doi : 10.17596/0003284

KR10-01 Cruise Report

Seismic study in the Sagami Bay

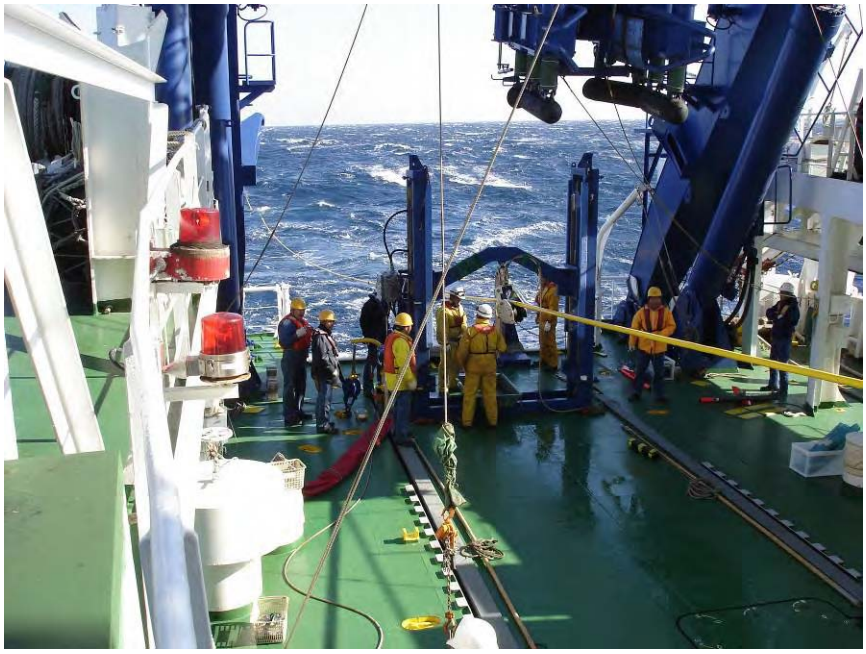
(Multichannel seismic reflection survey)

Jan. 4, 2010 – Jan. 8, 2010

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

Contents:



1. Cruise Information:

(1) **Cruise ID, Ship name:** KR10-01, R/V Kairei
(2) **Title of the cruise:** 2009FY "Seismic study in the Sagami bay"
(3) **Title of proposal:** High resolution deep seismic study in and around the Sagami Bay and Boso peninsula
(4) **Cruise period, Port call:** 2010/1/4-1/8, JAMSTEC Yokosuka Headquarters to Yokohama port
(5) **Research Area:** Sagami Bay
(6) **Research Map:** Fig.1

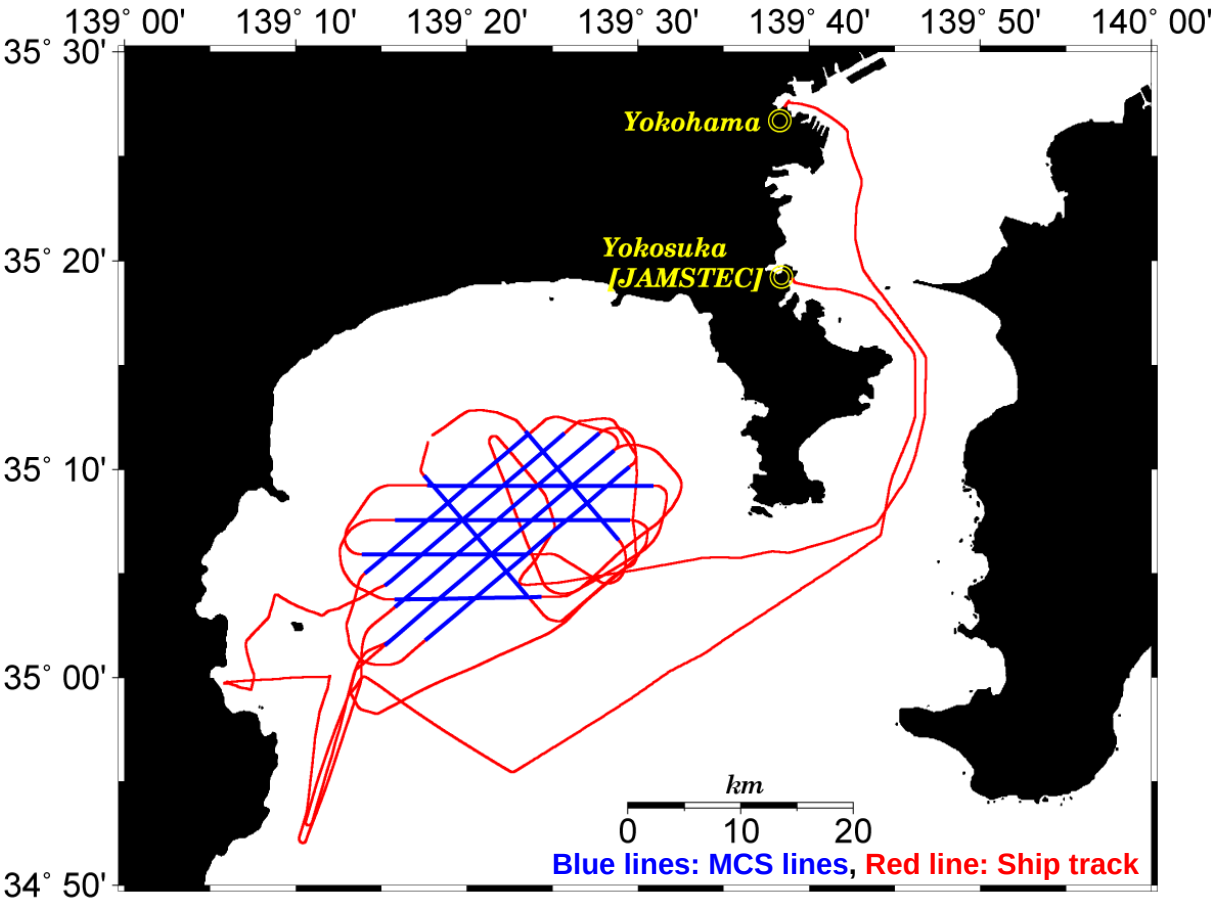


Fig.1 Ship track during KR10-01 cruise.

2. Researchers:

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(2) Representative of Science Party [Affiliation]:

Yoshio Fukao [IFREE, JAMSTEC]

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Tetsuo No [IFREE, JAMSTEC]

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Masayuki Azuma [ORI, Univ. of Tokyo]: Scientist
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Masayuki Toizumi [NME]: Technician (Party chief)
Toru Nakasone [NME]: Technician (Seismic observer)
Satoshi Shimizu [NME]: Technician (Seismic source technician)
Kaoru Takizawa [NME]: Technician (Seismic data processor)
Yuki Ohwatari [NME]: Technician (Seismic observer)
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Atsushi Isogai [NME]: Technician (Seismic source technician)
Kyoko Tanaka [NME]: Technician (Seismic observer)
Kiyoshi Hatakeyama [NME]: Technician

3. Overview of Observations:

(1) Objectives:

The Sagami Bay is located along the boundary between the Philippine Sea Plate and the Northeast Honshu arc. Great earthquakes (e.g., the 1923 Great Kanto earthquake, the 1703 Genroku earthquake) have frequently occurred in the Sagami Trough, including the Sagami Bay, and these earthquakes have caused very strong vibrations, large tsunamis, and serious damage around the Kanto and Tokai area. Studies conducted in the last ten years have contributed to the crustal exploration of the Philippine Sea Plate for territorial delimitation of the continental shelf. For example, the forearc in the Izu-Ogawasara arc includes a paleoarc formed during the Eocene, and an island arc formed during the Oligocene. Between these arcs is distributed a thin crust, which was rifted during the Eocene, and a thick sedimentary layer on the crust (e.g., Takahashi et al., 2008). Since the Philippine Sea Plate has these heterogeneous structures which formed in the Izu-Ogasawara, it is important to understand how it affects the seismogenic zone around the Sagami Bay. To study the seismotectonics around the Sagami Bay, some seismic reflection studies have been conducted (e.g., Kato et al., 1983, Kinoshita et al., 2006). However, the past seismic reflection surveys have been carried out using short streamer cables. In order to study the deep crustal structure, we need to carry out data acquisition by using long streamer cables.

In January 2010, we have conducted a multi-channel seismic reflection (MCS, Fig.2) survey around the Sagami Knoll in the Sagami Bay using R/V KAIREI of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). The survey lines were set according to the drilling sites proposed for the Integrated Ocean Drilling Program (IODP) expedition of the Kanto Asperity Project and the fishing operations around the survey area.

(2) List of observation instruments:

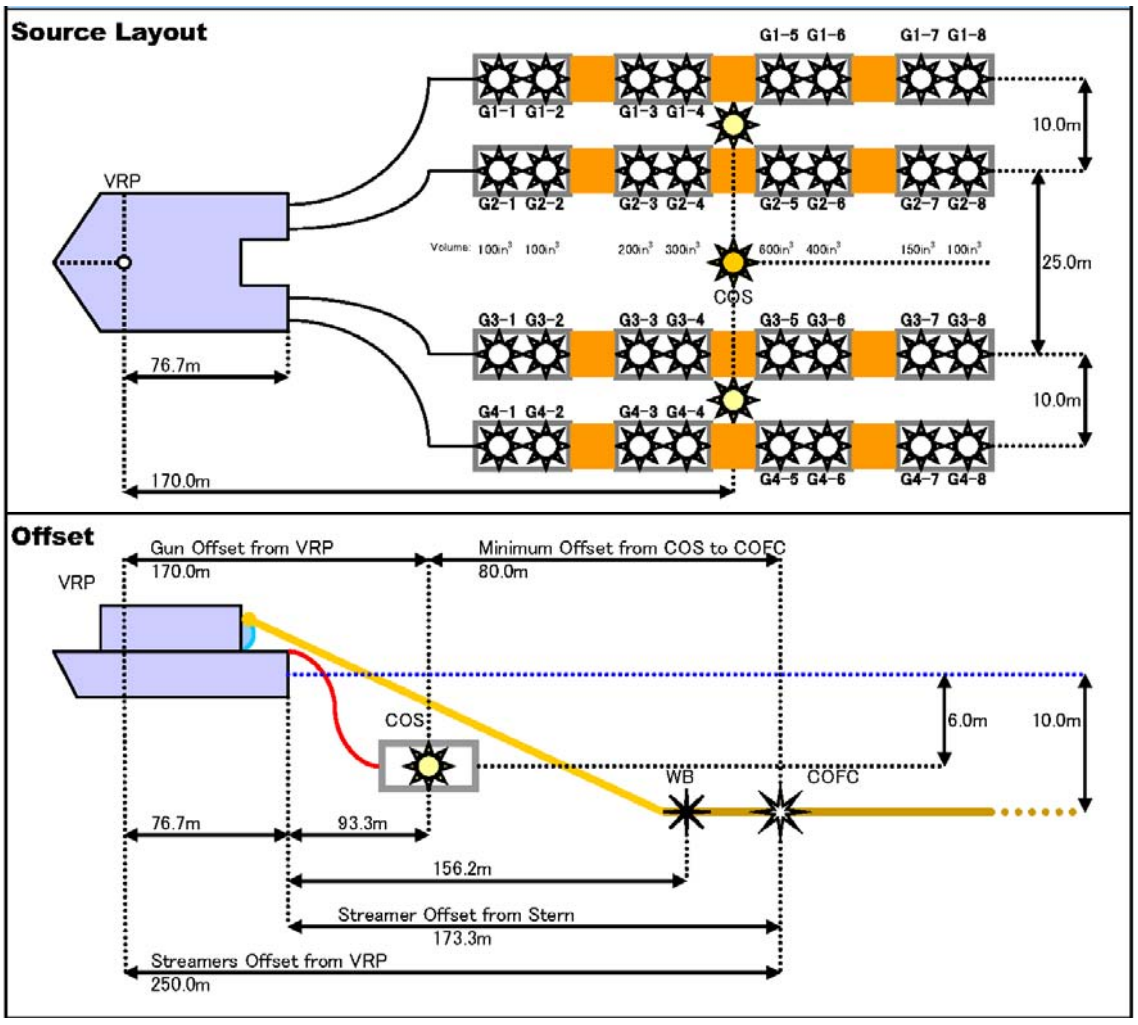
1) Multichannel seismic reflection survey (MCS) [Fig.2]

MCS data was acquired along 12 lines (SG10-1, SG10-2, SG10-A, SG10-B, SG10-C, SG10-D, SG10-E, SG10-EW1, SG10-EW2, SG10-EW3, SG10-EW4, and SG10-B-17m) with a total length of approximately 235 km. During the survey, the weather and sea conditions were normal and the ocean currents were weak; therefore, the data quality of this exploration was good.

Fig.2 MCS system on R/V KAIREI.

a) Source:

To obtain MCS data of good quality, we shot a tuned airgun array with a spacing of 37.5 m, which corresponds to 20–30 s in time depending on the vessel speed (average 4.0–4.5 knots). The tuned airgun array has a total capacity of 7,800 cubic inches (about 130 liters) and consists of 32 Bolt Annular Port Airguns. The standard air pressure was 2,000 psi (about 14 MPa). The depth of the airgun array during the experiment was kept at 6 m below the sea surface. The following figure shows four strings of sub-arrays deployed at the port and starboard sides of the vessel. Their width was expanded to 25.0 m by a paravane system, and the central position of the array was set 170 m behind that of the ship antenna (Fig.3).



VRP : Vessel Reference Point	COS : Center of Source
COFC : Center of First Receiver Channel	WB : Water Break hydrophone

Fig.3 Example of vessel towing geometry (SG10-1, SG10-2, SG10-C, SG10-EW1, SG10-EW2, SG10-EW3, SG10-EW4). Top figure shows the source (airgun system) layout, bottom one represents source-receiver depth and position, and navigation offsets.

b) Receiver:

During shooting, we towed a 360-channel hydrophone streamer cable (Sentinel Digital Streamer System, Sercel Inc.)(Fig.4). Hydrophone sensors (Benthos Reduced Diameter Array hydrophone) with sensitivity of 19.7 V/Bar were used. The signals from eight sensors in the same group (channel) were stacked before A/D conversion. The interval of each group is 12.5 m. The lengths of total active section and lead-in cable are 4,500 m and 110 m, respectively. The towing depth of the streamer cable was maintained at 10 m or 17 m below sea surface by the depth controller called Bird (I/O DigiCOURSE streamer depth controllers).

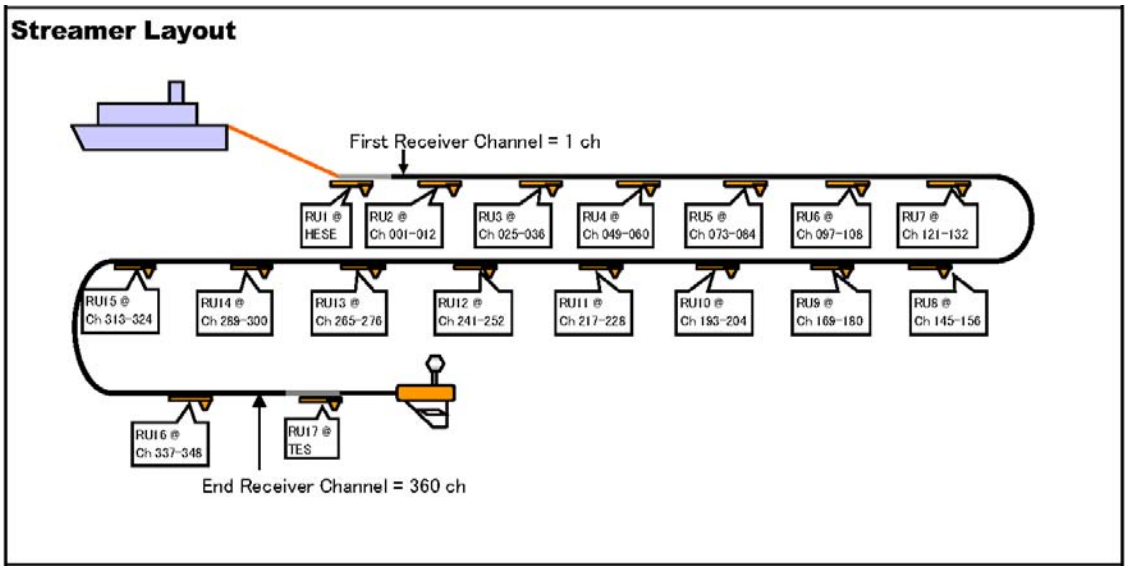


Fig.4 Streamer cable configuration in this survey.

c) Recording and navigation systems

The recording system is Sercel Seal System Ver.5.2, made by Sercel Inc.; it collected seismic data onto 3590E tapes with SEG-D 8058 Rev.1 format. We set the system delay to 200 msec. The sampling rate was 2 msec, and the record length was 15 sec.

The Differential Global Positioning System (DGPS) was used for positioning. We adopted the StarFire system (NAVCOM's DGPS service) as the main positioning system and SkyFix (Fugro's DGPS service) as the backup. The accuracy was reported to be about 0.4 m in StarFire and 5 m in SkyFix. As navigation software for seismic data acquisition, we used SPECTRA 2D, made by Concept Systems Ltd.. Positioning data collected from StarFire as well as SkyFix were sent to the Power Real Time Navigation Unit (PowerRTNU) by Concept Systems Ltd. via a terminal server connected to a LAN in the vessel. Shot times and shot point (SP) were set on SPECTRA, and then a trigger signal was sent to the recording system and the gun controller (ION DigiSHOT Ver.3.1). Main parameters of navigation are as follows: survey datum is WGS84; map projection is UTM; UTM zone parameter is 53N.

2) Bathymetry, magnetic, and gravity observations:

Bathymetry, magnetic, and gravity data were recorded continuously during the survey. The bathymetry survey on R/V KAIREI uses a multi-narrow beam echo sounder manufactured by SeaBeam Instruments (type: Sea Beam 2112.004)(Fig.5). Gravity data is obtained by a shipboard gravimeter manufactured by Fugro Co., Ltd. (type: BODESEEWERK KSS31). The magnetic survey uses a three-component magnetometer manufactured by Tiera Technica Corporation (type: SFG1214).

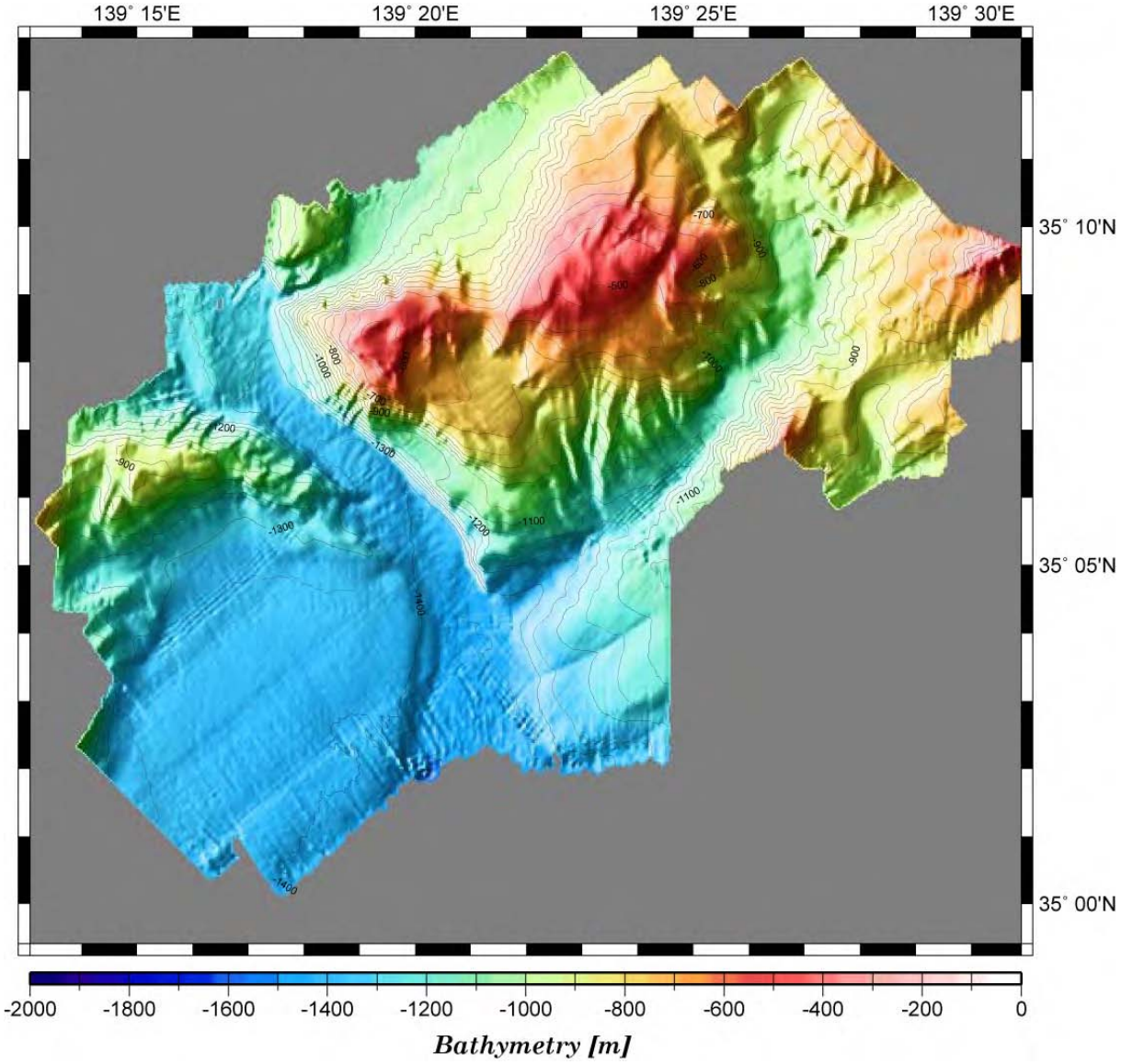


Fig.5 Results of bathymetric survey in this cruise.

(3) **Cruise log:** Table 1

Date		Remarks
2010/1/4	Mon.	Departure from Yokosuka. Transit to survey area of the Sagami Bay. Deployment of MCS system. MCS survey.
2010/1/5	Tue.	MCS survey.
2010/1/6	Wed.	MCS survey.
2010/1/7	Thu.	MCS survey.
2010/1/8	Fri.	MCS survey. Recovery of MCS system. Transit to Yokohama, and arrival at Yokomaha port.

Table 1　Cruise log during this survey.

(4) **Seismic lines (Black lines: MCS lines):** Fig.6

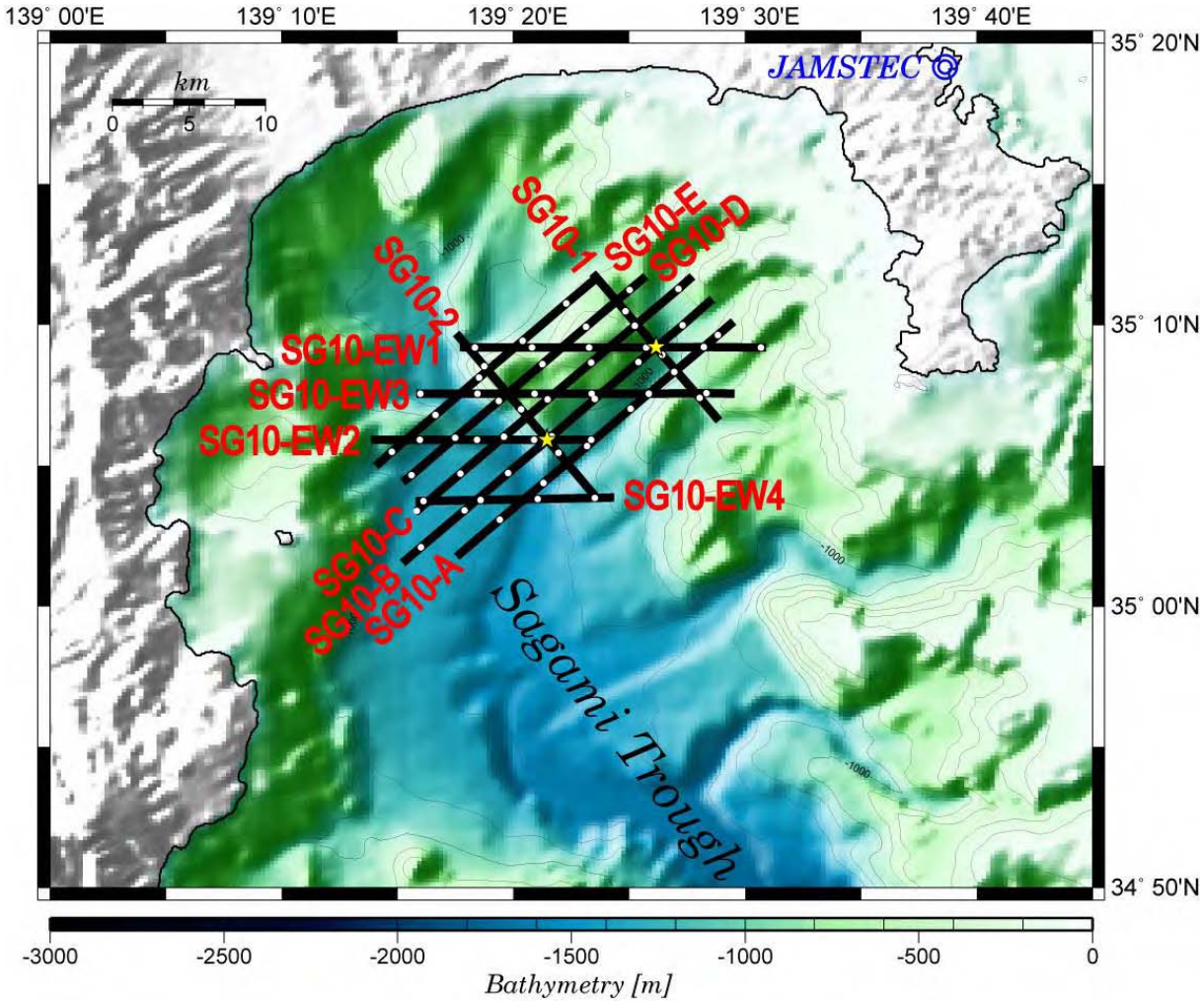


Fig.6　Bathymetry and location maps of the survey area. Black lines are the MCS lines of this survey.

(5) **Seismic line list:** Table 2

LINE NAME	DATE (UTC)	TIME (UTC)	F.S.P. / F.G.S.P. / L.G.S.P. / L.S.P.	S.P. POSITION		Depth (m)	DIRECTION (°)
			L.S.P.	Lat.	Lon.		
SG10-1	06/01/2010	14:10:48	1010	35_11.87712'N	139_23.38131'E	877	140.381
	06/01/2010	14:11:37	1013	35_11.83072'N	139_23.42920'E	832	
	06/01/2010	15:45:06	1352	35_06.60427'N	139_28.86989'E	909	
	06/01/2010	15:45:06	1352	35_06.60427'N	139_28.86989'E	909	
SG10-2	06/01/2010	10:36:56	991	35_03.77361'N	139_23.68274'E	1254	320.429
	06/01/2010	10:39:45	1001	35_03.92641'N	139_23.52031'E	1264	
	06/01/2010	12:22:51	1375	35_09.69057'N	139_17.51858'E	1015	
	06/01/2010	12:22:51	1375	35_09.69057'N	139_17.51858'E	1015	
SG10-A	04/01/2010	18:05:34	960	35_01.23519'N	139_16.79098'E	1371	50.546
	04/01/2010	18:17:01	1001	35_01.77670'N	139_17.55829'E	1384	
	04/01/2010	21:14:16	1636	35_10.12236'N	139_29.49545'E	684	
	04/01/2010	21:14:16	1636	35_10.12236'N	139_29.49545'E	684	
SG10-B	04/01/2010	09:17:58	991	35_01.99383'N	139_15.83296'E	1365	50.551
	04/01/2010	09:18:30	993	35_02.01793'N	139_15.87273'E	1371	
	04/01/2010	12:23:39	1668	35_10.88409'N	139_28.56810'E	744	
	04/01/2010	12:23:39	1668	35_10.88409'N	139_28.56810'E	744	
SG10-C	06/01/2010	04:07:16	961	35_02.90446'N	139_15.12266'E	1352	50.549
	06/01/2010	04:17:52	999	35_03.39171'N	139_15.80972'E	1364	
	06/01/2010	07:12:33	1633	35_11.72208'N	139_27.73386'E	759	
	06/01/2010	07:12:33	1633	35_11.72208'N	139_27.73386'E	759	
SG10-D	04/01/2010	22:48:02	1060	35_11.76648'N	139_25.76764'E	740	230.554
	04/01/2010	22:48:55	1063	35_11.72797'N	139_25.71038'E	679	
	05/01/2010	02:00:21	1620	35_04.42751'N	139_15.21524'E	1259	
	05/01/2010	02:00:21	1620	35_04.42751'N	139_15.21524'E	1259	
SG10-E	04/01/2010	13:47:35	1130	35_11.67376'N	139_23.59521'E	759	230.561
	04/01/2010	13:48:11	1132	35_11.64812'N	139_23.55690'E	756	
	04/01/2010	16:19:22	1638	35_04.99627'N	139_14.04260'E	1181	
	04/01/2010	16:19:22	1638	35_04.99627'N	139_14.04260'E	1181	
SG10-EW1	06/01/2010	20:42:50	961	35_09.22537'N	139_17.36502'E	1267	90.901
	06/01/2010	20:46:22	974	35_09.22004'N	139_17.68597'E	1088	
	06/01/2010	23:15:33	1509	35_09.20690'N	139_30.89845'E	702	
	06/01/2010	23:15:33	1509	35_09.20690'N	139_30.89845'E	702	
SG10-EW2	06/01/2010	17:22:35	991	35_05.91846'N	139_23.57815'E	1204	270.951
	06/01/2010	17:23:09	993	35_05.91913'N	139_23.52886'E	1200	
	06/01/2010	19:11:03	1385	35_05.92015'N	139_13.85461'E	999	
	06/01/2010	19:11:03	1385	35_05.92015'N	139_13.85461'E	999	

SG10-EW3	07/01/2010	04:46:34	991	35_07.56682'N	139_15.75326'E	1252	90.923
	07/01/2010	04:47:07	993	35_07.56889'N	139_15.80267'E	1261	
	07/01/2010	07:20:54	1549	35_07.56229'N	139_29.52923'E	747	
	07/01/2010	07:20:54	1549	35_07.56229'N	139_29.52923'E	747	
SG10-EW4	07/01/2010	01:19:29	961	35_03.87337'N	139_24.46899'E	1175	270.000
	07/01/2010	01:20:53	966	35_03.86974'N	139_24.34560'E	1185	
	07/01/2010	02:56:58	1313	35_03.74554'N	139_15.78667'E	1356	
	07/01/2010	02:56:58	1313	35_03.74554'N	139_15.78667'E	1356	
SG10-B-17m	07/01/2010	12:40:41	952	35_01.47861'N	139_15.10319'E	1337	50.551
	07/01/2010	12:42:27	958	35_01.55341'N	139_15.21990'E	1347	
	07/01/2010	16:08:18	1669	35_10.90164'N	139_28.58249'E	742	
	07/01/2010	16:08:18	1669	35_10.90164'N	139_28.58249'E	742	
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							

Table 2　List of MCS survey lines.

(6)　Onboard processing of MCS data:

Raw MCS reflection data are processed on board for the purpose of quality control in the study areas. Onboard data processing was conducted preserving relative amplitudes under the conventional processing scheme, which includes trace header edit, trace edit, common midpoint (CMP) binning with an interval of 6.25 m, a bandpass filter (3–250 Hz), datum correction, amplitude compensation, predictive deconvolution, velocity analysis, normal moveout correction, a radon filter for multiple suppression, mute, CMP stack, F-K migration, and a bandpass filter (4–120 Hz) (Fig. 7-9).

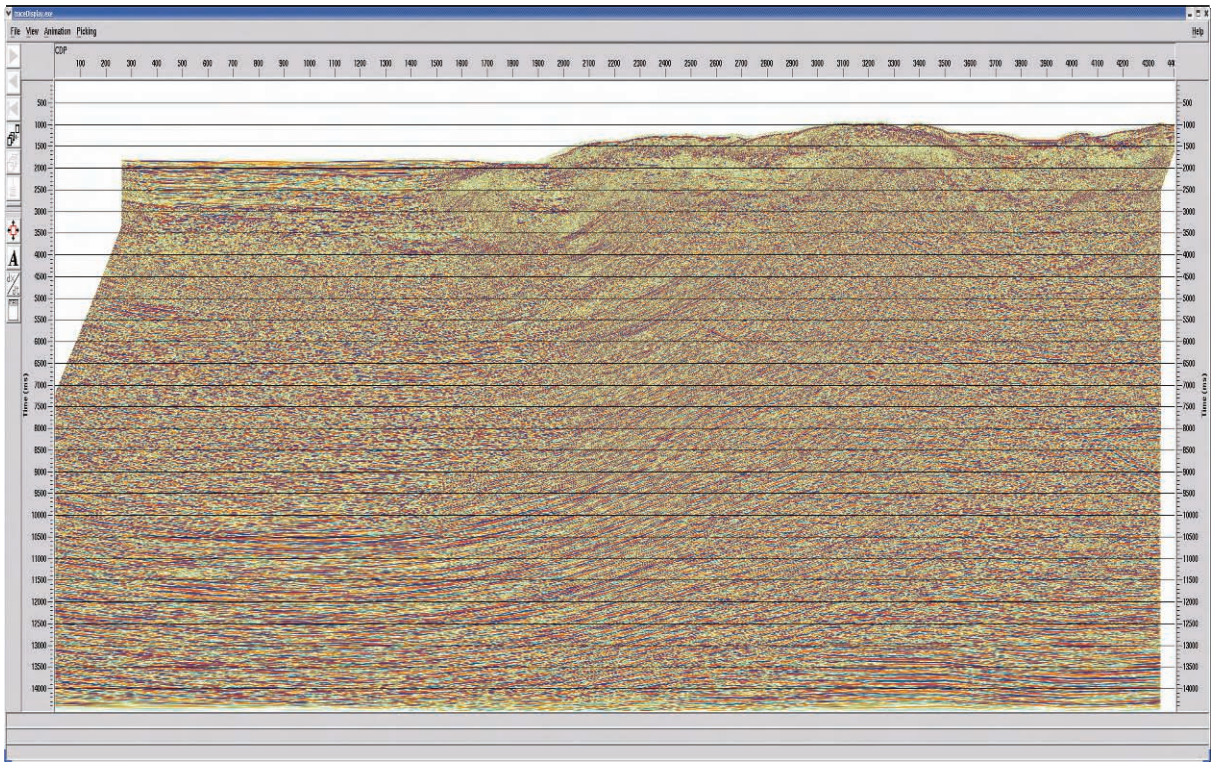


Fig.7　Example of MCS profile with onboard processing (Poststack time migration section of Line SG10-2).

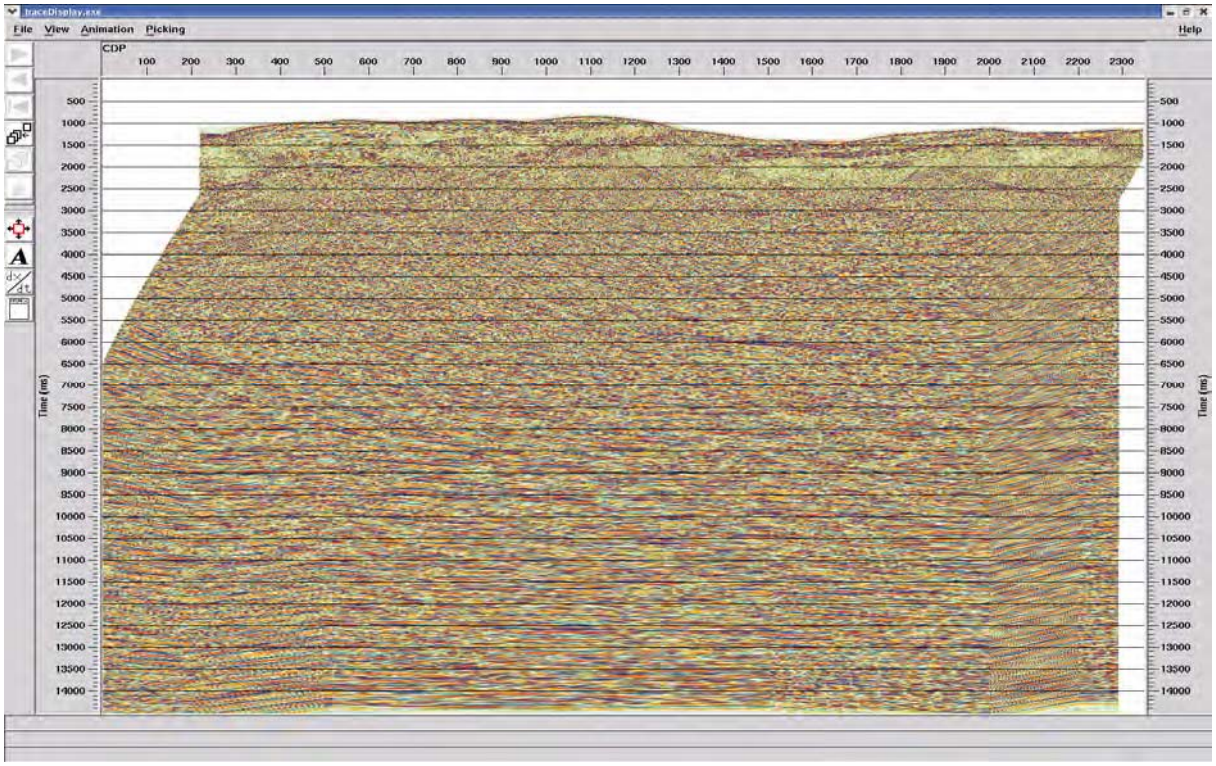


Fig.8　Example of MCS profile with onboard processing (Poststack time migration section of Line SG10-A).

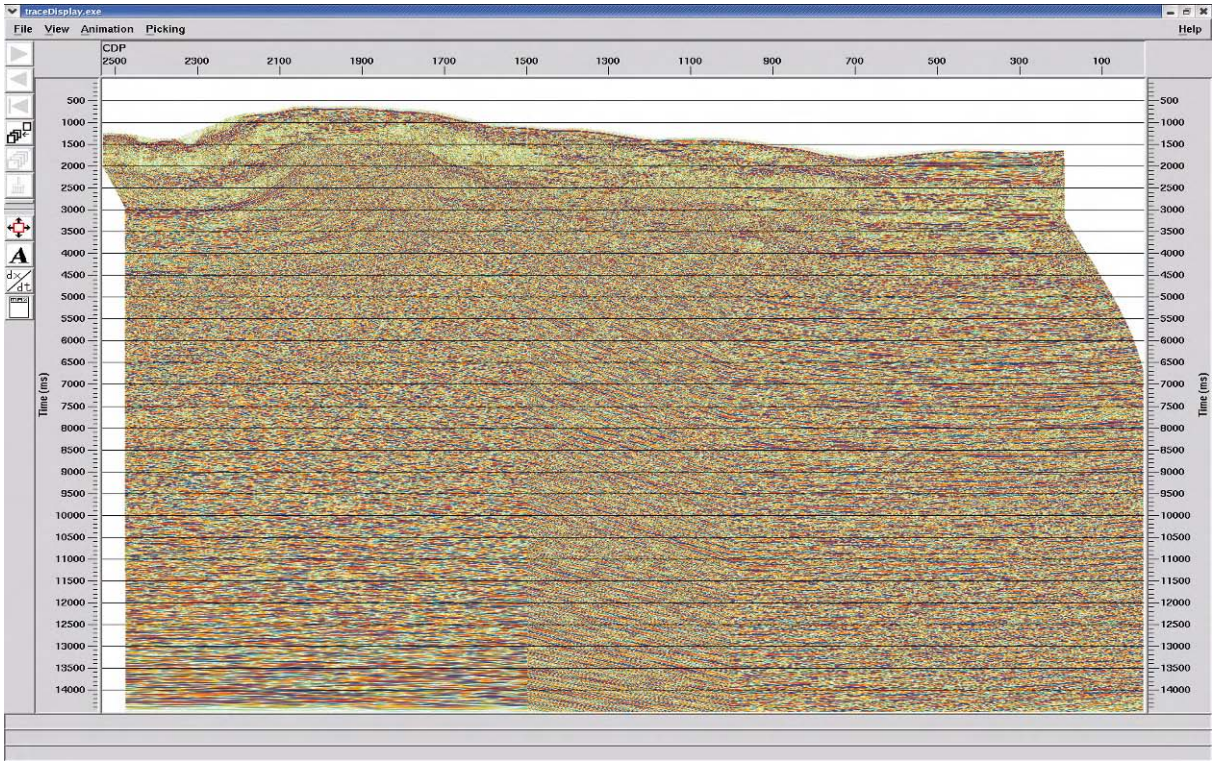
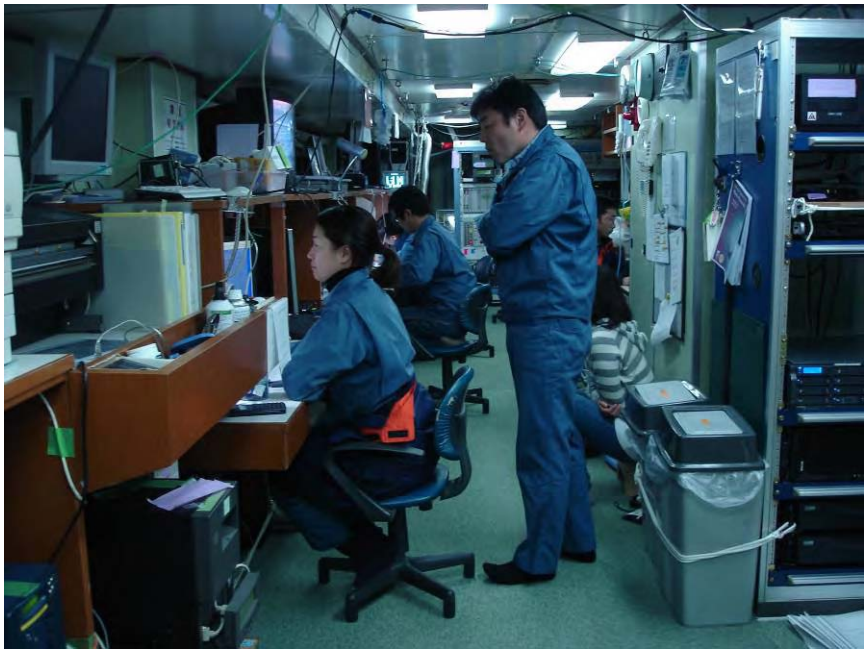


Fig.9　Example of MCS profile with onboard processing (Poststack time migration section of Line SG10-B).

4. Notice on use:

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



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Acknowledgement:

We thank to the captain Hitoshi Tanaka and the crews (Nippon Marine Enterprises, Ltd.) of R/V KAIREI for their efforts in obtaining MCS data and other geophysical data. We are also grateful to participants of Institute for Research on Earth Evolution (IFREE), Marine Technology Center (MARTEC), Research Support Department, Earthquake and Tsunami research project for Disaster Prevention, Center for Deep Earth Exploration (CDEX) in JAMSTEC, and Nippon Marine Enterprises for great supporting in this cruise. We used “The Generic Mapping Tools” (Wessel and Smith, 1991) to make figures.