey.		OFF South-East HATSUSHIMA
	08:15	Hoisted up KM-ROV.		35-01.0'N、139-13.3'E
	08:25	Launched KM-ROV then it dove and com'ced her operation.		Fine but cloudy
	09:02	KM-ROV landed on the sea bottom.	Dive No.18	South-2(light breeze)
	10:50	KM-ROV left the sea bottom.	Depth = 876m	1(Calm)
	11:22	Hoisted up KM-ROV.	Depth = 864m	1(Low swell sea)
	11:30	Recovered KM-ROV and finished avobe operation.		Visibly: 7'
	14:15-15:48	Carried out SBP survey.		
	16:00	Left research area for YOKOSUKA.		
	16:30-16:45	Scientist meeting.		
05-Jul-16		**Disembarkation scientist group & completed KM16-04.**		
	09:00	Arrived at the JAMSTEC. Then completed KM16-04.		

2. Participants List

Principal Investigator

Kazuki Iijima
Marine Technology and Engineering Center
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Onboard Researchers

Masahiko Ida
Marine Technology and Engineering Center
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Tetsuji Maki
Marine Technology and Engineering Center
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Tsuyoshi Miyazaki
Marine Technology and Engineering Center
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Takao Yoshida
Department of Marine Biodiversity Research
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Yuichi Nogi
Research and Development Center for Marine Biosciences
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Hideaki Matchiyama
Research and Development Center for Submarine Resources
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Hiroyasu Monnma
Research and Development Center for Ocean Drilling Science
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Yoshihiro Takaki
Department of Subsurface Geobiological Analysis and Research
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Chong Chen
Department of Subsurface Geobiological Analysis and Research
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Yoko Chiba
Department of Subsurface Geobiological Analysis and Research
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Hideki Sezoko
Nippon Marine Enterprises, LTD.

Marine Technician

Mitsuteru Kuno
Nippon Marine Enterprises, LTD.

Toshimasa Nasu
Nippon Marine Enterprises, LTD.

Kouichi Inagaki
Nippon Marine Enterprises, LTD.

ROV HYPER DOLPHIN and KM ROV Team

Operation Manager	KONDO TOMOE
Operation Manager	SAKURAI TOSHIAKI

1st ROV Operator	ONO YOSHINARI
1st ROV Operator	MIURA ATSUMORI
2nd ROV Operator	KIDO TEPPEI
2nd ROV Operator	KIKUYA SHIGERU
2nd ROV Operator	TAKENOUCHI ATSUSHI
2nd ROV Operator	KATAGIRI MASAYA
3rd ROV Operator	KUMAGAI SHINOSUKE

R/V Kaimei Crew Member

Captain	SUSAMI SATOSHI
Chief Officer	ADACHI TATSUO
2nd Officer	MIYAKE KAZUKI
3rd Officer	SUZUKI AKIRA
Chief Engineer	KANEDA KAZUHIKO
1st Engineer	KATO KENZO
2nd Engineer	MORI TAKAHIRO
3rd Engineer	IKEGUCHI KENTA
Chief Radio Operator	INOUE YOICHI
2nd Radio Operator	ISHIWATA HIROKI
3rd Radio Operator	SHIROZUME TAKATOMO
Boat Swain	OHATA MASANORI
Able Seaman	YOSHINO YUKI
Able Seaman	HIRAI SAIKAN
Able Seaman	ABE SHUN
Able Seaman	NAKANISHI TORU
Sailor	SUZUKI SHO
Sailor	NASU KENTA
No.1 Oiler	IKEDA TOSHIKAZU
Oiler	FUNAWATARI KEITA
Oiler	MISAGO SOTA
Oiler	KOZAKI MAKOTO
Chief Steward	TAKEMURA RYUEI
Steward	TANAKA SHINSUKE

Steward	ABE TAKAHIRO
Steward	SONODA KAZUMA

3. Overview of the cruise

Operation training and performance check of ROV Hyper-Dolphin and ROV KM-ROV in R/V Kaimei were main propose of this cruise. We had two dives of ROV Hyper-Dolphin and four dives of ROV KM-ROV at Off Hatsushima in Sagami Bay, Izu-Ogasawara area, and Off Suruga Bay. In this cruise, several scientists participated to this cruise. The research subjects of scientists were environmental, physiological, biochemical, chemical, and molecular-biological studies of cold seep-specific organisms, and sediments, and topographic servey of sea floor. During dives, we collect samples, e.g., deep-sea mussels, vesicomyid clams, sediments, and so on. Bivelves were kept alive and brought back to JAMSTEC. Detailed analyses of samples will be performed after the cruise.

4. Dive report

1) Summary of the Hyper-dolphin Dive #1992

Date: June 30, 2016
Site: Off Hatsushima, Sagami Bay
Landing: 35°00.940'N, 139°13.384'E, 907m (15:01)
Leaving: 35°00.953'N, 139°13.324'E, 857m (16:17)

Purpose:
Operation training of ROV Hyper-Dolphin on R/V Kaimei and sample collection

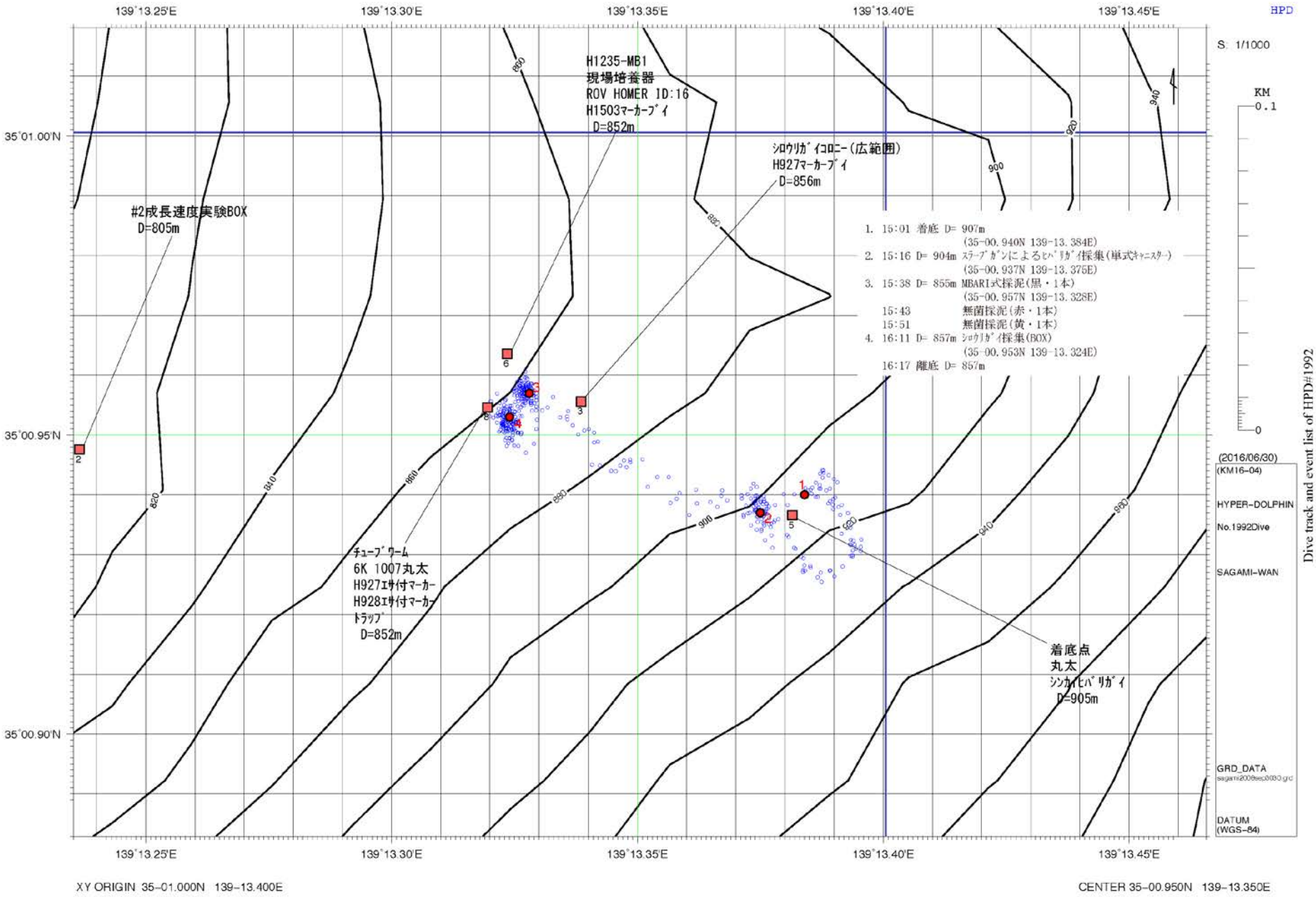
Payload Equipment:
Suction sampler (single canister)
Scoop sampler x1
Sample box x1
MBARI core x1
Sterilizing mud sampler X2

Dive Summary

‡ Sampling of Bathymodiolus mussels with a suction sampler.
The sampling site location 35°00.937'N, 139°13.375'E, 904m

‡ Sampling of sediments with MBARI core and sterilizing mud sampler.
The sampling site location 35°00.957'N, 139°13.328'E, 855m

‡ Sampling of *Calyptogena* clams with a scoop sampler.
The sampling site location 35°00.953'N, 139°13.324'E, 857m



Dive track and event list of HPD#1992

2) Summary of the Hyper-dolphin Dive #1993

Date: July 1, 2016
Site: Izu-Ogasawara
Landing: 33°57.463’N, 141°07.820’E, 4407m (12:21)
Leaving: 33°57.411’N, 141°07.818’E, 4412m (14:17)

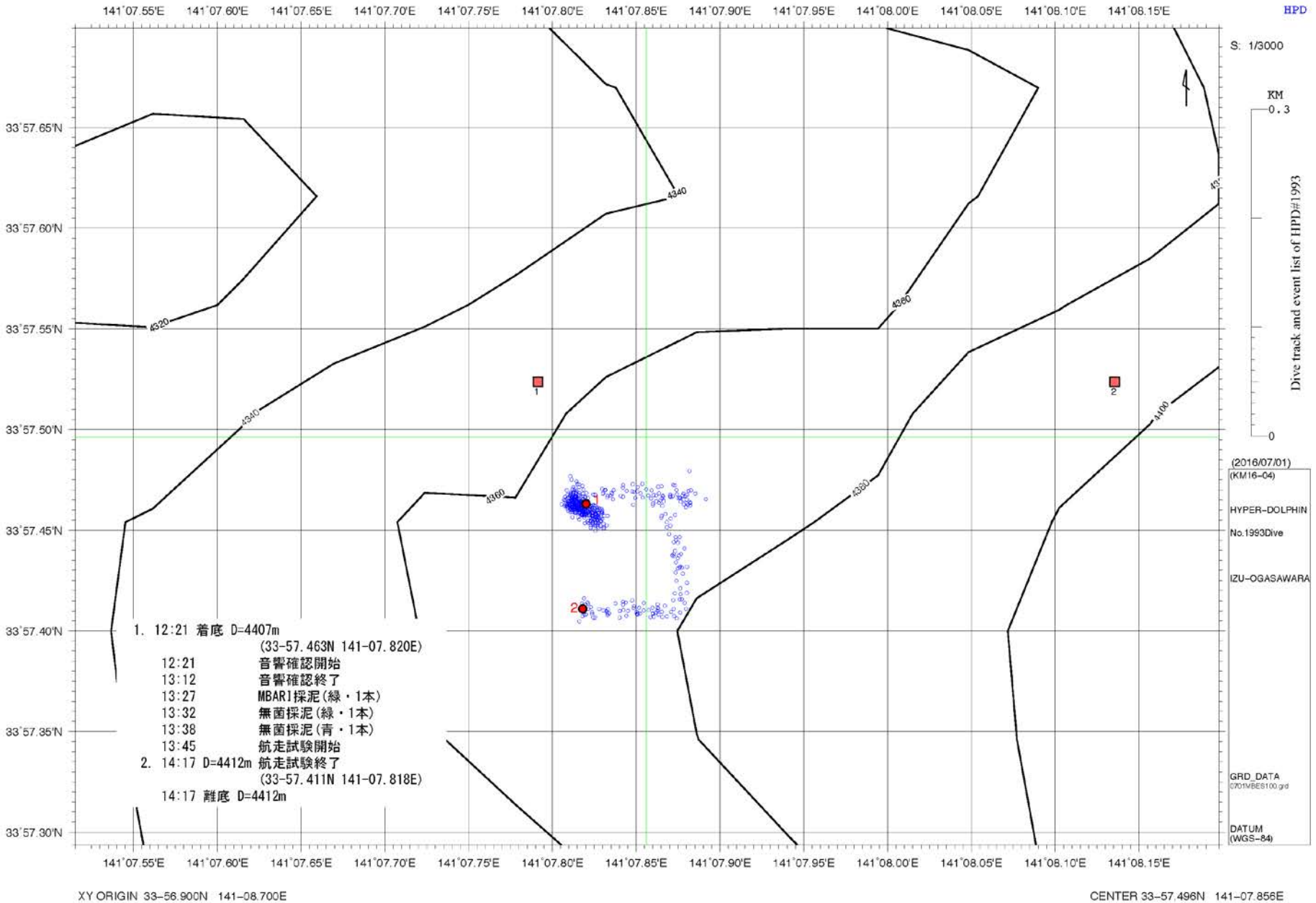
Purpose:
Operation training of ROV Hyper-Dolphin on R/V Kaimei and sample collection

Payload Equipment:
MBARI core x1
Sterilizing mud sampler X2

Dive Summary

‡ Test of acoustic positioning system in ROV
Site location 33°57.463’N, 141°07.820’E, 4407m

‡ Sampling of sediments with sterilizing mud sampler.
The sampling site location 33°57.463’N, 141°07.820’E, 4407m


HPD
S: 1/3000
KM
0.3
0
Dive track and event list of HPD#1993
(2016/07/01)
(KM16-04)
HYPER-DOLPHIN
No.1993Dive
IZU-OGASAWARA
GRD_DATA
0701MBES100.grd
DATUM
(WGS-84)
141°07.55'E
141°07.60'E
141°07.65'E
141°07.70'E
141°07.75'E
141°07.80'E
141°07.85'E
141°07.90'E
141°07.95'E
141°08.00'E
141°08.05'E
141°08.10'E
141°08.15'E
33°57.65'N
33°57.60'N
33°57.55'N
33°57.50'N
33°57.45'N
33°57.40'N
33°57.35'N
33°57.30'N
4320
4340
4360
4380
4400
1
2
1. 12:21 着底 D=4407m
(33-57.463N 141-07.820E)
12:21 音響確認開始
13:12 音響確認終了
13:27 MBAR1採泥(緑・1本)
13:32 無菌採泥(緑・1本)
13:38 無菌採泥(青・1本)
13:45 航走試験開始
2. 14:17 D=4412m 航走試験終了
(33-57.411N 141-07.818E)
14:17 離底 D=4412m
XY ORIGIN 33-56.900N 141-08.700E
CENTER 33-57.496N 141-07.856E

3) Summary of the KM-ROV Dive #15

Date: July 2, 2016
Site: Suruga Bay
Landing: 34°13.947’N, 138°24.968’E, 2992m (11:27)
Leaving: 34°13.947’N, 138°24.968’E, 2989m (13:22)

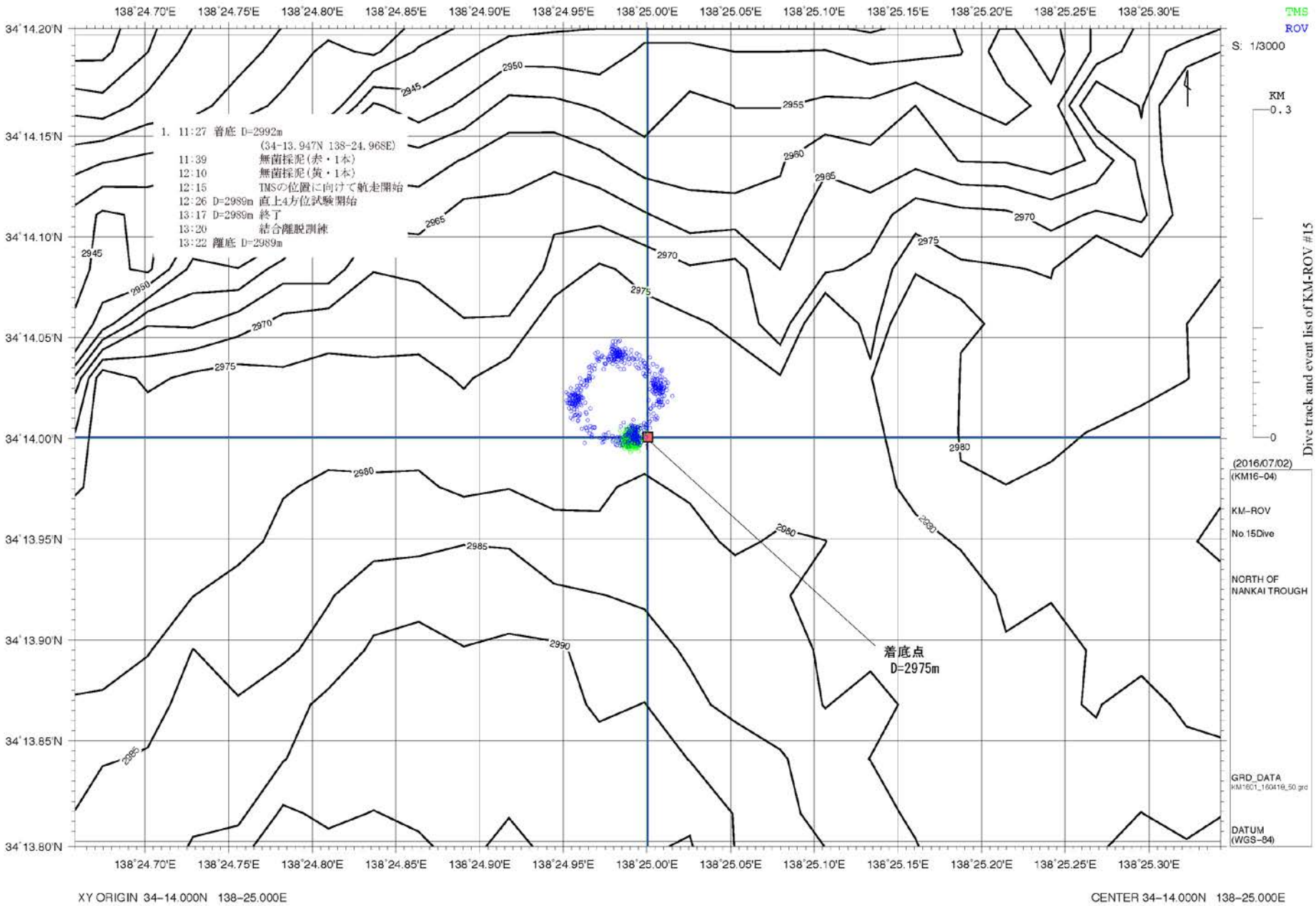
Purpose:
Operation training of ROV KM-ROV on R/V Kaimei and sample collection

Payload Equipment:
Sterilizing mud sampler X2

Dive Summary

‡ Sampling of sediments with sterilizing mud sampler.
The sampling site location 34°13.947’N, 138°24.968’E, 2992m

‡ Training of separation and connection of ROV via TMS


TMS
ROV
S: 1/3000
KM
0.3
0
1. 11:27 着底 D=2992m
(34-13.947N 138-24.968E)
11:39 無菌採泥(赤・1本)
12:10 無菌採泥(黄・1本)
12:15 TMSの位置に向けて航走開始
12:26 D=2989m 直上4方位試験開始
13:17 D=2989m 終了
13:20 結合離脱訓練
13:22 離底 D=2989m
着底点
D=2975m
(2016/07/02)
(KM16-04)
KM-ROV
No.15Dive
NORTH OF
NANKAI TROUGH
GRD_DATA
KM1601_160419_50.grd
DATUM
(WGS-84)
Dive track and event list of KM-ROV #15
XY ORIGIN 34-14.000N 138-25.000E
CENTER 34-14.000N 138-25.000E

4) Summary of the KM-ROV Dive #16

Date: July 3, 2016
Site: Off Hatsushima, Sagami Bay
Landing: 35°00.952'N, 139°13.371'E, 880m (9:23)
Leaving: 35°00.948'N, 139°13.336'E, 863m (11:19)

Purpose:
Operation training of ROV KM-ROV on R/V Kaimei and sample collection

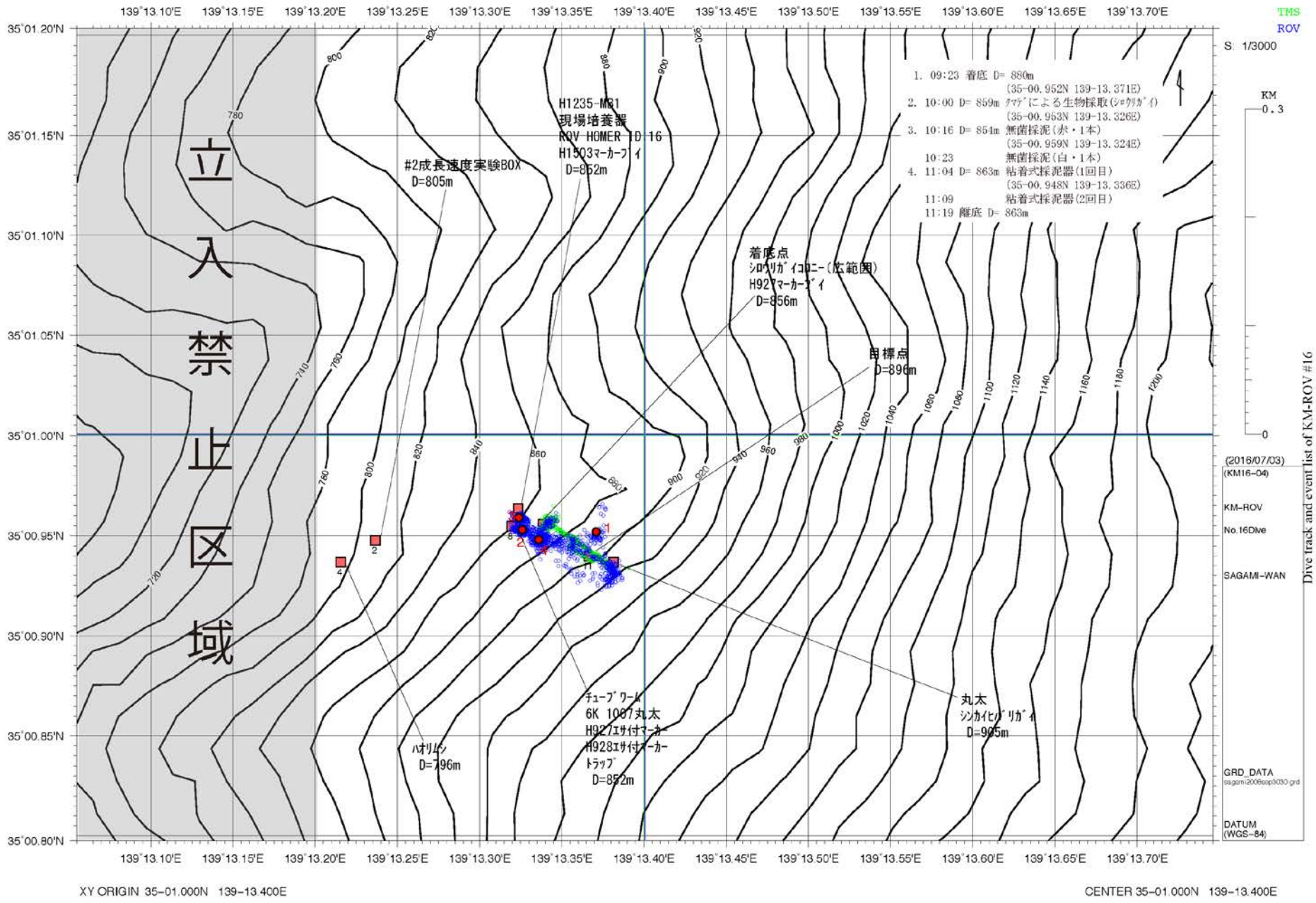
Payload Equipment:
Scoop sampler x1
Sample box x1
Monnma mud sampler X1
Sterilizing mud sampler X2

Dive Summary

‡ Sampling of *Calyptogena* clams with a scoop sampler.
The sampling site location 35°00.953'N, 139°13.326'E, 859m

‡ Sampling of sediments with sterilizing mud sampler.
The sampling site location 35°00.959'N, 139°13.324'E, 854m

‡ Sampling test of sediments with Monnma mud sampler.
The sampling site location 35°00.948'N, 139°13.336'E, 863m


TMS
ROV
S: 1/3000
1. 09:23 着底 D= 880m
(35-00.952N 139-13.371E)
2. 10:00 D= 859m ｸﾏﾃﾞによる生物採取(ｼｮｳﾘｶﾞｲ)
(35-00.953N 139-13.326E)
3. 10:16 D= 854m 無菌採泥(赤・1本)
(35-00.959N 139-13.324E)
10:23 無菌採泥(白・1本)
4. 11:04 D= 863m 粘着式採泥器(1回目)
(35-00.948N 139-13.336E)
11:09 粘着式採泥器(2回目)
11:19 離底 D= 863m
H1235-M81
現場培養器
ROV HOMER ID-16
H1503ﾏｰｶｰﾌﾞｲ
D=852m
#2成長速度実験BOX
D=805m
着底点
ｼﾛｳﾘｶﾞｲｺﾛﾆｰ(広範囲)
H927ﾏｰｶｰﾌﾞｲ
D=856m
目標点
D=896m
立入禁止区域
ﾁｭｰﾌﾞﾜｰﾑ
6K 1007丸太
H927ｴｻｲﾄﾞﾏｰｶｰ
H928ｴｻｲﾄﾞﾏｰｶｰ
ﾄﾗｯﾌﾟ
D=852m
ﾊｵﾘﾑｼ
D=796m
丸太
ｼﾝｶｲﾋﾔｸﾘｶﾞｲ
D=905m
KM
0.3
0
(2016/07/03)
(KM16-04)
KM-ROV
No.16Dive
SAGAMI-WAN
GRD_DATA
sagami2006eop3030-grd
DATUM
(WGS-84)
Dive track and event list of KM-ROV #16
139°13.10'E
139°13.15'E
139°13.20'E
139°13.25'E
139°13.30'E
139°13.35'E
139°13.40'E
139°13.45'E
139°13.50'E
139°13.55'E
139°13.60'E
139°13.65'E
139°13.70'E
35°01.20'N
35°01.15'N
35°01.10'N
35°01.05'N
35°01.00'N
35°00.95'N
35°00.90'N
35°00.85'N
35°00.80'N
XY ORIGIN 35-01.000N 139-13.400E
CENTER 35-01.000N 139-13.400E

5) Summary of the KM-ROV Dive #17

Date: July 3, 2016
Site: Off Hatsushima, Sagami Bay
Landing: 35°00.971'N, 139°13.347'E, 868m (14:20)
Leaving: 35°00.948'N, 139°13.336'E, 862m (15:45)

Purpose:
Operation training of ROV KM-ROV on R/V Kaimei and sample collection

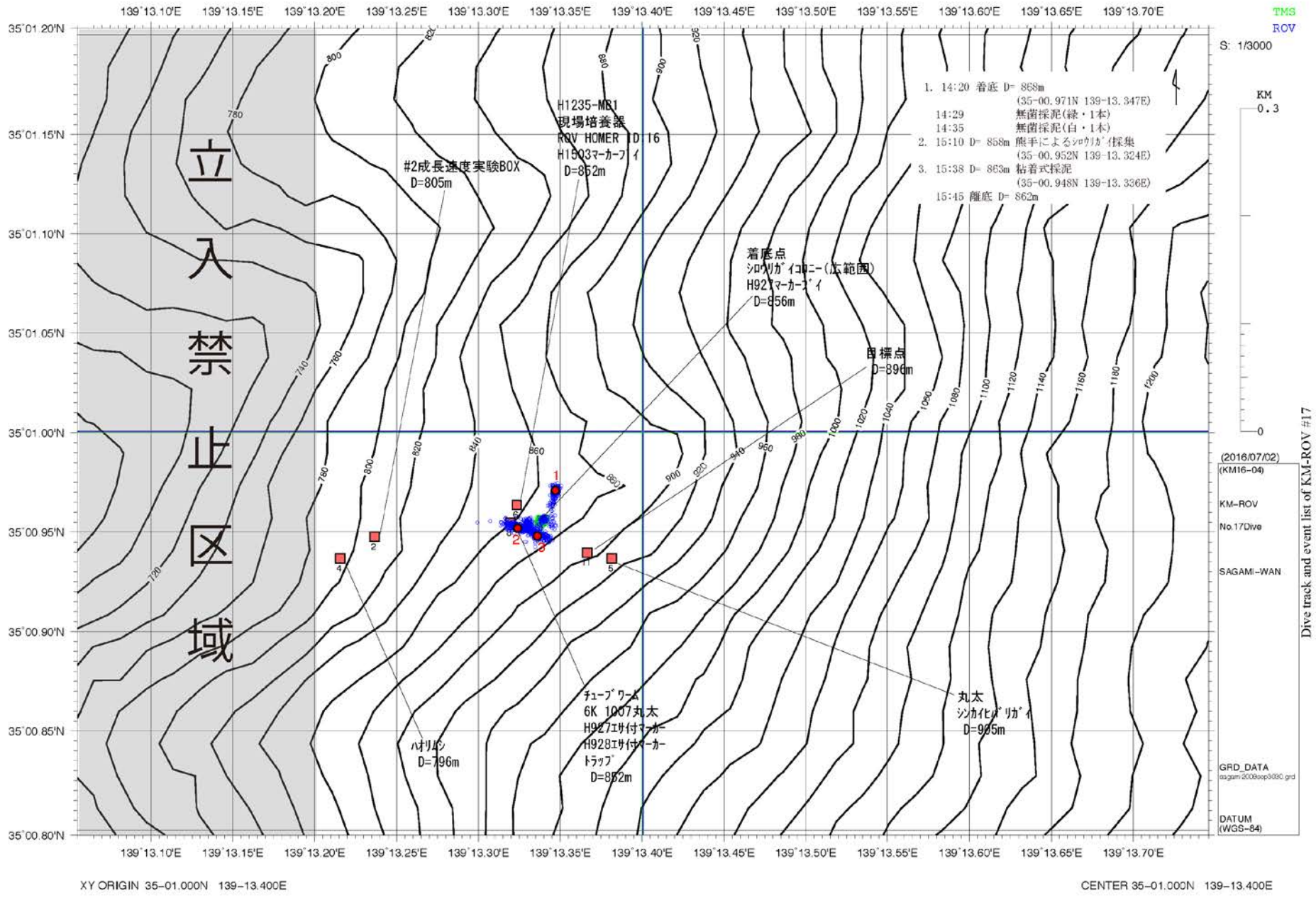
Payload Equipment:
Scoop sampler x1
Sample box x1
Monnma mud sampler X1
Sterilizing mud sampler X2

Dive Summary

‡ Sampling of sediments with sterilizing mud sampler.
The sampling site location 35°00.971'N, 139°13.347'E, 868m

‡ Sampling of *Calyptogena* clams with a scoop sampler.
The sampling site location 35°00.952'N, 139°13.324'E, 858m

‡ Sampling test of sediments with Monnma mud sampler.
The sampling site location 35°00.948'N, 139°13.336'E, 863m


139°13.10'E
139°13.15'E
139°13.20'E
139°13.25'E
139°13.30'E
139°13.35'E
139°13.40'E
139°13.45'E
139°13.50'E
139°13.55'E
139°13.60'E
139°13.65'E
139°13.70'E
35°01.20'N
35°01.15'N
35°01.10'N
35°01.05'N
35°01.00'N
35°00.95'N
35°00.90'N
35°00.85'N
35°00.80'N
TMS
ROV
S: 1/3000
KM
0.3
0
立入禁止区域
H1235-MB1
現場培養器
ROV HOMER ID 16
H1903マーカーブイ
D=852m
#2成長速度実験BOX
D=805m
着底点
シロウリガイコロニー(広範囲)
H927マーカーブイ
D=856m
固標点
D=896m
1. 14:20 着底 D= 868m
(35-00.971N 139-13.347E)
14:29 無菌採泥(緑・1本)
14:35 無菌採泥(白・1本)
2. 15:10 D= 858m 熊手によるシロウリガイ採集
(35-00.952N 139-13.324E)
3. 15:38 D= 863m 粘着式採泥
(35-00.948N 139-13.336E)
15:45 離底 D= 862m
チューブワーム
6K 1007丸太
H927エサ付マーカー
H928エサ付マーカー
トラップ
D=852m
ハオリムシ
D=796m
丸太
シンカイヒバリガイ
D=905m
(2016/07/02)
(KM16-04)
KM-ROV
No.17Dive
SAGAMI-WAN
GRD_DATA
sagami-2008oop303C.grd
DATUM
(WGS-84)
Dive track and event list of KM-ROV #17
XY ORIGIN 35-01.000N 139-13.400E
CENTER 35-01.000N 139-13.400E

6) Summary of the KM-ROV Dive #18

Date: July 4, 2016
Site: Off Hatsushima, Sagami Bay
Landing: 35°00.951'N, 139°13.369'E, 876m (9:02)
Leaving: 35°00.955'N, 139°13.375'E, 864m (10:50)

Purpose:
Operation training of ROV KM-ROV on R/V Kaimei and sample collection

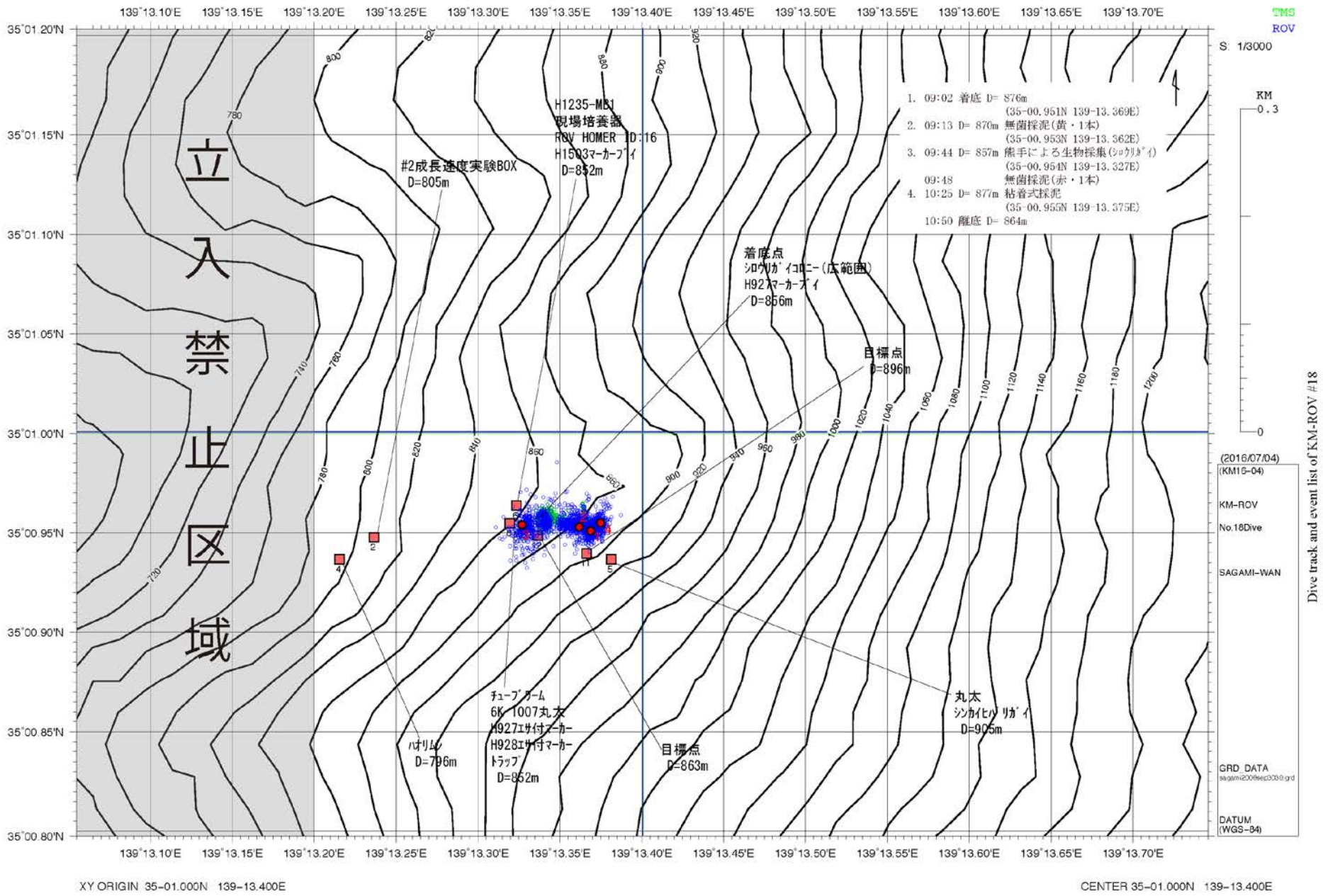
Payload Equipment:
Scoop sampler x1
Sample box x1
Monnma mud sampler X1
Sterilizing mud sampler X2

Dive Summary

‡ Sampling of sediments with sterilizing mud sampler.
The sampling site location 35°00.953'N, 139°13.362'E, 870m

‡ Sampling of *Calyptogena* clams with a scoop sampler.
The sampling site location 35°00.954'N, 139°13.327'E, 857m

‡ Sampling test of sediments with Monnma mud sampler.
The sampling site location 35°00.955'N, 139°13.375'E, 877m


TMS
ROV
S. 1/3000
KM
0.3
0
1. 09:02 着底 D= 876m
(35-00.951N 139-13.369E)
2. 09:13 D= 870m 無菌採泥(黄・1本)
(35-00.953N 139-13.362E)
3. 09:44 D= 857m 熊手による生物採集(ｼｮｸﾘﾙﾞｲ)
(35-00.954N 139-13.327E)
09:48 無菌採泥(赤・1本)
4. 10:25 D= 877m 粘着式採泥
(35-00.955N 139-13.375E)
10:50 離底 D= 864m
立入禁止区域
H1235-MB1
現場培養器
ROV HOMER ID:16
H1503ﾏｰｶｰﾌﾞｲ
D=852m
#2成長速度実験BOX
D=805m
着底点
ｼﾛｳﾘｶﾞｲｺﾛﾆｰ(広範囲)
H927ﾏｰｶｰﾌﾞｲ
D=856m
目標点
D=896m
ﾁｭｰﾌﾞﾌﾗｰﾑ
6K 1007丸太
H927ｴｻ付ﾏｰｶｰ
H928ｴｻ付ﾏｰｶｰ
ﾄﾗｯﾌﾟ
D=852m
ﾊﾅﾘﾑﾝ
D=796m
目標点
D=863m
丸太
ｼﾝｶｲﾋﾊﾞﾘｶﾞｲ
D=905m
(2016/07/04)
(KM16-04)
KM-ROV
No.18Dive
SAGAMI-WAN
GRD_DATA
sagami2009sep0030.grd
DATUM
(WGS-84)
Dive track and event list of KM-ROV #18
139°13.10'E
139°13.15'E
139°13.20'E
139°13.25'E
139°13.30'E
139°13.35'E
139°13.40'E
139°13.45'E
139°13.50'E
139°13.55'E
139°13.60'E
139°13.65'E
139°13.70'E
35°01.20'N
35°01.15'N
35°01.10'N
35°01.05'N
35°01.00'N
35°00.95'N
35°00.90'N
35°00.85'N
35°00.80'N
XY ORIGIN 35-01.000N 139-13.400E
CENTER 35-01.000N 139-13.400E

5. Preliminary research reports

1) The analysis of symbiosis between deep-sea bivalves and intracelluer symbiont.

Takao Yoshida (JAMSTEC), Kiyotaka Takishita (JAMSTEC), Akihiro Tame (JAMSTEC/Marine Works Japan, Ltd), and Tesuro Ikuta (JAMTEC)

Deep-sea bivalves, including *Calyptogena* spp. and *Bathymodiolus* spp, form dense communities on the deep sea floor near hydrothermal vents and seeps. These bivalves have vestigial digestive tracts and are nutritionally dependent on chemoautotrophic symbiotic bacteria, which are harbored within their gill epithelial cells. However, detailed symbiotic mechanisms are still unknown. To elucidate the symbiotic relationship between deep-sea bivalves and intracellular bacterial symbiont, we collected the *Calyptogena* clams and *Bathymodiolus* mussels.

Bathymodiolus mussels were collected at approximately 900 m site in Off Hatsushima. After collecting, we moved from 900m to 850m. At 850m site, *Calyptogena* clams were collected. After dive, the *Calyptogena* clams, and *Bathymodiolus* mussels were immediately dissected, and blood, serum, and other tissues were frozen and stored at -80ºC until used. Other samples were also stored at -80ºC. Gill of these bivalves were fixed in 4% paraformaldehyde in PBS, and stored at 4ºC or -20ºC. Other samples were keep in aquarium at 4ºC.

Future plan
*Analysis of expression of several genes in bivalves
*Analysis of metabolite of bivalves
Detailed analyses of these samples will be performed after the cruise.

2) Sterilizing mud sampler

Yuichi Nogi (JAMSTEC)

When searching for microorganism lives to a specific place in the deep-sea, it is necessary to prevent the microorganism being mixed other than the field setting. It is necessary to use the sterilized apparatus for that. It is necessary to prevent the microorganism from the outside being mixed during the round trip to the point. The device developed for that is a sterilizing mud sampler. This sampler uses the centrifuging tube of 50ml on the market. The part where the centrifuging tube was installed is sealed up, the pressure adjustment with the outside is done through the filter of 0.22μm, it is possible to gather it without mixing of the microorganism of other points.

ROV *Hyper-Dolphin* Dive #1992, two sediment sample were obtained at Area A in the deep methane seep site off Hatsushima, Sagami Bay (depth 855 m). These sample were taken on the rim of the *Calyptogena okutanii* clam colony, as close as possible to the active seepage area.

ROV *Hyper-Dolphin* Dive #1993, two sediment sample were obtained at Area C in the Izu-Ogasawara Trench (depth 4407 m). These samples were taken on the normal bottom.

KM-ROV Dive #15, two sediment sample were obtained at Area B in the Nankai Trough northern marginal part (depth 2992 m). These samples were taken on the sediment deposited on seabed.

KM-ROV Dive #16, two sediment sample were obtained at Area A in the deep methane seep site off Hatsushima, Sagami Bay (depth 854 m). These samples were taken on around the neighborhood of the *Calyptogena okutanii* clam colony.

KM-ROV Dive #17, two sediment sample were obtained at Area A in the deep methane seep site off Hatsushima, Sagami Bay (depth 868 m). These samples were taken on the sediment deposited on seabed.

KM-ROV Dive #18, two sediment sample were obtained at Area A in the deep methane seep site off Hatsushima, Sagami Bay. The samples were taken on the sediment deposited on seabed (depth 870 m) and in the *Calyptogena okutanii* clam colony (depth 857 m).

The samples were repackage into smaller sizes and stored at 4°C and container of

liquid nitrogen. After the cruise, useful bacteria isolated and genomic DNA will be extracted from the samples.

3) Cruise report in KM16-04

Yoshihiro Takaki (JAMSTEC)

Objective:

The bacterial epigenome is dynamic feature that changes during growth in response to external stimuli, and thereby facilitating adjustment to varying environmental conditions that controls gene exchange, transcription, and genome stability on a broad scale. Recently, several model proteobacteria, *Escherichia ecoli* and *Caulobacter crescentus*, is well studied in the control of the timing of the cell cycle and differentiation. However, less is known about the epigenetic regulation in the symbiosis. Thus the present study is an attempt at exploring symbiotic epigenomics using the next-generation sequencing technology.

Material and Methods

Two species of *Bathymodiolus* clam, *B. japonicus* and *B. platifrons,* was sampled from the 850 m deep methane seep site off Hatsushima, Sagami Bay during ROV *HyperDolphin* Dive #1992. Gill tissues from three individuals of each species were homogenized in Tris-HCl bufer (pH7.5) with xx mM EDTA. Symbiont cells in the suspension were collected by centrifuge and treated with DNaseI. The cells were stored at -80°C. After the cruise, genomic DNA of these samples will be extracted and used in the methylome analysis.

Future plan:

We have a plan to perform the single molecule real time (SMRT) DNA sequencing of symbiont genome. SMRT sequencing enables to identify the DNA modification along with methylation over genome. Furthermore, we study the biological significance of these modifications in the correlation between host and symbiont.

4) Megafauna Sampling

Chong Chen (JAMSTEC), and Yoko Chiba (JAMSTEC)

During the KM16-04 cruise, megafauna samples were obtained from a methane seep site (850 m deep) off Hatsushima, Sagami Bay on multiple ROV dives. During ROV *Hyper-Dolphin* dive #1992, specimens were collected using both slurp gun (with single canister) and kumade scoop. A kumade scoop was used for collections by *KAIMEI ROV* during dives #0016, #0017, and #0018. When kumade scoop was used, the samples were emptied into a watertight biobox with the lid tightly closed afterwards.

After recovery of the ROV on to the ship, the canister / sample box was immediately removed from ROV and brought to the wet lab (Lab. 3). There, the contents were washed on a 1 mm mesh and sorted to the lowest taxonomic level possible. The sorted specimens were preserved in 99% ethanol, 10% buffered formalin, or frozen in -80°C freezer for shore-based taxonomy and genetic analyses. Specimens of *Bathyacmaea nipponica* Okutani, Tsuchida & Fujikura, 1992 successfully recovered in living state were immediately transferred to cold condition (4 °C) for long-term rearing. They will be used for live rearing experiments in JAMSTEC after the cruise. All megafauna samples obtained during this cruise are listed on the biology metadatasheet.

5) MBARI Push-core

Yoko Chiba (JAMSTEC), and Chong Chen (JAMSTEC)

A push-core sample was taken from the 850 m deep methane seep site off Hatsushima, Sagami Bay during ROV *HyperDolphin* Dive #1992. The core sample was taken on the rim of the *Calyptogena okutanii* clam colony, as close as possible to the active seepage area. A subset of the core was taken at every 5 cm intervals (i.e., at 0 cm, 5 cm, 10 cm, and so on) and placed into sterile glass vials. The samples were fixed and stored at room temperature. After the cruise, these samples will be used for geochemical analyses by Dr. Shinsuke Kawagucci (D-SUGAR, JAMSTEC).

During ROV *Hyper-Dolphin* Dive #1993, a sediment core sample was obtained using MBARI push-core at Area C in the Izu-Ogasawara Trench (depth 4407 m). Immediately

after recovery of the ROV, the core sample was cut into 5 cm thick sections from top to bottom. Sections were placed into ZipLoc bags and stored at -80℃. The total length of the core sample was 28 cm. After the cruise, genomic DNA will be extracted from the samples to detect several marker protein genes of prokaryotic fermentation metabolism.

The push-core samples obtained during this cruise are listed on the metadatasheet for 'other samples'.

6) Temperature Probe

Chong Chen (JAMSTEC), and Yoko Chiba (JAMSTEC)

A temperature probe built to measure the temperature of hydrothermal fluid (owned by D-SUGAR, JAMSTEC) was tested on both ROV *Hyper-Dolphin* and *KAIMEI ROV* for the purpose of signal transmission testing. This probe has been used many times with ROV *Hyper-Dolphin* on-board other JAMSTEC research vessels, but this is the first time it is used with R/V *KAIMEI*. In addition, it has never been tested on *KAIMEI ROV*. Although probe is usually mounted on a pistol-shaped mount and held by manipulator to acquire measurements from specific vent orifices, this was not required for the purpose of this cruise and thus the probe was simply attached to the vehicle body using cable-ties.

The test on ROV *Hyper-Dolphin* was carried out during dive #1993 to a depth of over 4400 m, and was completed successfully without any error. Temperature recordings showed generally expected values and were stable. Therefore the probe is ready to be used with the *Hyper-Dolphin* / R/V *KAIMEI* pair for research purposes in the future.

The probe was tested on *KAIMEI ROV* dives #0016 and #0017 to a depth of approximately 850 m off Hatsushima, Sagami Bay. These were two consecutive dives carried out on the same day. On dive #0016, a small issue occurred due to the stop button being accidentally pressed, but otherwise the communication between probe and computer programme was fine. The test on dive #0017 was completed without any error, and the temperature recordings showed generally expected values and were stable. The probe appears to be in good shape for use with *KAIMEI ROV* in the future for scientific purposes.