



# NATSUSHIMA Cruise Report

NT14-08

Off Joetsu area / Northeastern area off Sado Island,

Japan Sea

May 2<sup>nd</sup>, 2014 – May 8<sup>th</sup>, 2014

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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# NT14-08 Cruise Report

## 1. Cruise Information

### 1.1 Cruise ID

NT14-08

### 1.2 Name of vessel

R/V Natsushima

### 1.3 Title of the cruise

The phase transformation of methane caused by pressure change during its rising from seepage, revealed by video observation and acoustic reflection data

### 1.4 Chief scientist

Kyohei Kaneko (Japan Agency for Marine-Earth Science and Technology)

### 1.) Title of dfcdcgU

The phase transformation of methane caused by pressure change during its rising from seepage, revealed by video observation and acoustic reflection data

### 1.\* Representative of the Science Party

Kyohei Kaneko (Japan Agency for Marine-Earth Science and Technology)

### 1.+ Cruise period

May 2nd, 2014 – May 8th, 2014

### 1., Ports of call

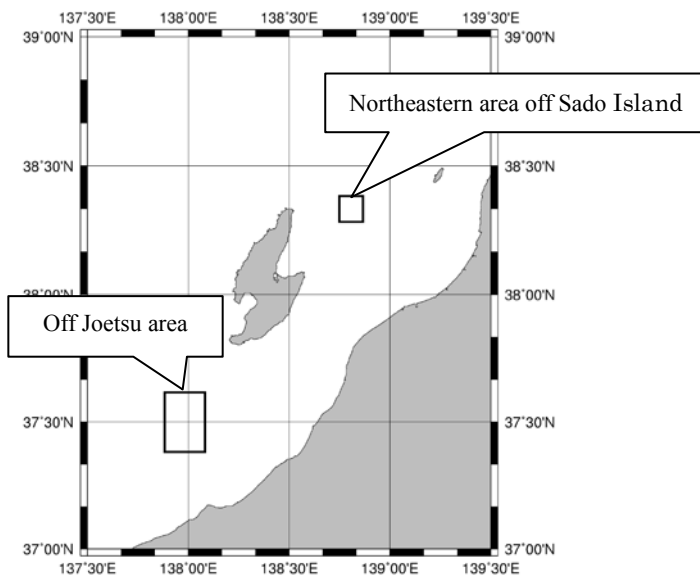
May 2nd, 2014 Departure Kanmon port, Yamaguchi prefecture

May 8th, 2014 Arrival Yokosuka port, Kanagawa prefecture

### 1.- Research area

Off Joetsu area / Northeastern area off Sado Island

### 1.⌘ Research map



## 2. Overview of the Observation

### 2.1 Objectives

The objective of this cruise is to measure acoustical reflection from the methane plumes at close range by utilizing a remotely-operated vehicle, in order to quantify methane gas flux seeping out from shallow methane hydrates in the sea of Japan.

### 2.2 Methods

In the off-Joetsu area, we conducted acoustic survey for methane plumes distribution using quantitative echo sounder (Simrad EK60) and Multi beam echo sounder (SEABAT 8160) installed on R/V *Natsushima*, and then conducted underwater survey using ROV *Hyper-Dolphin* in the following methods, 1) Observing seafloor morphology, 2) Measurement methane discharge with a calibrated collecting equipment, 3) Measuring rising speed of methane bubbles with a ruler, 4) Collecting acoustic reflection data using quantitative echo sounder, 5) Observing rising methane bubbles. All processes in the underwater survey were recorded by a HD camera equipped on ROV, and those videos are used for after-cruise analysis.

In the northeastern area off Sado Island, we also conducted acoustic survey for methane plumes distribution using quantitative echo sounder (Simrad EK60).

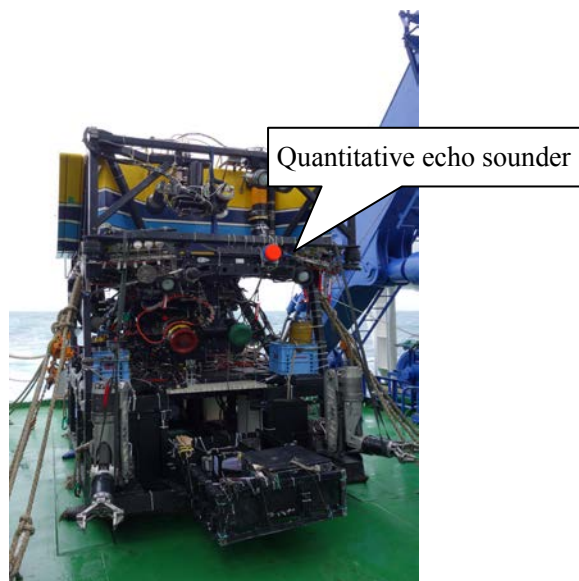


Fig.1 Location of quantitative echo sounder (Simrad EK60) with Hyper-Dolphin.

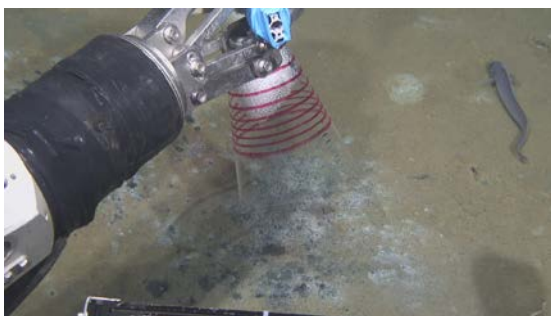


Fig.2 Measurement of methane plume flow

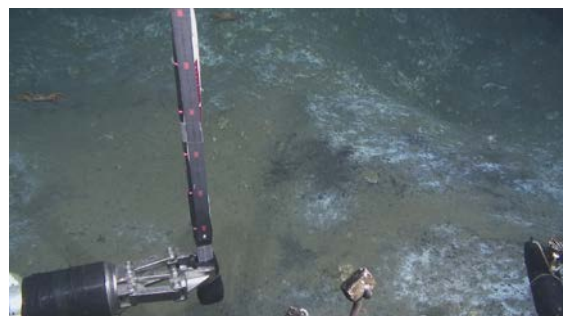


Fig.3 Measurement of bubble rising speed

## 2.3 Onboard Results

In the underwater survey by ROV, we found three methane plume points and successfully collected acoustic data which would detect each methane bubble. In the acoustic survey off Sado Island, multiple acoustic reflections presumed to be methane plumes were detected. Based on videos and acoustic data obtained in this cruise, detailed analysis will be conducted.

## 3. Participants

### 3.1 Scientists

Kyohei KANEKO	Japan Agency for Marine-Earth Science and Technology
Chiharu AOYAMA	Japan's Independent Institute Co., Ltd
Takaaki TATSUTA	NIPPON KAIYO CO., LTD

### 3.2 Marine Technician

Satomi MINAMIZAWA	Nippon Marine Enterprises, LTD.
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### 3.3 R/V NATSUSHIMA Officers and Crew

Captain	Hiroaki MASUJIMA
Chief Officer	Takaaki SHISHIKURA
2nd Officer	Takeshi MURAMATSU
3rd Officer	Syunsuke FUJII
Chief Engineer	Kazuhiko KANEDA
1st Engineer	Daisuke GIBU
2nd Engineer	Saburo SAKAEMURA
3rd Engineer	Katsuto YAMAGUCHI
Chief Electronics Operator	Takehito HATTORI
2nd Electronics Operator	Michiyasu KATAGIRI
3rd Electronics Operator	Ryosuke KOMATSU
Boat Swain	Hideo ISOBE
Able Seaman	Kazumi OGASAWARA
Able Seaman	Yoshiaki MATSUO
Able Seaman	Jiro HANAZAWA
Able Seaman	Shinsuke UZUKI
Sailor	Yusaku KANADA
Sailor	Toshiya SAGA
No.1 Oiler	Katsuyuki YOSHIDA
Oiler	Masanori UEDA
Oiler	Eiji ARATAKE
Oiler	Daiki SATO

Oiler	Shota SHIMOHATA
Chief Steward	Isao MATSUMOTO
Steward	Hideo FUKUMURA
Steward	Tatsunari ONOUE
Steward	Kazuhiro HIRAYAMA
Steward	Kazuhisa KAWASHIMA
Steward	Hiroaki MORIMOTO

#### 3.4 ROV Hyper-Dolphin operation team

Operation Manager	Yoshinari Ono
1st ROV Operator	Tomoe KONDO
2nd ROV Operator	Junya NIIKURA
2nd ROV Operator	Yosuke CHIDA
2nd ROV Operator	Takuma ONISHI
2nd ROV Operator	Shigeru KIKUYA
2nd ROV Operator	Atsushi TAKENOUCI
3rd ROV Operator	Shinnosuke KUMAGAI

#### 4. Cruise Log

Date	Local Time	Note	Description	Position/Weather/Wind ea condition
02-May-14		<b>Sail out, proceeding to research area</b>		05/02 12:00 (UTC+9h)
	10:00	boarded		33-56.5N,130-55.6E
	10:30-11:15	carried out onboard education & training for scientists		Shimonoseki Ko
	12:30	let go all shore line, left SHIMONOSEKI	for Off Joestu	Fine but cloudy
				NE-4 (Moderate breeze)
				2 (Sea smooth)
				1 (Low swel short)
				Visibly: 8'
03-May-14		<b>Proceeding to research area</b>		05/03 12:00 (UTC+9h)
				36-30.0N,134-41.0E
				North off WAKASA WAN
				Cloudy
				West-6(strong breeze)
				3 (Sea slight)
				3 (Moderate short)
				Visibly: 5'
04-May-14		<b>ROV Hyper Dolphin dive 1647</b>		05/04 12:00 (UTC+9h)
	05:00	arrived at research area		37-26.0N,138-00.0E
	05:23-06:12	carried out methane plume survey		Off Joestu
	05:54	released XBT		Fine but cloudy
	08:31	started HPD#1658 dive operation	Jouestu Knoll- Umitaka Spur	ENE-3 (Gentle breeze)
	09:08	landed at sea bottom	Depth: 893m	2 (Sea smooth)
	18:09	left bottom	Depth: 887m	2 (Low swell long)
	18:52	recovered HPD		Visibly: 8'
	19:30	proceeded to methane plume survey area	for Northeast off SADO	
05-May-14		<b>Carry out methane plume survey</b>		05/05 12:00 (UTC+10h)
	01:00	arrived at Northeast off SADO, commenced methane plume survey		38-19.0N,138-51.0E
	14:11	finished methane plume survey		Northeast off SADO
	14:15	lest research area, proceeded to YOKOSUKA		Cloudy
				SE-3 (Light breeze)
				2 (Sea smooth)
				2 (Low swell long)
				Visibly: 8'
06-May-14		<b>Proceed to YOKOSUKA</b>		05/06 12:00 (UTC+9h)
				41-13.0N,141-42.0E
				Southeast off SIRIYASAKI
				Fine but cloudy
				WSW-5 (Fresh breeze)
				3 (Sea slight)
				2 (Low swell long)
				Visibly: 8'
07-May-14		<b>Proceed to YOKOSUKA</b>		04/16 12:00 (UTC+9h)
	13:00-14:00	science seminar		
				Myojin-sho
				Cloudy
				West-5 (Fresh breeze)
				3 (Sea slight)
				3 (Moderate short)
				Visibly: 8'
08-May-14		<b>Proceed to YOKOSUKA</b>		04/17 12:00 (UTC+9h)
				Myojin-sho
				Fine but cloudy
				WSW-5(fresh breeze)
				4 (Sea moderate)
				3 (Moderate short)
				Visibly: 8'
09-May-14		<b>Arrive at YOKOSUKA</b>		
	10:00	disembarked at YOKOSUKA		
		finished NT14-08 cruise		

## 5. Dive Log

HPD Dive#1658

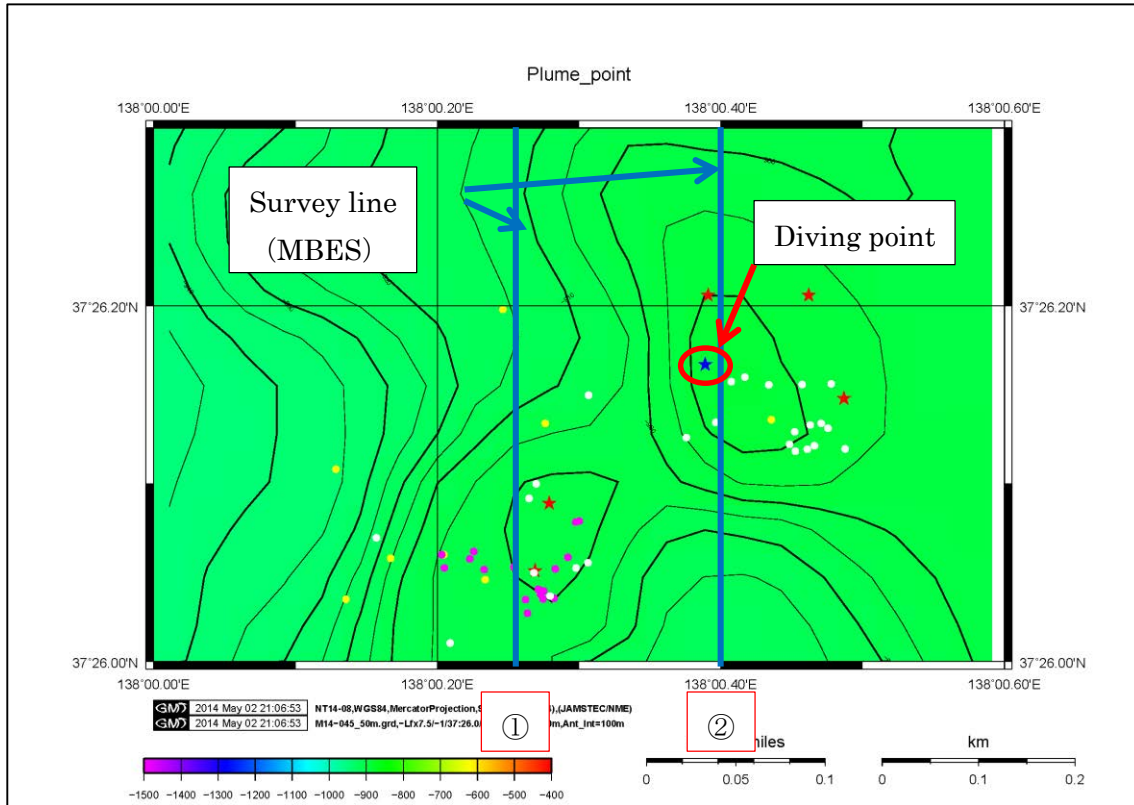
## Joetsu Knoll-Umitaka Spur area

Time (JST)	Dep. (m)	Alt. (m)	Head (Deg)	Pos. Xm	Pos. Ym	Description	Remarks
08:31	-	-	-			Start diving	
09:07						Switch on the frontal sonar	
09:08	892.7	1.6	314.2	181.7	890.6	Reach the bottom	
09:08	893	1.3	315.9	177.9	2654.2	Head to the point #3	
09:10						Crabs, sea anemones	
09:14	889.3	1.6	311.4	220.8	243.1	Crabs	
09:17	892	2.3	310.5			Carbonate sediments	
09:19	890.6	1.2	310.7	241.7	220	Microbial mat, Arrive at point #3	
09:21	890.8	2.3	311.3	244.2	209.7	OBS	
09:25	888.4	2.2	320.5			Head to point #5	
09:27	888	2.7	319.3	247.9	209.1	Microbial mat	
09:37	879	3.1	270			Crabs	
09:39						Arrive at point #6	
09:44	880.3	2.1	270.1	290.8	117.8	Search methane plumes around point #6	
09:58	889	1.4	291.6	362	161.4	Microbial mat	
10:04	886	1.1	319.3	372.6	140	Arrive at point #7	
10:10	890.3	2.2	330.6	430.5	137.7	Head to point #6	
10:15	888.8	1.1	239.6	395.7	144.2	sea anemones	
10:17	888.3	0.9	241.3	384.4	136.1	Microbial mat	
10:18	888.6	0.6	239.7	387.7	131.2	Find methane plumes	
10:19						Land on the bottom	
10:20	889.6	—	240.3	386.6	133.1	Find methane plumes	
10:25	889.4	-	239.9	3894	130.2	Set a marker #1658	
10:26	888	1.7	220	387.2	129.5	Ascend, head to point #6	
10:32						Head to point #5 via point #6	
10:38	882	0.9	172.9	331.2	138.6	Arrive at north of point #6, land on the bottom	
10:44						Arrive at point #6	
10:44	881.4	2.7	99.6	296.5	147.4	Head to point #20	
10:56	889.5	0.8	89.8	281.6	208	Arrive at point #20	
11:04	888.1	1.3	331.3	311.3	240.6	Head to point #7	
11:18	886.9	2	280.8			Find a marker #1658	
11:20	888.9	-	232.6	379.3	130.4	Land on the bottom	
11:25						Switch off the frontal sonar of ROV	
11:26						Switch off the altimeter of ROV	
11:28	889.1	0	230.9	379.9	132	Start first measurement of methane plume flow by collecting tool	
12:16	889.4	0	230.4	387	128.5	Start second measurement of methane plume flow by collecting tool	
12:59	889.2	0	233.2	388.9	125.1	Start measurement of methane plume speed by a scale	
13:39						Start acoustic measurement of methane plume	
13:43						Finish acoustic measurement of methane plume	
13:44	889.2	0	229.3	416.3	156.1	Ascend, start measurement of methane plume speed	
13:51	889.2	-	225.4	419.4	160	Start observing methane plume on point about 4m away	
13:56	888.7	-	225.4	421.4	160.2	Start observing methane plume on point about 2m away	
14:05						Retrieve a marker #1658	
14:07	888.8	-	226.3	412.5	159.7	Ascend after a methane plume	
14:11	838.4					Lost a methane plume	
14:12	823.5	-	222.7			Switch on the frontal sonar and altimeter	
14:19						Switch off the frontal sonar and altimeter	
14:21	879.4	5.7	90.3	397.1	166.1	Start acoustic measurement of a methane plume	
14:23	880.6	8	188.9			Finish acoustic measurement of a methane plume	
14:29	886.7	0.9	191	366.3	157	Head to point #6	



14:42	885.5	1.4	177.8	288.4	158.7	Find a methane plume	
14:46	887.6	-	104.8	290.9	155.9	Land on the bottom	
14:49	887.5	-	105.4	286.7	155.5	Set a marker #1658	
14:52	887.5	-	107	284.5	159.3	Start measurement of methane plume speed by a scale	
15:04	887.5	-	112.4	286	156.7	Finish measurement of methane plume speed by a scale	
15:07	887.6	-	112.4	289.4	154.9	Start measurement of methane plume flow by collecting tool	
15:24	887.5	-	128.7	295.9	151.2	Finish measurement of methane plume flow by collecting tool	
15:26						Retrieve a marker #1658	
15:27	886.8	-	127	288.2	157.5	Head to point #2	
15:54	904.8	2.7	225.6	12	-125	Long-term monitoring system	
15:57	905.6	0	152.9	10.6	-129.7	Land on the bottom	
16:18	900.5	6.8	245,8	15	123.2	Head to point #6	
16:36						Head to point #19	
17:30	887.5	-	137	296.8	204.5	Land on the bottom	
17:45	887.4	-	123.5	301.6	198.1	Start measurement of methane plume flow by collecting tool	
17:53	887.5	0	123.4	298.7	196.4	Finish measurement of methane plume flow by collecting tool	
17:59	887.3	-	123.5	295.9	195.6	Start measurement of methane plume speed by a scale	
18:03	887.5	-	123.3	297	198.3	Finish measurement of methane plume flow by collecting tool	
18:03	887.5	-	123.3	297,1	200.6	Set a marker #1658	
18:07	887.5	-	126.5	299.2	100	Start acoustic measuremt of a methane plume	
18:09						Finish acoustic measuremt of a methane plume	
18:09	885.5	-	124.7	294.7	198.7	Ascend,start measument of methane plume speed	
18:11	866.6	-	124.1			Lost a methane plume	
18:38	1.4	-	243			Leave the bottom	

## NT14-08 Survey map



### Diving point

37-26.167N 138-00.389E (Depth = 895m)

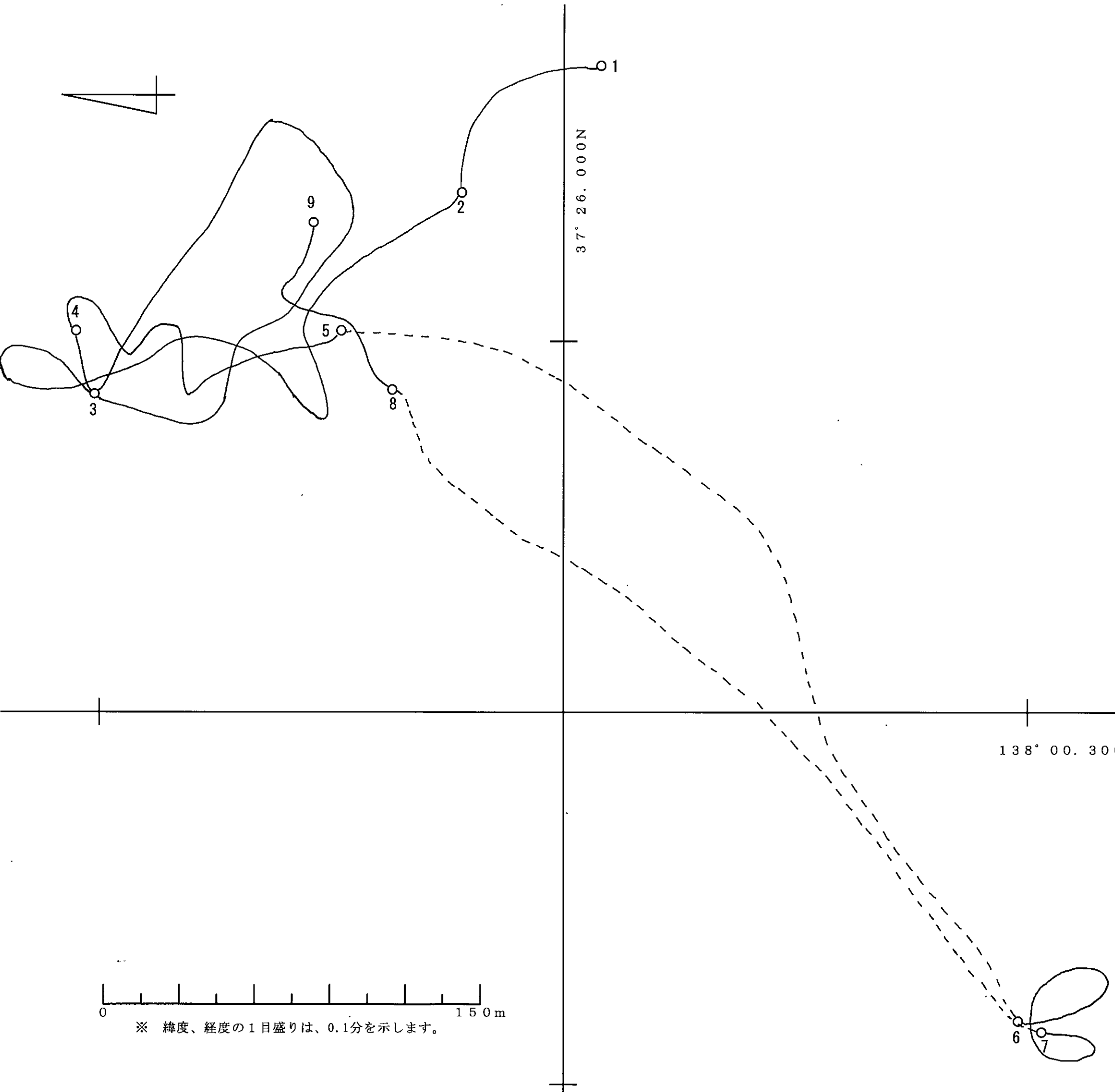
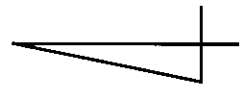
### Survey lines (MBES)

① 37-26.00N 138-00.25E

37-26.30N 138-00.25E

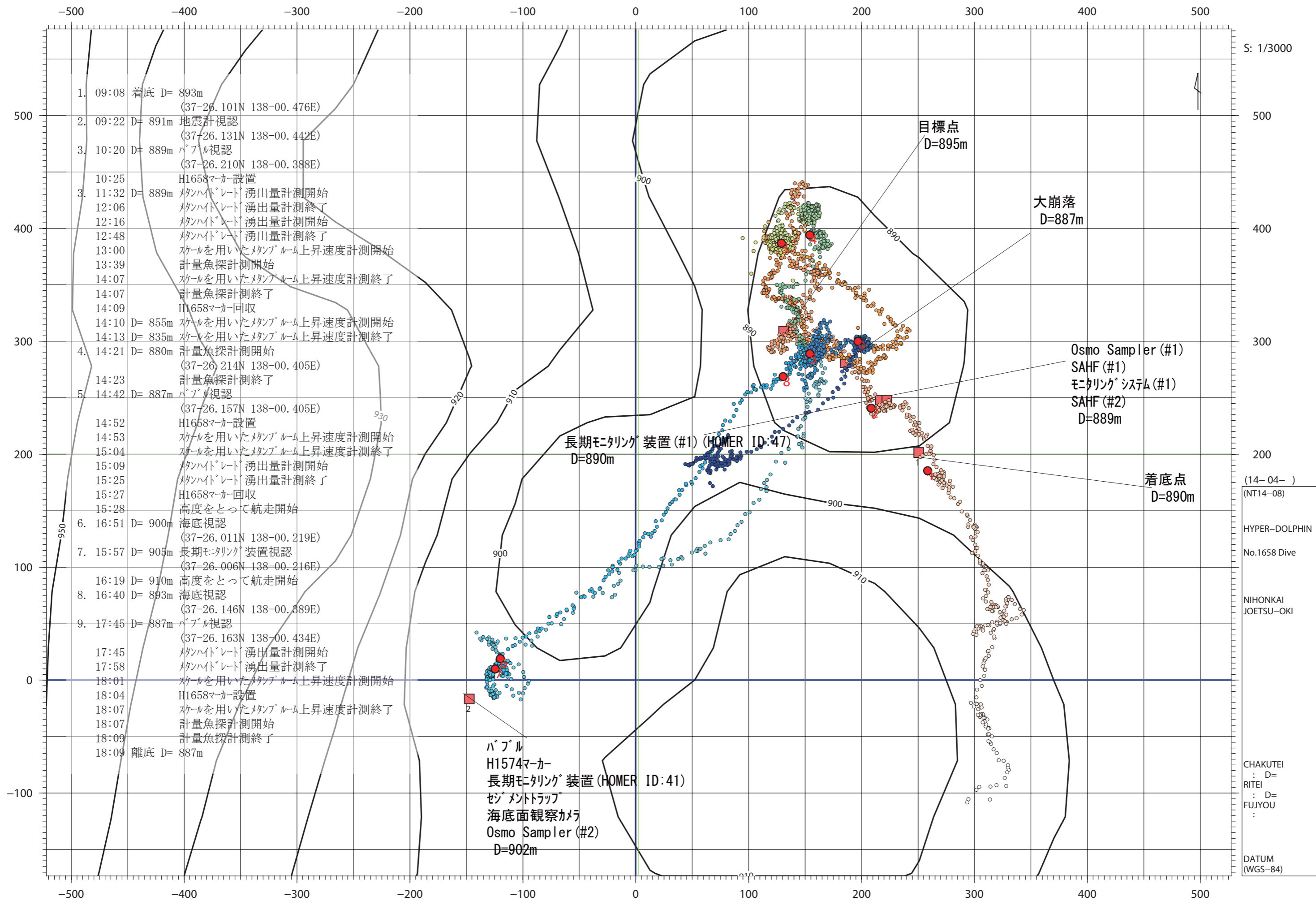
② 37-26.00N 138-00.40E

37-26.30N 138-00.40E



1. 09:08 着底 D= 893m  
(37-26. 101N 138-00. 476E)
2. 09:22 D= 891m 地震計視認  
(37-26. 131N 138-00. 442E)
3. 10:20 D= 889m バブル視認  
(37-26. 210N 138-00. 388E)
- 10:25 H1658マーカー設置
3. 11:32 D= 889m マンハイトレド湧出量計測開始  
12:06 マンハイトレド湧出量計測終了  
12:16 マンハイトレド湧出量計測開始  
12:48 マンハイトレド湧出量計測終了  
13:00 スケルを用いたマンブーム上昇速度計測開始  
13:39 計量魚探計測開始  
14:07 スケルを用いたマンブーム上昇速度計測終了  
14:07 計量魚探計測終了  
14:09 H1658マーカー回収
- 14:10 D= 855m スケルを用いたマンブーム上昇速度計測開始  
14:13 D= 835m スケルを用いたマンブーム上昇速度計測終了
4. 14:21 D= 880m 計量魚探計測開始  
(37-26. 214N 138-00. 405E)  
14:23 計量魚探計測終了
5. 14:42 D= 887m バブル視認  
(37-26. 157N 138-00. 405E)
- 14:52 H1658マーカー設置  
14:53 スケルを用いたマンブーム上昇速度計測開始  
15:04 スケルを用いたマンブーム上昇速度計測終了  
15:09 マンハイトレド湧出量計測開始  
15:25 マンハイトレド湧出量計測終了  
15:27 H1658マーカー回収  
15:28 高度をとって航走開始
6. 16:51 D= 900m 海底視認  
(37-26. 011N 138-00. 219E)
7. 15:57 D= 905m 長期モニタリング装置視認  
(37-26. 006N 138-00. 216E)
- 16:19 D= 910m 高度をとって航走開始
8. 16:40 D= 893m 海底視認  
(37-26. 146N 138-00. 389E)
9. 17:45 D= 887m バブル視認  
(37-26. 163N 138-00. 434E)
- 17:45 マンハイトレド湧出量計測開始  
17:58 マンハイトレド湧出量計測終了
- 18:01 スケルを用いたマンブーム上昇速度計測開始  
18:04 H1658マーカー設置  
18:07 スケルを用いたマンブーム上昇速度計測終了  
18:07 計量魚探計測開始  
18:09 計量魚探計測終了  
18:09 離底 D= 887m

ハイパードルフィン3000  
 # 1658 DIVE  
 2014年05月04日  
 日本海上越沖  
 縮尺 1 / 1500  
 測位 D-GPS(Skyfix-XP Trimble SPS751)  
 測地系 WGS-84 DATUM (世界測地系)  
 音速 1470. 2m/s (D=1000m)



## **6. Notice on using**

This cruise report is a preliminary documentation as of the end of the cruise. This report may not be corrected even if changes on contents (i.e. taxonomic classifications) may be found after its publication. This report may also be changed without notice. Data on this cruise report may be raw or unprocessed. If you are going to use or refer to the data written on this report, please ask the Chief Scientist for latest information. Users of data or results on this cruise report are requested to submit their results to the Data Management Group of JAMSTEC.