



## R/V Kaiyo Cruise Report

KY15-14

Marine Geological and Geophysical surveys  
to investigate the nature of subduction zone  
mega earthquakes and tsunamis

2. High resolution seismic surveys in the trench axis area

5. Seismicity observation in the outer rise  
and trench axis region

Japan Trench

Sept. 02, 2015 - Sep. 30, 2015

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

## **Contents**

### **1. Cruise Information**

### **2. Researchers**

### **3. Observations**

#### **3.1 Background and objectives**

#### **3.2 List of Observations**

#### **3.3 List of observation equipments**

#### **3.4 Cruise log**

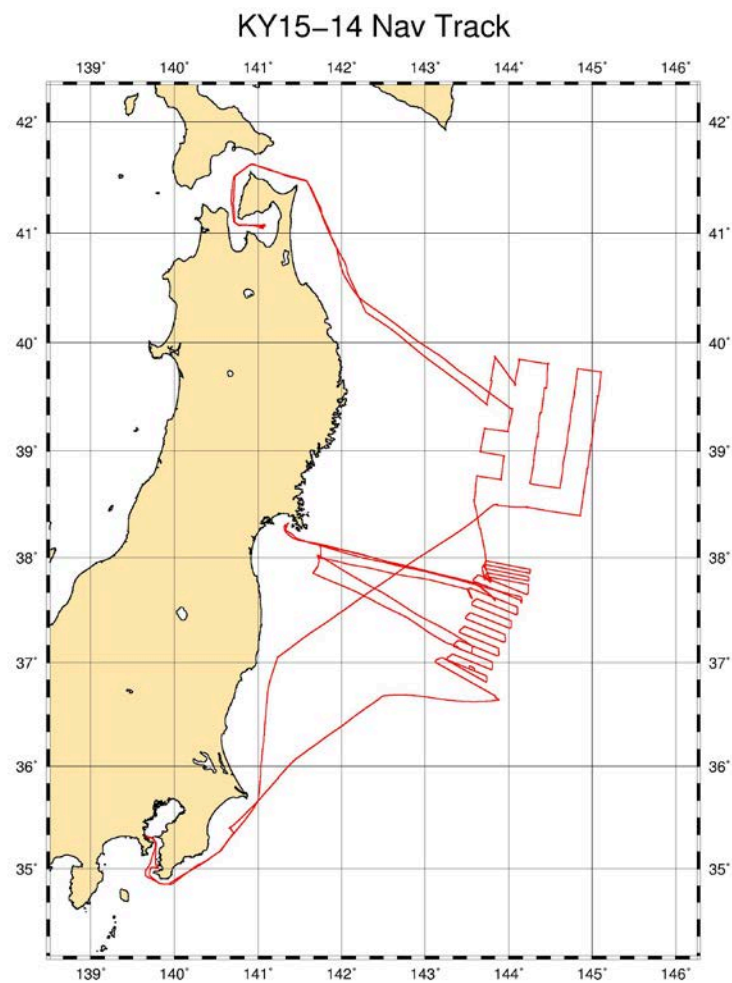
#### **3.5 Research Information**

### **4. Notice on using**

### **Acknowledgement**

## 1. Cruise Information

- Cruise ID: KY15-14
- Name of vessel: R/V Kaiyo
- Title of the cruise: Marine Geological and Geophysical surveys to investigate the nature of subduction zone mega earthquakes and tsunamis
  - 2. High resolution seismic surveys in the trench axis area
  - 5. Seismicity observation in the outer rise and trench axis region
- Title of proposal: Marine geological and geophysical research and surveys to unravel the subduction zone great earthquakes and tsunamis
  - 2. High resolution seismic surveys in the trench axis area
  - 5. Seismicity observation in the outer rise and trench axis region
- Cruise period: 2015/09/02 – 2015/09/30
- Ports of departure /arrival: Yokosuka (JAMSTEC) – Yokosuka (JAMSTEC)
- Research area: Japan Trench
- Ship track



## **2. Researchers**

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  - Takashi TONEGAWA [JAMSTEC]

## **3. Observation**

### **3.1 Background and objectives**

The 2011 Off the Pacific Coast of Tohoku Earthquake (Tohoku Earthquake: M9) was the largest earthquake in the Japanese history of earthquake observation. The plate boundary faults which was ruptured through the trench axis area were clearly imaged by the high-resolution seismic data. This observation and related studies exploded widely accepted conceptual model of the subduction zone earthquake, however the seismic survey area was limited within the vicinity of the epicenter of Tohoku Earthquake off central Miyagi. Thus further investigations in whole region of the Japan Trench, off Aomori to the north, off Ibaraki to the south, are necessary to understand the mechanism of the great subduction zone earthquakes and Tsunami generation in the Japan Trench region. Several tsunamigenic great earthquakes have occurred in the Japan Trench area before the 2011 Tohoku Earthquake, therefore understanding of the possible seismogenic and tsunamigenic structure of this region is indispensable to prevent or mitigate the disasters caused by the future great earthquakes. The one of the purposes of this cruise was to obtain detailed structural image in the central part of the Japan Trench axis area off Miyagi-Fukushima region using high resolution (portable) multichannel reflection seismic system.

The aftershock activity and postseismic displacement after the Tohoku earthquake still continue, and it is concerned that large aftershocks and tsunamis can occur in the main shock area and its adjacent outer rise region. We conduct the observation using the ocean bottom seismographs (OBSs) in the northern part of the Japan trench region to determine seismicity and the focal mechanism of the earthquakes in this region. The results will contribute to understand the nature of subduction zone great earthquakes, outer rise earthquakes and related tsunamis, which is indispensable information to prevent and/or mitigate the disaster caused by these earthquakes and tsunamis.

### **3.2 List of observations**

#### (1) High resolution seismic reflection survey

A cluster gun array with 380 inch<sup>3</sup> of total volume was towed at 5 m depth. The guns were fired every 37.5 m. Seismic data was recorded with a 168 channel, 1100-m-long streamer cable, which was towed at 6 m depth. Twenty two seismic lines were completed during the cruise.

#### (2) Recovery of the OBSs

Thirty-five OBSs were successfully recovered in this cruise, which were deployed during NT15-10 cruise in June-July 2015.

#### (3) XCTD casts

The XCTD casts were conducted at 6 locations during the cruise to obtain accurate velocity profile in the water column.

#### (4) Bathymetry measurements

Bathymetry data were recorded during the cruise.

### **3.3 List of observation equipments**

PMCS system (168 channel streamer cable, maximum offset ~1.1 km )

Cluster gun (40 inch<sup>3</sup> x2, 150 inch<sup>3</sup> x2)

Ocean Bottom Seismographs (OBS)

Seabeam 2112

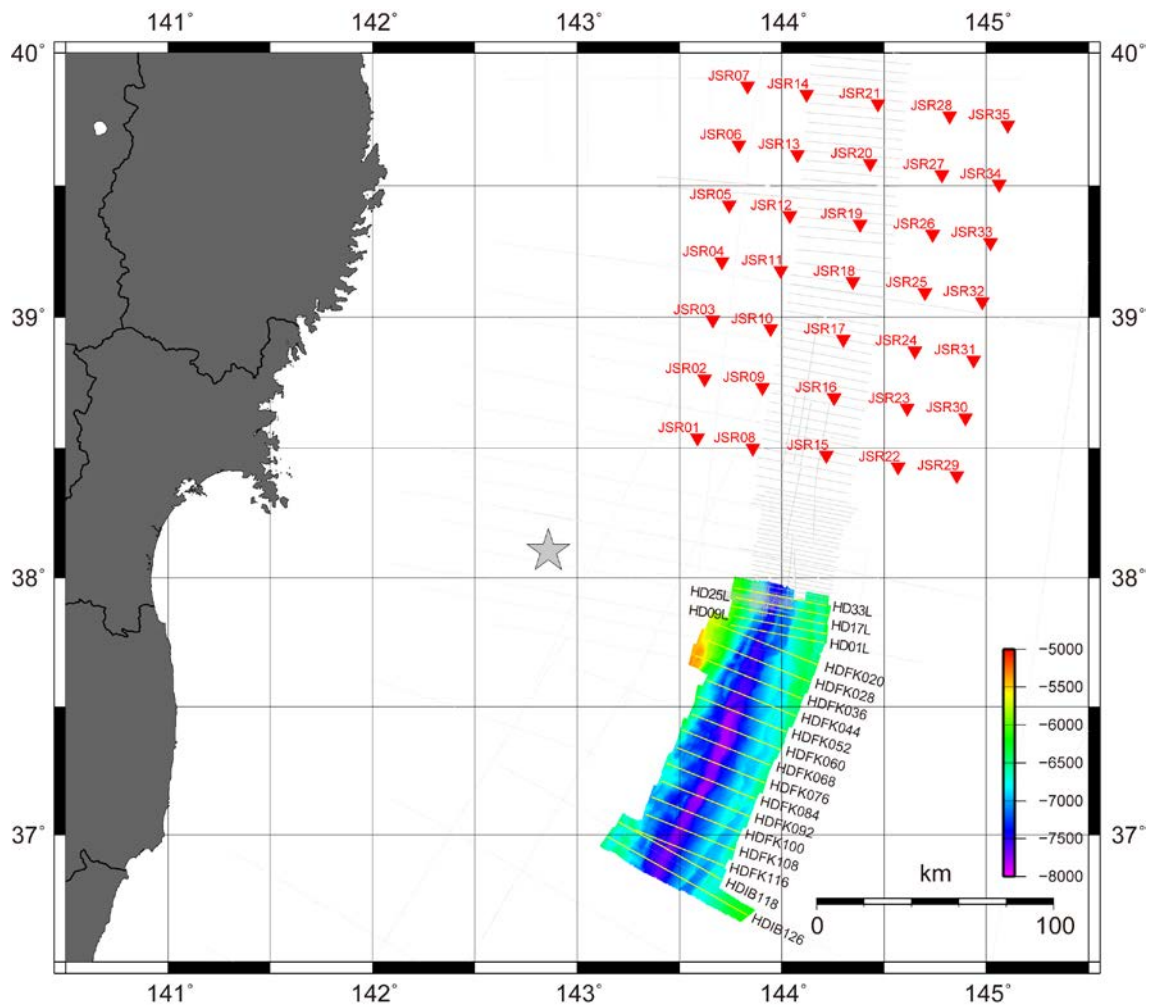
XCTD

### 3.4 Cruise log

Date	Log
09/02/2015	Departure from Yokosuka, Transit to survey area
09/03/2015	Arrival at survey area, recovery OBSs JSR08
09/04/2015	Recovery of OBSs JSR15, JSR22, JSR29, JSR30, JSR31, JSR32, JSR33
09/05/2015	Recovery of OBSs JSR34, JSR35, JSR28, JSR27, JSR26, JSR25, JSR24, JSR23
09/06/2015	Recovery of OBSs JSR16, JSR17, JSR18, JSR19, JSR20
09/07/2015	Recovery of OBSs JSR21, JSR14, JSR13, JSR07, JSR06, JSR05, transit to Mutsu Bay
09/08/2015	Stay in the Mutsu Bay for typhoon evacuation
09/09/2015	Stay in the Mutsu Bay for typhoon evacuation
09/10/2015	Stay in the Mutsu Bay for typhoon evacuation
09/11/2015	Stay in the Mutsu Bay for typhoon evacuation
09/12/2015	Stay in the Mutsu Bay for typhoon evacuation, transit to survey area
09/13/2015	Transit to survey area, recovery of OBSs JSR12, JSR11, JSR04
09/14/2015	Recovery of OBSs JSR03, JSR10, JSR09, JSR02, JSR01
09/15/2015	HR MCS Lines HD33L, HD25L
09/16/2015	HR MCS Lines HD17L, HD09L, HD01L
09/17/2015	HR MCS Lines HDFK020, HDFK028, transit to Ishinomaki Bay
09/18/2015	Stay in the Ishinomaki Bay due to bad sea condition
09/19/2015	Stay in the Ishinomaki Bay due to bad sea condition, transit to survey area
09/20/2015	Lines HDFK028, transit to Ishinomaki Bay
09/21/2015	Stay in the Ishinomaki Bay due to bad sea condition, transit to survey area
09/22/2015	HR MCS Lines HDFK036, HDFK044
09/23/2015	HR MCS Lines HDFK052, HDFK060, HDFK068
09/24/2015	HR MCS Lines HDFK076, HDFK084, HDFK092
09/25/2015	HR MCS Lines HDFK100, transit to Ishinomaki Bay
09/26/2015	Transit to survey area, HR MCS Line HDFK100
09/27/2015	HR MCS Lines HDFK108, HDFK116, HDIB118
09/28/2015	HR MCS Lines HDIB118, HDIB126, departure from survey area
09/29/2015	Transit to Yokosuka
09/30/2015	Arrival at Yokosuka

### 3.5 Research Information

OBS location and MCS line map



Red inverted triangle: OBS location recovered during this cruise.

Yellow line: MCS survey lines acquired during this cruise.

Grey lines: MCS survey lines previously acquired.

Color image: Bathymetry map obtained during this cruise.

## OBS location list

Site	OBS TYPE	Calibrated position					
		S/R(m)	HR(m)	Lat(N)	Lon(W)	Depth(m)	Remarks
JSR01	Katsujima	3329.0	350.6	38_32.2899	143_35.2525	3298.8	
JSR02	Katsujima	3388.0	271.6	38_45.8840	143_37.4004	3364.4	
JSR03	Katsujima	3310.0	96.9	38_59.3250	143_39.7757	3296.5	
JSR04	Katsujima	4135.0	301.8	39_12.6514	143_42.4358	4123.6	
JSR05	Katsujima	3527.0	451.2	39_25.6283	143_44.5704	3487.4	
JSR06	Katsujima	3517.0	227.5	39_39.2383	143_47.4673	3496.7	
JSR07	Katsujima	3525.0	257.9	39_52.5227	143_49.9767	3502	
JSR08	Katsujima	-	440.2	38_29.9620	143_51.5668	5815	
JSR09	Katsujima	5834.0	386.2	38_43.8735	143_54.2716	5862.7	
JSR10	Katsujima	5637.0	552.7	38_57.3036	143_56.7369	5623.9	
JSR11	Katsujima	5397.0	157.8	39_10.6501	143_59.6465	5414.8	
JSR12	Katsujima	5108.0	477.6	39_23.2116	144_02.3594	5104.2	
JSR13	Katsujima	5156.0	254.7	39_37.1052	144_04.6025	5170.4	
JSR14	Katsujima	5664.0	381.5	39_50.7108	144_07.2662	5687.9	
JSR15	Ultra-Deep	6770.0	189.3	38_28.2703	144_13.1108	6848.6	
JSR16	Ultra-Deep	6823.0	215.1	38_41.6216	144_15.4006	6905.3	
JSR17	Ultra-Deep	6856.0	311.9	38_54.9411	144_17.9872	6935	
JSR18	Ultra-Deep	6884.0	532.2	39_08.1405	144_20.8645	6959.1	
JSR19	Ultra-Deep	6884.0	477.4	39_21.2013	144_22.9347	6954.1	
JSR20	Ultra-Deep	6756.0	678.6	39_34.9680	144_25.9142	6800.1	
JSR21	Ultra-Deep	7013.0	448.0	39_48.4970	144_28.2612	7092.6	
JSR22	Katsujima	5697.0	240.7	38_25.6018	144_34.0874	5727.8	
JSR23	Katsujima	5843.0	134.0	38_39.1025	144_36.8714	5885.9	
JSR24	Katsujima	5879.0	55.6	38_52.2769	144_39.0823	5922.3	
JSR25	Ultra-Deep	5901.0	162.7	39_05.6125	144_42.0590	5942.2	
JSR26	Katsujima	5783.0	252.2	39_18.9276	144_44.3131	5817.6	
JSR27	Katsujima	-	-	39_32.471	144_47.011	5938.9	(1)
JSR28	Katsujima	5888.0	216.5	39_45.8206	144_49.2696	5830.8	
JSR29	Katsujima	5519.0	254.6	38_23.5860	144_51.2789	5480.9	
JSR30	Katsujima	5507.0	51.4	38_36.9066	144_53.8112	5540.1	
JSR31	Katsujima	5480.0	100.3	38_50.1820	144_56.2238	5509.8	



JSR32	Katsujima	5510.0	134.6	39_03.5278	144_58.8392	5538.9	
JSR33	Katsujima	5516.0	178.5	39_17.0101	145_01.2273	5546.7	
JSR34	Katsujima	5550.0	61.8	39_30.3351	145_03.7884	5583	
JSR35	Katsujima	5502.0	240.7	39_43.7034	145_06.2715	5526.5	

All position is determined upon the recovery of the OBS, except for JSR27

(1) Position is determined upon the deployment, because the positioning cannot be conducted upon the recovery.

MCS Line List

LINE NAME	DATE (UTC)	TIME (UTC)	F.S.P.	VESSEL POSITION	
			F.G.S.P.		
			L.G.S.P.	Lat.	Lon.
			L.S.P.		
HD01L_0	16/09/2015	09:23:57	1236	37_49.06867'N	143_44.79900'E
	16/09/2015	09:33:28	1260	37_48.97800'N	143_45.40117'E
	16/09/2015	16:49:20	2339	37_44.84167'N	144_12.45033'E
	16/09/2015	16:49:20	2339	37_44.84167'N	144_12.45033'E
HD09L_0	16/09/2015	02:26:12	2370	37_46.89867'N	144_13.37967'E
	16/09/2015	02:33:47	2346	37_46.98867'N	144_12.77767'E
	16/09/2015	08:15:11	1267	37_51.12967'N	143_45.71667'E
	16/09/2015	08:15:11	1267	37_51.12967'N	143_45.71667'E
HD17L_0	15/09/2015	18:22:58	1236	37_53.39750'N	143_45.23183'E
	15/09/2015	18:32:41	1260	37_53.30817'N	143_45.83500'E
	16/09/2015	01:18:44	2339	37_49.16883'N	144_12.90983'E
	16/09/2015	01:18:44	2339	37_49.16883'N	144_12.90983'E
HD25L_0	15/09/2015	11:06:05	2370	37_51.22567'N	144_13.84017'E
	15/09/2015	11:13:37	2346	37_51.31667'N	144_13.23767'E
	15/09/2015	16:23:08	1267	37_55.46067'N	143_46.15100'E
	15/09/2015	16:23:08	1267	37_55.46067'N	143_46.15100'E
HD33L_0	15/09/2015	03:20:46	1236	37_57.72933'N	143_45.66600'E
	15/09/2015	03:29:44	1260	37_57.63950'N	143_46.27000'E
	15/09/2015	09:50:15	2339	37_53.49767'N	144_13.37067'E
	15/09/2015	09:50:15	2339	37_53.49767'N	144_13.37067'E
HDFK020_0	16/09/2015	19:27:51	2369	37_39.50667'N	144_11.23900'E
	16/09/2015	19:34:40	2345	37_39.68483'N	144_10.67067'E
	17/09/2015	02:20:53	1000	37_49.86183'N	143_38.82983'E
	17/09/2015	02:20:53	1000	37_49.86183'N	143_38.82983'E
HDFK028_0	17/09/2015	03:58:55	969	37_46.15233'N	143_35.89383'E
	17/09/2015	04:07:55	993	37_45.97033'N	143_36.46117'E
	17/09/2015	06:00:18	1279	37_43.81717'N	143_43.23850'E
	17/09/2015	06:00:18	1279	37_43.81717'N	143_43.23850'E
HDFK028_1	20/09/2015	01:02:46	1201	37_44.40217'N	143_41.38900'E
	20/09/2015	01:11:23	1225	37_44.22733'N	143_41.96117'E

	20/09/2015	08:31:04	2338	37_35.79850'N	144_08.27483'E
	20/09/2015	08:31:04	2338	37_35.79850'N	144_08.27483'E
HDFK036_0	22/09/2015	00:00:11	969	37_42.23233'N	143_33.62150'E
	22/09/2015	00:09:17	993	37_42.05033'N	143_34.18983'E
	22/09/2015	09:12:14	2338	37_31.87967'N	144_05.97900'E
	22/09/2015	09:12:14	2338	37_31.87967'N	144_05.97900'E
HDFK044_0	22/09/2015	10:56:50	2369	37_27.74850'N	144_04.34250'E
	22/09/2015	11:04:05	2345	37_27.92400'N	144_03.77367'E
	22/09/2015	16:38:05	1250	37_36.22100'N	143_37.93000'E
	22/09/2015	16:38:05	1250	37_36.22100'N	143_37.93000'E
HDFK052_0	22/09/2015	18:24:43	1219	37_32.51350'N	143_35.00400'E
	22/09/2015	18:33:33	1243	37_32.33283'N	143_35.57083'E
	23/09/2015	01:30:34	2338	37_24.04100'N	144_01.39583'E
	23/09/2015	01:30:34	2338	37_24.04100'N	144_01.39583'E
HDFK060_0	23/09/2015	03:07:43	2369	37_19.91267'N	143_59.76817'E
	23/09/2015	03:14:55	2345	37_20.09433'N	143_59.20333'E
	23/09/2015	08:26:58	1250	37_28.32667'N	143_33.37117'E
	23/09/2015	08:26:58	1250	37_28.32667'N	143_33.37117'E
HDFK068_0	23/09/2015	10:11:06	1219	37_24.66650'N	143_30.47817'E
	23/09/2015	10:20:26	1243	37_24.48467'N	143_31.04383'E
	23/09/2015	16:39:27	2338	37_16.19567'N	143_56.82633'E
	23/09/2015	16:39:27	2338	37_16.19567'N	143_56.82633'E
HDFK076_0	23/09/2015	18:20:05	2369	37_12.06350'N	143_55.20550'E
	23/09/2015	18:28:06	2345	37_12.23750'N	143_54.63783'E
	24/09/2015	00:08:38	1250	37_20.53750'N	143_28.88267'E
	24/09/2015	00:08:38	1250	37_20.53750'N	143_28.88267'E
HDFK084_0	24/09/2015	01:51:16	1219	37_16.81917'N	143_25.97000'E
	24/09/2015	02:00:02	1243	37_16.64017'N	143_26.53567'E
	24/09/2015	08:57:40	2338	37_08.35183'N	143_52.27500'E
	24/09/2015	08:57:40	2338	37_08.35183'N	143_52.27500'E
HDFK092_0	24/09/2015	10:46:16	2369	37_04.20683'N	143_50.65550'E
	24/09/2015	10:53:29	2345	37_04.39900'N	143_50.09800'E
	24/09/2015	16:29:38	1250	37_12.69033'N	143_24.38117'E
	24/09/2015	16:29:38	1250	37_12.69033'N	143_24.38117'E
HDFK100_0	24/09/2015	18:08:31	1219	37_08.97567'N	143_21.48033'E

	24/09/2015	18:18:13	1243	37_08.79267'N	143_22.04383'E
	24/09/2015	21:00:00	1676	37_05.52700'N	143_32.21667'E
	24/09/2015	21:00:00	1676	37_05.52700'N	143_32.21667'E
HDFK100_1	26/09/2015	07:38:55	1548	37_06.50133'N	143_29.21450'E
	26/09/2015	07:47:57	1572	37_06.31517'N	143_29.77567'E
	26/09/2015	13:06:16	2338	37_00.49667'N	143_47.73567'E
	26/09/2015	13:06:16	2338	37_00.49667'N	143_47.73567'E
HDFK108_0	26/09/2015	14:59:03	2369	36_56.35900'N	143_46.12717'E
	26/09/2015	15:06:10	2345	36_56.54133'N	143_45.56467'E
	26/09/2015	21:06:34	1250	37_04.83733'N	143_19.89433'E
	26/09/2015	21:06:34	1250	37_04.83733'N	143_19.89433'E
HDFK116_0	26/09/2015	22:51:44	1219	37_01.11667'N	143_17.00017'E
	26/09/2015	22:58:12	1243	37_00.93433'N	143_17.56283'E
	27/09/2015	02:15:26	1944	36_55.64300'N	143_33.99883'E
	27/09/2015	02:15:26	1944	36_55.64300'N	143_33.99883'E
HDFK116_1	27/09/2015	04:22:14	1883	36_56.10417'N	143_32.56983'E
	27/09/2015	04:29:04	1907	36_55.92133'N	143_33.13150'E
	27/09/2015	06:30:48	2338	36_52.64467'N	143_43.21550'E
	27/09/2015	06:30:48	2338	36_52.64467'N	143_43.21550'E
HDIB118_0	27/09/2015	08:12:22	2368	36_49.33683'N	143_42.43050'E
	27/09/2015	08:25:29	2344	36_49.57700'N	143_41.90383'E
	27/09/2015	19:46:29	1000	37_02.90117'N	143_12.30083'E
	27/09/2015	19:46:29	1000	37_02.90117'N	143_12.30083'E
HDIB126_0	27/09/2015	21:38:26	969	36_59.57033'N	143_08.72750'E
	27/09/2015	21:45:06	993	36_59.33867'N	143_09.26150'E
	28/09/2015	06:00:06	2844	36_40.95083'N	143_49.95033'E
	28/09/2015	06:00:06	2844	36_40.95083'N	143_49.95033'E

\*F.S.P.: First Shot Point, F.G.S.P: First Good Shot Point

L.G.S.P.: Last Good Shot Point, L.S.P.: Last Shot Point

#### **4. 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.

#### **Acknowledgement**

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