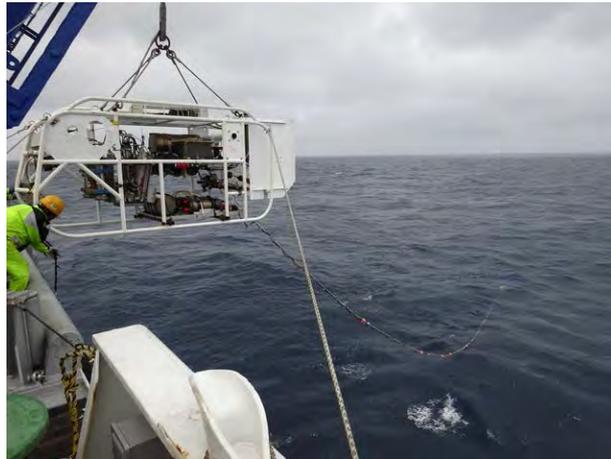


Cruise Report

MR15-E01_leg1

Izena holl, South-West Japan



R/V Mirai

1 Mar 2015- 13 Mar 2015

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Acknowledgements

We would like to thank Captain Mr. Akutagawa and all ship crew of R/V MIRAI for their safe cruise. We are grateful to marine technician of GODI, NME and MWJ for their operation. We are pleased to MARITEC/JAMSTEC staff for their supports during our cruise.

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 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.

Cruise summary of MR15-E01 cruise

1. Cruise information

Cruise number	MR15-E01_leg1
Name of vessel	R/V MIRAI
Chief scientist	Takafumi Kasaya (JAMSTEC)
Representative of the Science Party	Katsuhiko Suzuki (JAMSTEC)
Title of the cruise	

Towed DC resistivity survey around Iheya–Izena area

Cruise period	1 March 2015 – 13 March 2015
Ports of call	Sekinehama port – Naha
Research Area	Izena hole area (Fig.1)

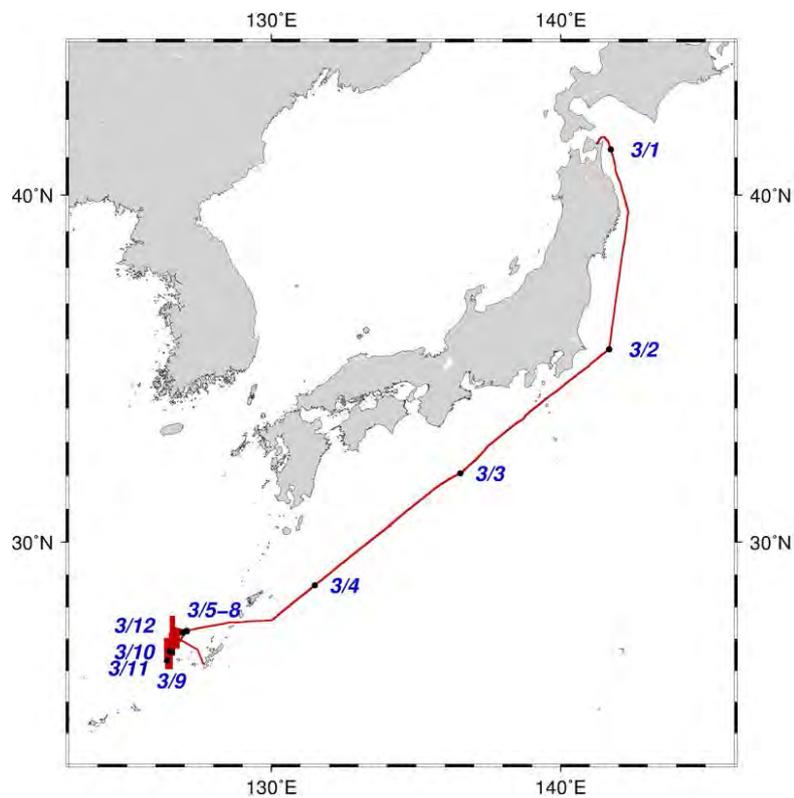


Fig.1 Ship track of this cruise.

Cruise proposal

” Towed DC resistivity survey around Iheya–Izena area”

In recent, the concern with the submarine massive sulfides (SMS) has been growing. However, few exploration techniques were developed to evaluate the thickness of SMS and to find the buried SMS. It is also very important for the study of the origin and formation of SMS to detect the subsurface hydrothermal circulation system.

The Izena hole field is known as one of the promising hydrothermal deposit Geophysical exploration method based on the electromagnetism is very sensitive to the conductive fluid and mineral resources. Therefore, we have carried out the DC resistivity survey around the Izena hole field. On this cruise, we carried out six deep-towed controlled source DC in the Izena hole geothermal area.

2. List of Participants

Onboard Scientists

Chief Scientist (JAMSTEC)	Takafumi Kasaya
Scientist (JAMSTEC)	Yoshifumi Kawada
Scientist (JAMSTEC)	Kazuya Kitada
Scientist (NME)	Hisanori Iwamoto

Marine Technicians

Chief Technician (MWJ)	Hiroyuki Hayashi	
Technician (MWJ)	Yusuke Sato	
Technician (MWJ)	Keiko Fujino	
Technician (MWJ)	Yuki Miyajima	
Technician (MWJ)	Haruka Tamada	
Chief Technician (Global Ocean Development Inc.)		Wataru Tokunaga
Technician (Global Ocean Development Inc.)		Yutaro Murakami
Technician (Global Ocean Development Inc.)		Toshio Furuta

R/V MIRAI Crews

Master	Toshihisa Akutagawa
Chief Officer	Takeshi Isohi
2nd Officer	Nobuo Fukaura
Jr. 2nd Officer	Hirokazu Sugawara
3rd Officer	Akihiro Nunome
Chief Engineer	Yoichi Furukawa
1st Engineer	Kazuhito Ikeda
2nd Engineer	Jun Takahashi
3rd Engineer	Katsuyoshi Kodama
Technical Officer	Ryo Kimura
Boatswain	Yosuke Kuwahara
Able Seaman	Tsuyoshi Sato
Able Seaman	Tsuyoshi Monzawa
Able Seaman	Shuji Komata
Able Seaman	Kait Murata
Able Seaman	Masaya Tanikawa
Ordinary Seaman	Shohei Uehara

Ordinary Seaman	Tomohiro Shimada
Ordinary Seaman	Akiya Chishima
Ordinary Seaman	Tetsuya Sakamoto
Ordinary Seaman	Tenki Yamashiro
No.1 Oiler	Yoshihiro Sugimoto
Oiler	Fumihito Kaizuka
Oiler	Toshiyuki Furuki
Oiler	Kazumi Yamashita
Wiper	Shintaro Abe
Wiper	Hiromi Ikuta
Chief Steward	Ryotaro Baba
Cook	Yukio Shige
Cook	Yukio Chiba
Cook	Shigenori Yamaguchi
Cook	Toshiyuki Asano

3. Ship Logs

UTC		SMT		Position		Event logs
Date	Time	Date	Time	Latitude	Longitude	
3.1	00:00	3.1	09:00	41-21.97N	141-14.38E	Departure from Sekinehama
3.1	03:30	3.1	12:30	41-06.14N	141-46.54E	Calibration for magnetometer #01
3.1	05:30	3.1	14:30	38-06.62N	142-04.61E	Surface sea water sampling Start
3.1	23:57	3.2	08:57	30-18.00N	141-45.90E	Calibration for magnetometer #02
3.2	13:57	3.3	22:57	29-14.19N	134-06.20E	Calibration for magnetometer #03
3.4	21:46	3.5	06:46	27-15.63N	127-04.23E	XCTD #01
3.4	21:54	3.5	06:54	27-31.38N	130-09.57E	Arrival at St. IZ_1
3.4	23:05	3.5	08:05	27-14.63N	127-03.84E	6KCDT Survey #1 Start
3.5	01:32	3.5	10:32	27-14.71N	127-04.00E	St. DCIZ-1 IN
3.5	03:34	3.5	12:34	27-16.30N	127-04.02E	St. DCIZ-1 OUT
3.5	04:18	3.5	13:18	27-16.06N	127-04.22E	St. DCIZ-2 IN
3.5	06:25	3.5	15:25	27-14.70N	127-04.18E	St. DCIZ-2 OUT
3.5	07:09	3.5	16:09	27-14.85N	127-04.26E	6KCDT Survey #1 End
3.5	07:32	3.5	16:32	27-14.84N	127-01.66E	Cesium magnetometer towing Start #01
3.5	08:31	3.5	17:31	27-16.51N	126-59.51E	MBES/SBP Survey Line IZ-5 IN
3.5	09:29	3.5	18:29	27-11.57N	127-59.52E	MBES/SBP Survey Line IZ-5 OUT
3.5	09:51	3.5	18:51	27-12.24N	127-01.72E	MBES/SBP Survey Line IZ-6 IN
3.5	10:49	3.5	19:49	27-16.72N	127-01.75E	MBES/SBP Survey Line IZ-6 OUT
3.5	11:33	3.5	20:33	27-17.51N	127-03.98E	MBES/SBP Survey Line IZ-7 IN
3.5	12:30	3.5	21:30	27-12.65N	127-04.05E	MBES/SBP Survey Line IZ-7 OUT
3.5	12:44	3.5	21:44	27-13.03N	127-04.64E	MBES/SBP Survey Line IZ-8 IN
3.5	13:44	3.5	22:44	27-17.89N	127-94.61E	MBES/SBP Survey Line IZ-8 OUT
3.5	13:59	3.5	22:59	27-17.51N	127-06.22E	MBES/SBP Survey Line IZ-9 IN
3.5	14:57	3.5	23:57	27-12.66N	127-06.21E	MBES/SBP Survey Line IZ-9 OUT
3.5	15:35	3.6	00:35	27-15.43N	127-07.98E	MBES/SBP Survey Line IZ-11 IN
3.5	17:28	3.6	02:28	27-13.94N	126-57.71E	MBES/SBP Survey Line IZ-11 OUT
3.5	17:28	3.6	02:28	27-13.94N	126-57.71E	MBES/SBP Survey Line IZ-10 IN
3.5	19:15	3.6	04:15	27-09.89N	126-49.55E	MBES/SBP Survey Line IZ-10 OUT

3.5	20:03	3.6	05:03	27-10.57N	126-56.64E	MBES/SBP Survey Line IZ-3 IN
3.5	21:06	3.6	06:06	27-15.35N	126-53.78E	MBES/SBP Survey Line IZ-3 OUT
3.5	21:22	3.6	06:22	27-15.93N	126-55.82E	MBES/SBP Survey Line IZ-4 IN
3.5	21:30	3.6	06:30	27-15.38N	126-56.24E	Cesium magnetometer towing Finish #01
3.5	21:45	3.6	06:45	27-14.50N	126-56.78E	MBES/SBP Survey Line IZ-4 OUT
3.5	23:18	3.6	08:18	27-16.12N	127-04.12E	6KCDT Survey #2 Start
3.6	01:00	3.6	10:00	27-16.10N	127-03.98E	St.DCIZ-1 IN
3.6	04:25	3.6	13:25	27-14.70N	127-04.01E	St. DCIZ-1 OUT
3.6	05:00	3.6	14:00	27-14.70N	127-04.22E	St. DCIZ-2 IN
3.6	06:05	3.6	15:05	27-15.51N	127-04.25E	St. DCIZ-2 OUT
3.6	06:43	3.6	15:43	27-15.55N	127-04.48E	6KCDT Survey #2 End
3.6	07:01	3.6	16:01	27-15.66N	127-04.67E	Cesium magnetometer towing Start #02
3.6	08:51	3.6	17:51	27-11.05N	126-48.07E	MBES/SBP Survey Line SW-16 IN
3.6	11:31	3.6	20:31	26-43.45N	126-48.00E	MBES/SBP Survey Line SW-16 OUT
3.6	11:45	3.6	20:45	26-43.92N	126-45.56E	MBES/SBP Survey Line SW-15 IN
3.6	14:26	3.6	23:26	27-11.46N	126-45.59E	MBES/SBP Survey Line SW-15 OUT
3.6	14:42	3.6	23:42	27-11.00N	126-43.19E	MBES/SBP Survey Line SW-14 IN
3.6	17:25	3.7	02:25	26-43.56N	126-43.20E	MBES/SBP Survey Line SW-14 OUT
3.6	17:36	3.7	02:36	26-43.38N	126-42.57E	XBT#02
3.6	17:44	3.7	02:44	26-43.95N	126-40.80E	MBES/SBP Survey Line SW-13 IN
3.6	20:22	3.7	05:22	27-11.55N	126-40.82E	MBES/SBP Survey Line SW-13 OUT
3.6	20:25	3.7	05:25	27-13.74N	126-58.79E	Cesium magnetometer towing Finish #02
3.6	22:58	3.7	07:58	27-15.36N	127-03.60E	6KCDT Survey #3 Start
3.7	01:22	3.7	10:22	27-14.90N	127-03.81E	St. DCIZ-5 IN
3.7	01:58	3.7	10:58	27-14.90N	127-04.41E	St. DCIZ-5 OUT
3.7	03:41	3.7	12:41	27-14.75N	127-04.40E	St. DCIZ-4 IN
3.7	04:18	3.7	13:18	27-14.75N	127-04.00E	St. DCIZ-4 OUT
3.7	06:10	3.7	15:10	27-14.72N	127-04.21E	St. DCIZ-3 IN
3.7	06:40	3.7	15:40	27-15.20N	127-03.61E	St. DCIZ-3 OUT
3.7	08:14	3.7	17:14	27-15.88N	127-03.08E	6KCDT Survey #3 End
3.7	08:28	3.7	17:28	27-15.77N	127-02.84E	Cesium magnetometer towing Start #03
3.7	10:48	3.7	19:48	27-14.89N	126-35.86E	MBES/SBP Survey Line SW-11_1' IN
3.7	12:15	3.7	21:15	27-00.00N	126-36.08E	MBES/SBP Survey Line SW-11_1' OUT
3.7	12:15	3.7	21:15	27-00.00N	126-36.08E	MBES/SBP Survey Line SW-11_1 IN

3.7	15:11	3.8	00:11	26-29.56N	126-36.00E	MBES/SBP Survey Line SW-11_1 OUT
3.7	15:25	3.8	00:25	26-30.02N	126-38.45E	MBES/SBP Survey Line SW-12_1 IN
3.7	18:18	3.8	03:18	27-00.00N	126-38.42E	MBES/SBP Survey Line SW-12_1 OUT
3.7	18:18	3.8	03:18	27-00.00N	126-38.42E	MBES/SBP Survey Line SW-12_1' IN
3.7	20:11	3.8	05:11	27-20.47N	126-38.42E	MBES/SBP Survey Line SW-12_1' OUT
3.7	21:34	3.8	06:34	27-27.05N	126-54.96E	Cesium magnetometer towing Finish #03
3.7	22:57	3.8	07:57	27-14.75N	127-04.81E	6KCDT Survey #4 Start
3.8	00:35	3.8	09:35	27-15.01N	127-04.40E	St. DCIZ-6 IN
3.8	01:32	3.8	10:32	27-15.00N	127-03.60E	St. DCIZ-6 OUT
3.8	02:18	3.8	11:18	27-15.19N	127-03.83E	St. DCIZ-7 IN
3.8	03:50	3.8	12:50	27-15.20N	127-04.95E	St. DCIZ-7 OUT
3.8	04:56	3.8	13:56	27-15.40N	127-04.95E	St. DCIZ-8 IN
3.8	06:37	3.8	15:37	27-15.39N	127-03.60E	St. DCIZ-8 OUT
3.8	07:28	3.8	16:28	27-15.53N	127-03.44E	6KCDT Survey #4 End
3.8	07:44	3.8	16:44	27-15.40N	127-03.78E	Cesium magnetometer towing Start #04
3.8	10:08	3.8	19:08	27-17.96N	126-38.38E	MBES/SBP Survey Line SW-12_2mid IN
3.8	12:19	3.8	21:19	27-41.97N	126-38.40E	MBES/SBP Survey Line SW-12_2mid OUT
3.8	12:25	3.8	21:25	27-42.16N	126-37.51E	XCTD#3
3.8	12:37	3.8	21:37	27-41.44N	126-36.00E	MBES/SBP Survey Line SW-11_2mid IN
3.8	15:20	3.9	00:20	27-12.44N	126-36.09E	MBES/SBP Survey Line SW-11_2mid OUT
3.8	16:15	3.9	01:15	27-13.90N	126-49.00E	Calibration for magnetometer #04
3.8	16:50	3.9	01:50	27-13.25N	126-50.08E	MBES/SBP Survey Line IZ-1 IN
3.8	17:54	3.9	02:54	27-08.40N	126-53.02E	MBES/SBP Survey Line IZ-1 OUT
3.8	18:09	3.9	03:09	27-09.63N	126-54.78E	MBES/SBP Survey Line IZ-2 IN
3.8	19:09	3.9	04:09	27-14.55N	126-51.75E	MBES/SBP Survey Line IZ-2 OUT
3.8	19:34	3.9	04:34	27-15.90N	126-55.93E	MBES/SBP Survey Line IZ-4' IN
3.8	20:35	3.9	05:35	27-11.04N	126-58.83E	MBES/SBP Survey Line IZ-4' OUT
3.8	20:55	3.9	05:55	27-11.48N	126-58.92E	MBES/SBP Survey Line IZ-4.5 IN
3.8	21:50	3.9	06:50	27-16.47N	126-56.92E	Cesium magnetometer towing Finish #04
3.8	21:51	3.9	06:51	27-16.55N	126-56.89E	MBES/SBP Survey Line IZ-4.5 OUT
3.9	00:44	3.9	09:44	27-00.00N	126-33.69E	MBES/SBP Survey Line SW-10_1 IN
3.9	05:47	3.9	14:47	26-04.71N	126-33.55E	MBES/SBP Survey Line SW-10_1 OUT
3.9	06:03	3.9	15:03	26-04.93N	126-31.22E	MBES/SBP Survey Line SW-9_1' IN
3.9	07:10	3.9	16:10	26-13.30N	126-31.29E	MBES/SBP Survey Line SW-9_1' OUT

3.9	07:10	3.9	16:10	26-13.30N	126-31.29E	MBES/SBP Survey Line SW-9.5 IN
3.9	12:52	3.9	21:52	27-00.21N	126-31.85E	MBES/SBP Survey Line SW-9.5 OUT
3.9	12:58	3.9	21:58	27-00.00N	126-31.22E	MBES/SBP Survey Line SW-9_1 IN
3.9	18:10	3.10	03:10	26-04.81N	126-31.22E	MBES/SBP Survey Line SW-9_1 OUT
3.9	18:21	3.10	03:21	26-04.94N	126-29.97E	MBES/SBP Survey Line SW-8.5 IN
3.10	00:33	3.10	09:33	27-00.27N	126-30.02E	MBES/SBP Survey Line SW-8.5 OUT
3.10	00:43	3.10	09:43	27-00.01N	126-28.86E	MBES/SBP Survey Line SW-8_1 IN
3.10	05:48	3.10	14:48	26-04.77N	126-28.78E	MBES/SBP Survey Line SW-8_1 OUT
3.10	05:57	3.10	14:57	26-05.01N	126-27.64E	MBES/SBP Survey Line SW-7.5 IN
3.10	11:57	3.10	20:57	27-00.25N	126-27.63E	MBES/SBP Survey Line SW-7.5 OUT
3.10	12:06	3.10	21:06	27-00.03N	126-26.40E	MBES/SBP Survey Line SW-7_1 IN
3.10	17:15	3.11	02:15	26-05.27N	126-26.39E	XCTD#4
3.10	17:22	3.11	02:22	26-04.27N	126-26.38E	MBES/SBP Survey Line SW-7_1 OUT
3.10	17:32	3.11	02:32	26-04.82N	126-25.20E	MBES/SBP Survey Line SW-6.5 IN
3.10	22:47	3.11	07:47	27-00.22N	126-25.14E	MBES/SBP Survey Line SW-6.5 OUT
3.10	22:55	3.11	07:55	27-00.37N	126-24.01E	MBES/SBP Survey Line SW-6_1 IN
3.11	00:02	3.11	09:02	26-50.00N	126-24.02E	Cesium magnetometer towing Start #05
3.11	04:26	3.11	13:26	26-04.20N	126-23.98E	MBES/SBP Survey Line SW-6_1 OUT
3.11	04:43	3.11	13:43	26-04.81N	126-21.63E	MBES/SBP Survey Line SW-5_1 IN
3.11	09:51	3.11	18:51	27-00.37N	126-21.59E	MBES/SBP Survey Line SW-5_1 OUT
3.11	09:54	3.11	18:54	27-00.68N	126-21.35E	XCTD#5
3.11	10:17	3.11	19:17	26-59.19N	126-19.23E	XBT#6
3.11	10:13	3.11	19:13	26-59.50N	126-19.24E	MBES/SBP Survey Line SW-4 IN
3.11	14:13	3.11	23:13	26-16.74N	126-19.17E	MBES/SBP Survey Line SW-4 OUT
3.11	21:31	3.12	06:31	27-12.88N	127-03.56E	Cesium magnetometer towing Finish #05
3.11	21:55	3.12	06:55	27-13.84N	127-03.52E	6KCDT Survry #5 Start
3.11	23:34	3.12	08:34	27-14.69N	127-03.91E	St. DCIZ-9 IN
3.12	00:44	3.12	09:44	27-15.20N	127-04.42E	St. DCIZ-9 OUT
3.12	01:41	3.12	10:41	27-16.16N	127-05.05E	6KCDT Survey #5 End
3.12	01:57	3.12	10:57	27-16.31N	127-05.02E	Cesium magnetometer towing Start #06
3.12	05:23	3.12	14:23	26-58.14N	126-33.51E	MBES/SBP Survey Line SW-10_2 IN
3.12	06:00	3.12	15:00	27-06.10N	126-33.54E	Surface sea water sampling end
3.12	08:48	3.12	17:48	27-41.92N	126-33.59E	MBES/SBP Survey Line SW-10_2 OUT

3.12	08:54	3.12	17:54	27-42.18N	126-33.04E	Cesium magnetometer towing end #06
3.12	09:15	3.12	18:54	27-41.48N	126-31.18E	MBES/SBP Survey Line SW-9_2 IN
3.12	13:13	3.12	22:55	26-57.84N	126-31.21E	MBES/SBP Survey Line SW-9_2 OUT
3.12	13:28	3.12	22:28	26-57.98N	126-28.77E	MBES/SBP Survey Line SW-8_2' IN
3.12	14:32	3.12	23:32	27-10.17N	126-28.80E	MBES/SBP Survey Line SW-8_2' OUT
3.12	23:50	3.13	08:50	26-14.36N	127-40.62E	Arrival at Naha

4. Instruments

4.1. Shipboard observation system

4.1.1 SEABEAM 3012 Upgrade Model (12kHz system)

R/V MIRAI is equipped with a Multi-narrow Beam Echo Sounding system (MBES), SEABEAM 3012 Upgrade Model (L3 Communications ELAC Nautik). Table 4.1-1 shows the system configuration and performance of the SEABEAM 3012.

Table 4.1-1 the system configurations and performance

SEABEAM 3012 Upgrade Model (12 kHz system)

Frequency:	12 kHz
Transmit beam width:	1.6 degree
Transmit power:	20 kW
Transmit pulse length:	2 to 20 msec
Receive beam width:	1.8 degree
Depth range:	100 to 11,000 m
Beam spacing:	0.5 degree athwart ship
Swath width:	150 degree (max) 120 degree to 4,500 m 100 degree to 8,000 m 90 degree to 11,000 m
Depth accuracy:	Within < 0.5% of depth or ± 1 m, whichever is greater, over the entire swath. (Nadir beam has greater accuracy; typically within < 0.2% of depth or ± 1 m, whichever is greater)

4.1.2 Sub Bottom Profiler

R/V MIRAI is equipped a with Sub-bottom Profiler (SBP), Bathy2010 (SyQwest). Table 4.1-2 shows the system configurations and performance of Sub Bottom Profiler.

Table 4.1-2 the system configurations and performance

Sub bottom Profiler, Bathy2010 (3.5 kHz system)

Frequency:	3.5 kHz, FM Chirp
Transmit beam width:	23 degree
Transmit pulse length:	0.5 to 50 msec
Strata resolution:	Up to 8 cm with 300+ Meters of bottom penetration; bottom type dependant
Depth resolution:	0.1 Feet, 0.1 Meters
Depth accuracy:	± 10 cm to 100 m, $\pm 0.3\%$ to 6,000 m

4.1.3 Magnetometer

1) Three-component magnetometer

The shipboard three-component magnetometer system (Tierra Technica SFG1214) is equipped on-board R/V MIRAI. Three-axis flux-gate sensor with ring-cored coils are fixed on the foremast. The outputs of the sensors are digitized by a 20-bit A/D converter (1 nT/LSB), and sampled at 8 times per second. Ship's heading, pitch, and roll are measured utilizing Inertial Navigation System (Fiber Optical Gyro) installed for controlling the attitude of the Doppler radar. Ship's position and speed data are taken from LAN every second.

2) Cesium marine magnetometer

We measured total geomagnetic field using a cesium marine magnetometer (Geometrics Inc., G-882) and recorded by the G-882 data logger (Clovertech Co., Ver.1.0.0). The G-882 magnetometer uses an optically pumped Cesium-vapor atomic resonance system. The sensor fish towed 500 m behind the vessel to minimize the effects of the ship's magnetic field. Table 4.1.2-1 shows the system configuration of the MIRAI cesium magnetometer system.

Table 4.1.3 the system configurations of the MIRAI cesium magnetometer system

Dynamic operating range:	20,000 to 100,000 nT
Absolute accuracy:	< ±2 nT throughout range
Setting: Cycle rate;	0.1 sec
Sensitivity;	0.001265 nT at a 0.1 second cycle rate
Sampling rate;	1 sec

4.1.4 Gradiometer

The LaCoste and Romberg air-sea gravity meter S-116 (Micro-g LaCoste, LLC) is equipped on-board R/V MIRAI. Table 4.1.3 shows the system configurations of MIRAI gravity meter.

Table 4.1.4 the system configurations

<u>LaCoste and Romberg air-sea gravity meter (S-116)</u>	
Range:	12,000 mGal
Drift rate:	<±3.0 mGal/month
Temperature set point:	46 to 55 deg-C
Resolution:	0.01 mGal
Static repeatability:	0.05 mGal
Accuracy at sea:	1.0 mGal or better
Sampling rate:	1 sec
Relative gravity	Counter unit [CU]
	To change gravity [mGal] = (coef1: 0.9946) * [CU]

4.2 DC resistivity system

On this cruise, we examined the deep towed DC resistivity surveys using R/V Mirai and deep-tow system of JAMSTEC. Our controlled source survey system consists of a transmitter unit and a main unit with a data logger, which recorded a transmitting signal and received signal. The AC 100 V supplied from the deep-tow transfers to DC 24 V, and it is input to a transmitter unit. The maximum output power of this transmitter is about 1.2 kW with maximum voltage of 48V peak-to-peak and current of 50A. We planned to use improved transmitter, however, some troubles of the electric circuit occurred. Therefore, output power data were recorded with 4 Hz sampling. On the other hand, four electric fields data were recorded with a 50 Hz sampling rate using the new data logger.

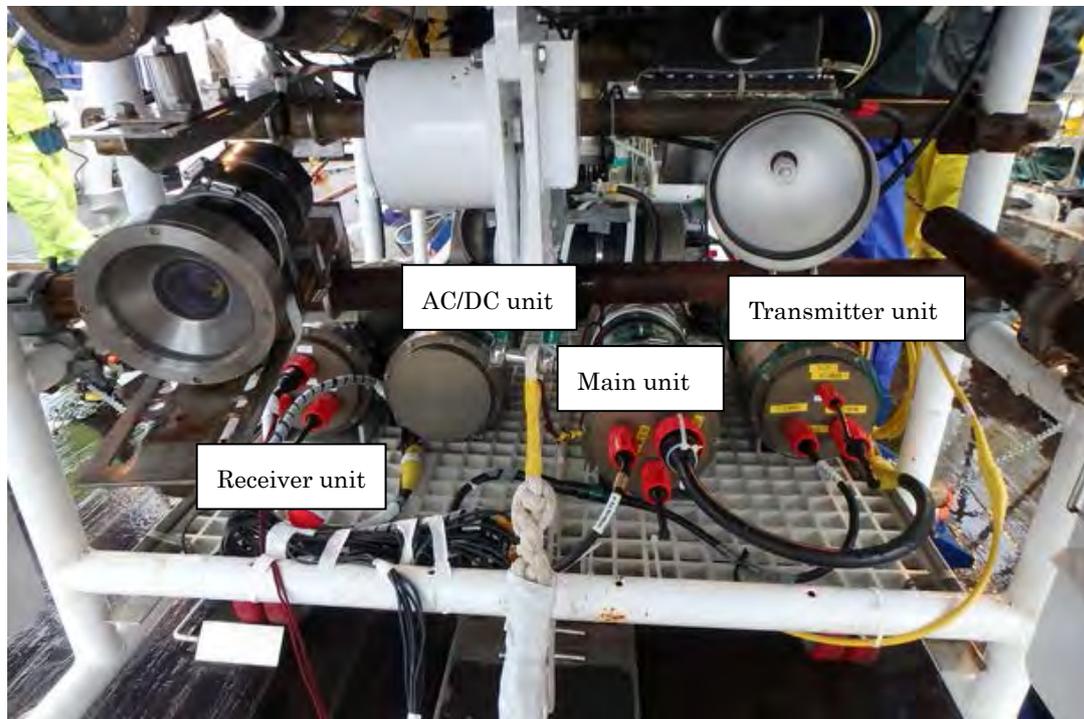


Fig. 4.3.1.2 Photo of a controlled source survey system.

Table 4.3.1 Specification of a controlled source survey system

Power unit

Max Input Voltage: 120 V

Max Output Current: 50 A

Circuit type: IGBT

Transmit channel: 4 ch

Main unit

Control unit

Max Measurement Current Range: 50 A

Max Measurement Voltage Range: 200V

A/D converter: 24 bit

Recording Media: SDHC

Sampling rate: 8 Hz

Logger unit

Measurement channels: 5 CH

Measurement Voltage Range: ± 100 mV

A/D converter: 24 bit

Recording Media: SDHC

Sampling rate: 50 Hz

5. Operation reports

5.1 Shipboard data

We conducted a surface geophysical survey to characterize back-arc basin development and also the distribution of hydrothermal activity in the northwestern part of Okinawa Trough. Multi-narrow beam bathymetry, backscatter intensity, vertical sub-bottom profile, gravity field, and magnetic field data were collected with ~10.5-kt ship speed (Fig. 5.1.1). The real-time sound velocity data by Surface Sound Velocimeter (SSV) at the sea surface (6.62m depth) and the sound velocity vertical profiles estimated by the results of XCTD (eXpendable Conductivity Temperature Depth profiler) XBT (eXpandable Bathy Thermograph) were used for the ray-path correction of acoustic multi-beam. The sound velocity was calculated by using the equation in Del Grosso (1974). Four XCTDs and two XBTs in total were done in the survey area as shown in Fig. 5.1.1 and Table 5.1.2.

Magnetic field data were collected by two equipments; a shipboard three-component magnetometer (STCM, Tierra Tecnica SFG1214), which can measure the vector of the geomagnetic field using deck-mounted fluxgate magnetometers and gyros, and a ship-towed cesium magnetometer (Geometrics Inc., G-882) which can measure the intensity of the geomagnetic field. The STCM data contain the effects of ship's magnetic field. To be corrected in order to derive the real geomagnetic field, "Eight figure turn" were conducted four times (Table 5.1.3). Gravity field data were obtained from a shipboard gravimeter (S-116, LaCoste & Romberg Air-Sea Gravity Meter – System II). Free-air gravity anomaly is calculated by subtracting the normal gravity field and correction of the Eotvos effect using the GPS data. The gravity field data at the Yokohama and Naha ports measured by the portable gravimeter (Scintrex gravity meter CG-5) will be used to correct the data drift.

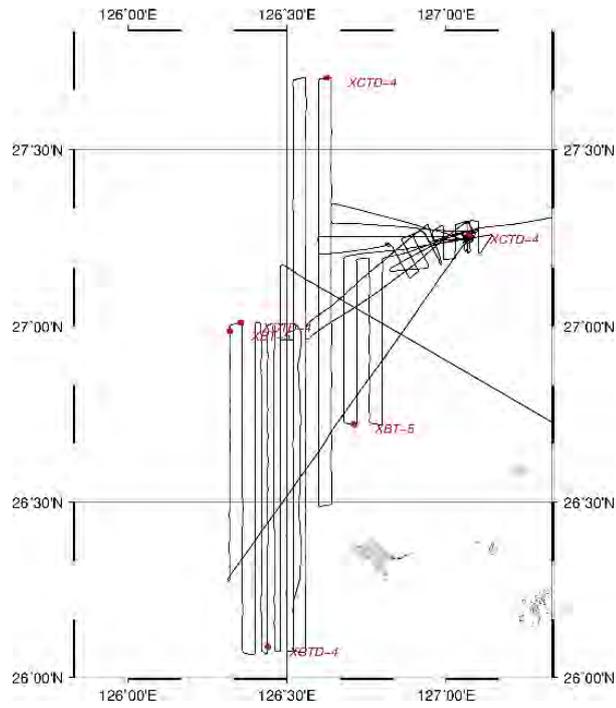


Figure 5.1.1 Ship tracks of survey lines and observation points of XCTD and XBT.

Table 5.1.1 Survey line list of MR15-E01 Cruise.

Line No.	North/West		South/East		Distance[nm]
	Latitude	Longitude	Latitude	Longitude	
SW-1	27°00.00'N	126°12.00'E	26°05.00'N	126°12.00'E	55.0
SW-2	27°00.00'N	126°14.40'E	26°05.00'N	126°14.40'E	55.0
SW-3	27°00.00'N	126°16.80'E	26°05.00'N	126°16.80'E	55.0
SW-4	27°00.00'N	126°19.20'E	26°05.00'N	126°19.20'E	55.0
SW-5_1	27°30.00'N	126°21.60'E	27°00.00'N	126°21.60'E	55.0
SW-5_2	27°00.00'N	126°21.60'E	26°05.00'N	126°21.60'E	30.0
SW-6_1	27°30.00'N	126°24.00'E	27°00.00'N	126°24.00'E	55.0
SW-6_2	27°00.00'N	126°24.00'E	26°05.00'N	126°24.00'E	30.0
SW-7_1	27°30.00'N	126°26.40'E	27°00.00'N	126°26.40'E	55.0
SW-7_2	27°00.00'N	126°26.40'E	26°05.00'N	126°26.40'E	30.0
SW-8_1	27°30.00'N	126°28.80'E	27°00.00'N	126°28.80'E	55.0
SW-8_2	27°00.00'N	126°28.80'E	26°05.00'N	126°28.80'E	30.0
SW-9_1	27°41.50'N	126°31.20'E	27°00.00'N	126°31.20'E	55.0
SW-9_2	27°00.00'N	126°31.20'E	26°05.00'N	126°31.20'E	41.5
SW-10_1	27°41.50'N	126°33.60'E	27°00.00'N	126°33.60'E	55.0

SW-10_2	27°00.00'N	126°33.60'E	26°05.00'N	126°33.60'E	41.5
SW-11_1	27°41.50'N	126°36.00'E	27°00.00'N	126°36.00'E	30.0
SW-11_2	27°00.00'N	126°36.00'E	26°30.00'N	126°36.00'E	41.5
SW-12_1	27°41.50'N	126°38.40'E	27°00.00'N	126°38.40'E	30.0
SW-12_2	27°00.00'N	126°38.40'E	26°30.00'N	126°38.40'E	41.5
SW-13	27°11.00'N	126°40.80'E	26°40.00'N	126°40.80'E	31.0
SW-14	27°11.00'N	126°43.20'E	26°40.00'N	126°43.20'E	31.0
SW-15	27°11.00'N	126°45.60'E	26°40.00'N	126°45.60'E	31.0
SW-16	27°11.00'N	126°48.00'E	26°40.00'N	126°48.00'E	31.0

Table 5.1.2 XCTD and XBT measurement list.

Date [YYYY/MM/DD]	Time [hh:mm]	Latitude [degS]	Longitude [degE]	Btm.Depth [m]	SST [deg-C]
2015/03/04	21:46	27-15.6356N	127-04.2552E	1636	22.000
2015/03/06	17:03	26-43.3789N	126-42.5711E	1284	22.900
2015/03/08	12:25	27-42.1631N	126-37.5058E	1464	22.600
2015/03/10	17:14	26-05.2696N	126-26.3912E	1423	23.200
2015/03/11	09:54	27-00.6800N	126-21.3506E	1682	22.700
2015/03/11	10:17	26-59.1942N	126-19.2347E	1705	22.700

Table 5.1.3 “Eight figure turn” position list.

No.	Date(UTC)	Start Time(UTC)	End Time(UTC)	Latitude	Longitude
1	2015/3/1	3:29	3:52	41°07.596'N	141°45.843'E
2	2015/3/1-2	23:58	0:25	36°18.000'N	141°45.900'E
3	2015/3/3	13:56	14:25	30°31.278'N	134°06.320'E
4	2015/3/8	16:16	16:41	27°14'N	126°49'E

5.2 Deep-tow dives

We conducted six deep-tow dives in this cruise for a controlled electro-magnetic source survey in the Izena hole. Figure 5.2.1 shows all survey lines of deep-tow dives carried out in this cruise, and the dive information is summarized in table 5.3.1.

On this cruise, we examined the deep towed DC resistivity survey using R/V Mirai and deep-tow system of JAMSTEC. We should have been able to control the main unit and confirm a recording data in real-time. However, it has become an off-line survey because of a problem with the electric circuit of the transmitter. In these operations, we used a thin FRP bar as a towed rod instead of the towed rope, and towed height is about 5 meters while a visual observation using a CCD camera. Output current was controlled with 20-25 A because of a limitation of the power supply of the deep-tow system. Electrode configuration of each EM dive is shown in Fig. 5.2.2.

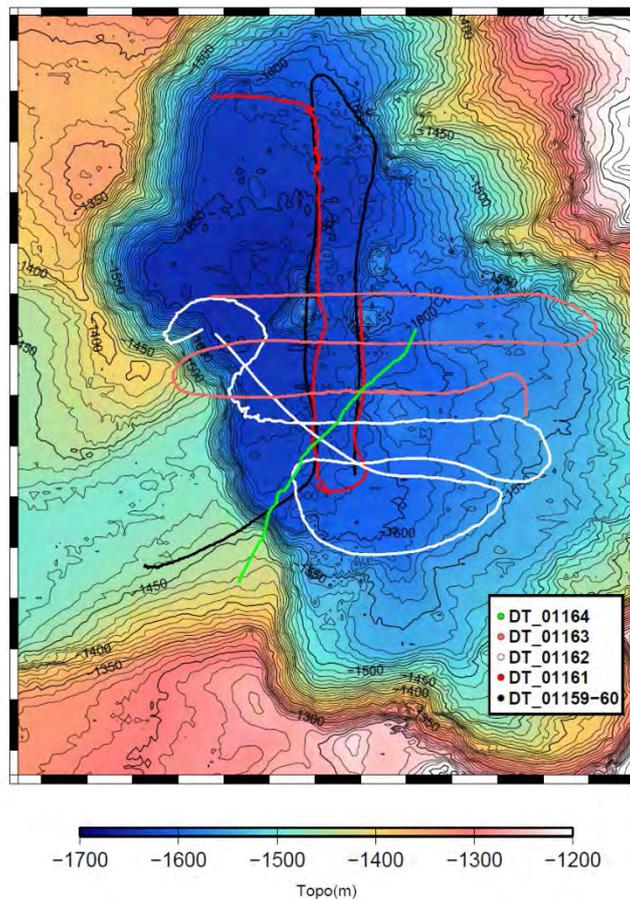


Fig. 5.2.1 Deep-tow survey lines carried out on a MR15-E01 cruise.

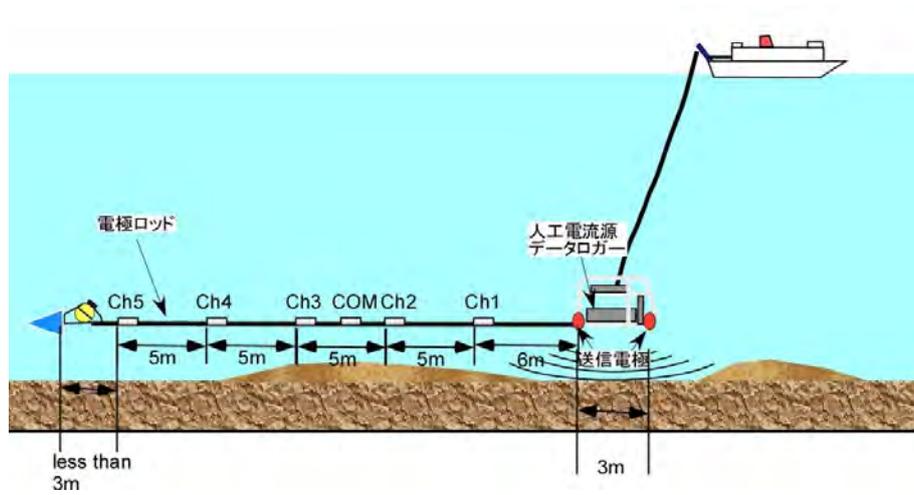


Fig. 5.2.2 Schematic diagram of electrode configuration of DC resistivity survey dive. Green circles show the receiver electrodes. Each electrode spacing is 5 meters.