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Kaimei Cruise Report

KM17-08C

2017FY “Research project for compound disaster mitigation on the great earthquakes and tsunamis around the Nankai trough region”, northern Ryukyu arc

Aug. 16, 2017 – Sep. 6, 2017

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

●Contents

1. Cruise Information

(1) Cruise ID: KM17-08C

(2) Name of vessel: Kaimei

(3) Title of the cruise:

2017FY "Research project for compound disaster mitigation on the great earthquakes and tsunamis around the Nankai trough region"

(4) Title of proposal

Research project for compound disaster mitigation on the great earthquakes and tsunamis around the Nankai trough region

(5) Cruise period: Aug. 16, 2017 – Sep. 6, 2017

(6) Ports of departure / call / arrival: Tokyo port to Yokohama port

(7) Research area: Ryukyu arc

(8) Research Map

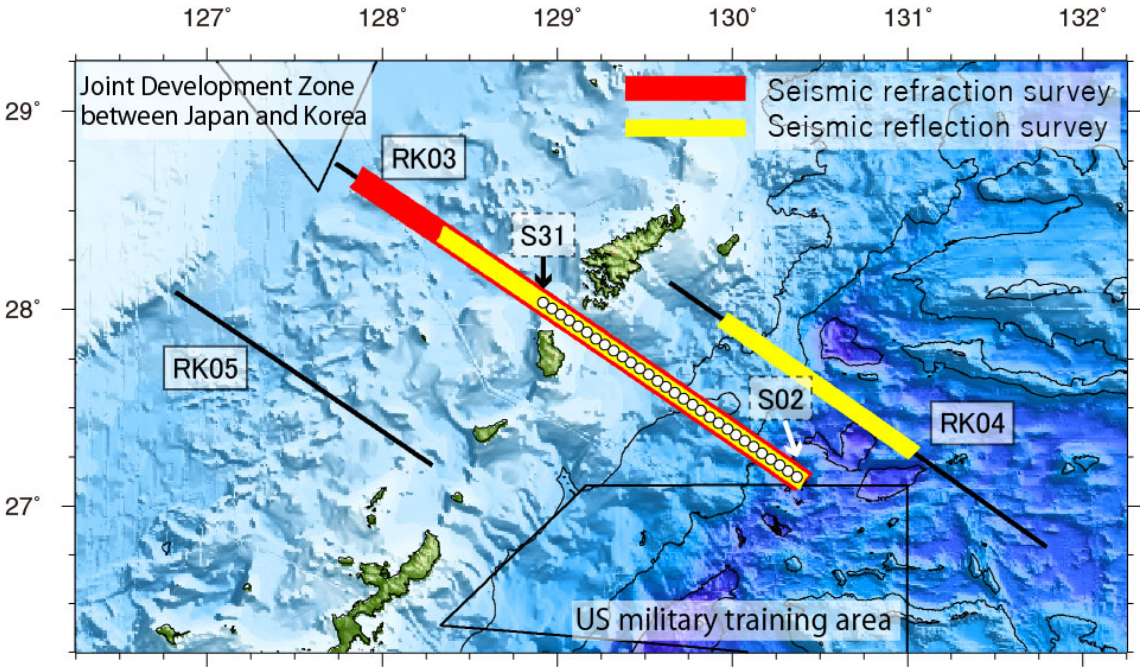

Figure 1. Map of study area. Black lines represent proposed survey lines. White circles are the deployed OBSs for seismic refraction survey. Seismic refraction data are acquired at red line, and reflection data is acquired at yellow lines.

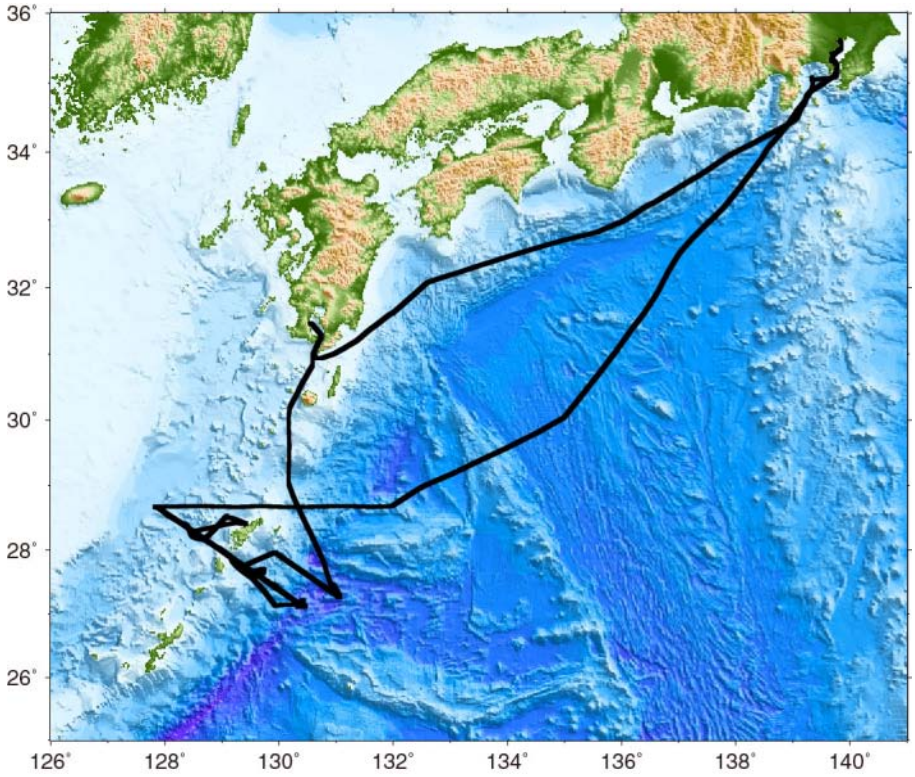

Figure 2. Ship track of KM17-08C cruise.

2. Researchers

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(2) Representative of the science party [Affiliation]: Shuichi Kodaira [JAMSTEC]

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3. Overview of Observations

(1) Objective

In Ryukyu subduction zone, permanent seismic observatories are deployed only on islands, and therefore island distribution causes a significant restriction of estimations of seismicity and underground structures in this area. To elucidate details of seismicity, lithospheric structures, and plate geometry of this subduction zone, we conduct a series of passive and active seismic surveys around Ryukyu arc, as a part of research project "Research project for compound disaster mitigation on the great earthquakes and tsunamis around the Nankai trough region" funded by Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. In this KM17-08C cruise, we conducted seismic refraction and reflection surveys at the middle Ryukyu arc to elucidate crustal structures and plate geometry.

(2) List of observation equipments

(a) OBS

We deployed 30 ocean bottom seismographs (OBSs) at RK03 survey line for seismic refraction survey, and recovered all of them after the refraction survey. The deployed OBS is "TOBS-24N, TOKYO SOKUSHIN CO., LTD" that is equipped with a 3-component short period geophone and hydrophone.

(b) MCS system

We used MCS system of R/V Kaimei that is composed of an air-gun array and streamer cable. The air-gun array has 4 sub-arrays of air-gun, and each sub-array consists with 12 air-guns (Bolt Long Life Air Gun). Capacities of the 12 air-guns are 600 cu.in., 600 cu.in., 175 cu.in., 175 cu,in, 100 cu.in., 100 cu.in., 200 cu.in., 200 cu.in., 150 cu.in., 150 cu.in., 400 cu.in., and 400 cu.in. Note that the second gun with 600 cu.in. is a spare. The streamer cable length for seismic reflection survey was set as 1,500m. Acoustic signal was recorded by 480-channel hydrophones with a group interval of 3.125m by 1ms sampling rate. During the experiments of this cruise, air-gun and streamer cable were towed with a depth of 10m and 21m below the sea surface, respectively.

(c) Bathymetry, magnetic, and gravity observations

Bathymetry, magnetic, and gravity data were recorded continuously during the survey by using multi-narrow beam echo sounders (EM712 and EM122, Kongsberg), a three-component magnetometer (SFG-2015, Tiera Technica Ltd.), and a shipboard gravimeter (MGS-6, MICROg LACOSTE), respectively.

(3) Cruise log

2017/8/16 (Wed)	Departure from Tokyo port Transit to the survey area
2017/8/17 (Thu)	Transit to the survey area
2017/8/18 (Fri)	Transit to the survey area
2017/8/19 (Sat)	Arrival at the survey area Check fishing implements along a survey line (RK03) OBS deployment (S31~S10)
2017/8/20 (Sun)	OBS deployment (S09~S02) Seismic refraction survey (RK03, East → West)
2017/8/21 (Mon)	Seismic refraction survey (RK03, East → West)
2017/8/22 (Tue)	Seismic refraction survey (RK03, East → West) Seismic refraction survey (RK03, West → East) Standby off the west coast of Amami-Oshima due to typhoon
2017/8/23 (Wed)	Standby off the west coast of Amami-Oshima due to typhoon
2017/8/24 (Thu)	Seismic refraction survey (RK03, West → East)
2017/8/25 (Fri)	Seismic refraction survey (RK03, West → East) OBS recovery (S02, S03)
2017/8/26 (Sat)	OBS recovery (S04-S19)
2017/8/27 (Sun)	OBS recovery (S20-S31)
2017/8/28 (Mon)	Seismic reflection survey (RK03)
2017/8/29 (Tue)	Seismic reflection survey (RK03) Transit to RK04 line
2017/8/30 (Wed)	Transit to RK04 line Seismic reflection survey (RK04)
2017/8/31 (Thu)	Seismic reflection survey (RK04) Transit to Yokohama port
2017/9/1 (Fri)	Standby at Kagoshima bay due to typhoon
2017/9/2 (Sat)	Standby at Kagoshima bay due to typhoon
2017/9/3 (Sun)	Transit to Yokohama port
2017/9/4 (Mon)	Transit to Yokohama port
2017/9/5 (Tue)	Transit to Yokohama port
2017/9/6 (Wed)	Arrival at Yokohama port

Table 1. Cruise log of KM17-08C

(4) Research Information

(a) Seismic refraction survey

We deployed 30 OBSs along the RK03 survey line (Table 2). Then, we conducted air-gun shooting twice by using two or three air-gun sub-arrays with a shooting interval of 200m. Offset distance of shooting point between the first and second shooting is 100m. After the air-gun shooting, we recovered the deployed OBSs.

OBS	North Latitude		East Longitude		Depth
	Degree	Minute	Degree	Minute	(m)
S02	27	8.7905	130	22.1369	5416.0
S03	27	10.6370	130	19.1460	5656.7
S04	27	12.4597	130	16.1824	5305.8
S05	27	14.3203	130	13.2024	4503.4
S06	27	16.1808	130	10.2148	4104.0
S07	27	18.0165	130	7.2153	3759.0
S08	27	19.8661	130	4.2485	3407.9
S09	27	21.7050	130	1.2438	3424.6
S10	27	23.5619	129	58.2783	3475.7
S11	27	25.4059	129	55.2856	2511.3
S12	27	27.2480	129	52.2886	2086.6
S13	27	29.0907	129	49.2916	1947.7
S14	27	30.9591	129	46.3186	1917.4
S15	27	32.7642	129	43.2823	1916.7
S16	27	34.6160	129	40.2741	1826.7
S17	27	36.4670	129	37.2903	1663.5
S18	27	38.2843	129	34.2789	1835.4
S19	27	40.1361	129	31.2915	1851.7
S20	27	41.9664	129	28.2799	1632.7
S21	27	43.7954	129	25.2677	1421.0
S22	27	45.6312	129	22.2587	1318.9
S23	27	47.4580	129	19.2471	1129.3
S24	27	49.2897	129	16.2425	886.0
S25	27	51.1086	129	13.2311	741.3
S26	27	52.9577	129	10.2009	621.6
S27	27	54.7814	129	7.1913	388.9

S28	27	56.6063	129	4.1579	293.6
S29	27	58.4441	129	1.1402	218.9
S30	28	0.2501	128	58.1104	385.3
S31	28	2.0804	128	55.0805	597.4

Table 2. Position list of OBSs. These are the vessel positions and seafloor depth at the OBS deployment.

(b) Seismic reflection survey

Seismic reflection surveys were conducted along RK03 and RK04 survey lines with three air-gun sub-arrays. At the shallow area of which water depth is less than about 300m, we used only two sub-arrays because of extremely strong reflected waves for the research vessel.

Survey Lines	North Latitude		East Longitude	
	Degree	Minute	Degree	Minute
RK03	27	7.277	130	24.536
Refraction Survey	28	40.070	127	51.219
RK03	27	7.346	130	24.408
Reflection Survey	28	23.005	128	20.035
RK04	27	56.997	129	56.691
Reflection Survey	27	16.155	131	2.349

Table 3. Start and end points of seismic refraction and reflection surveys.

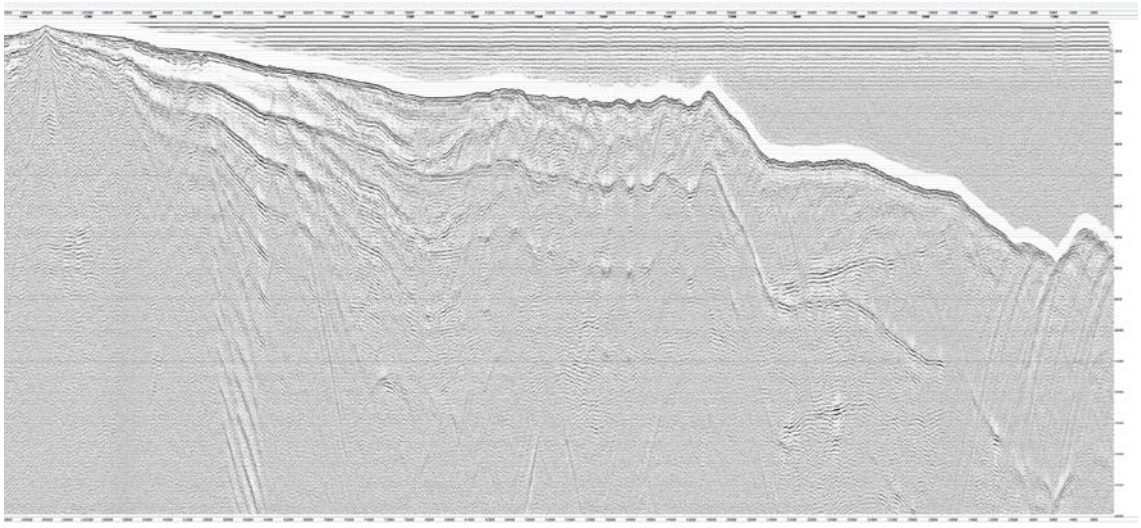

Figure 3. Seismic reflection image along RK03 profile at fore-arc side of island arc.

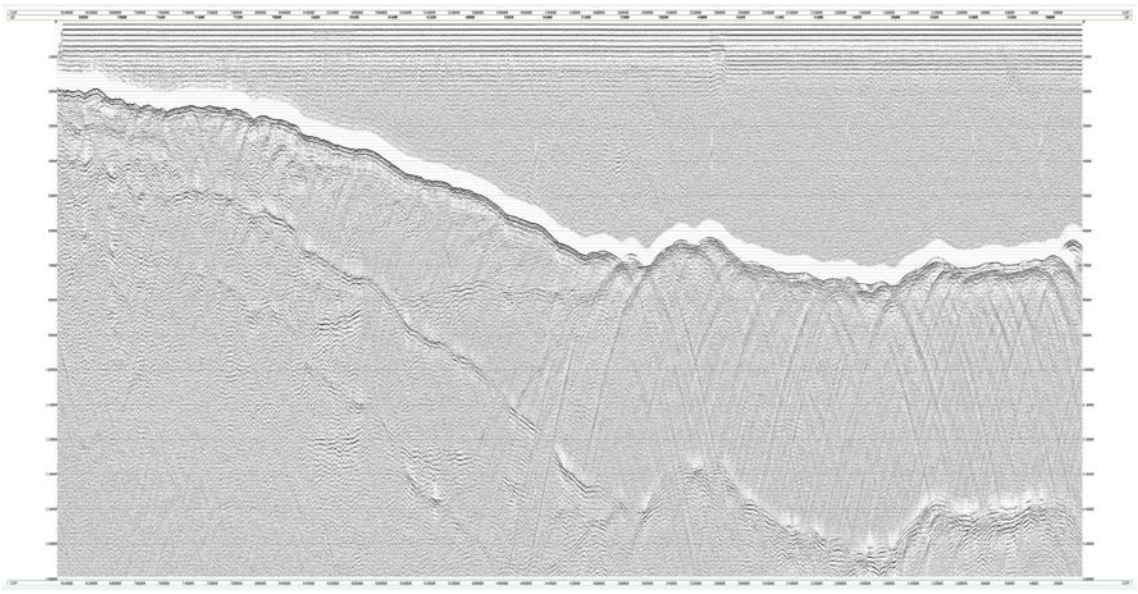

Figure 4 Seismic reflection image along RK04 profile

(c) Bathymetry, magnetic, and gravity observations

Bathymetry, magnetic and gravity data are recorded throughout this cruise.

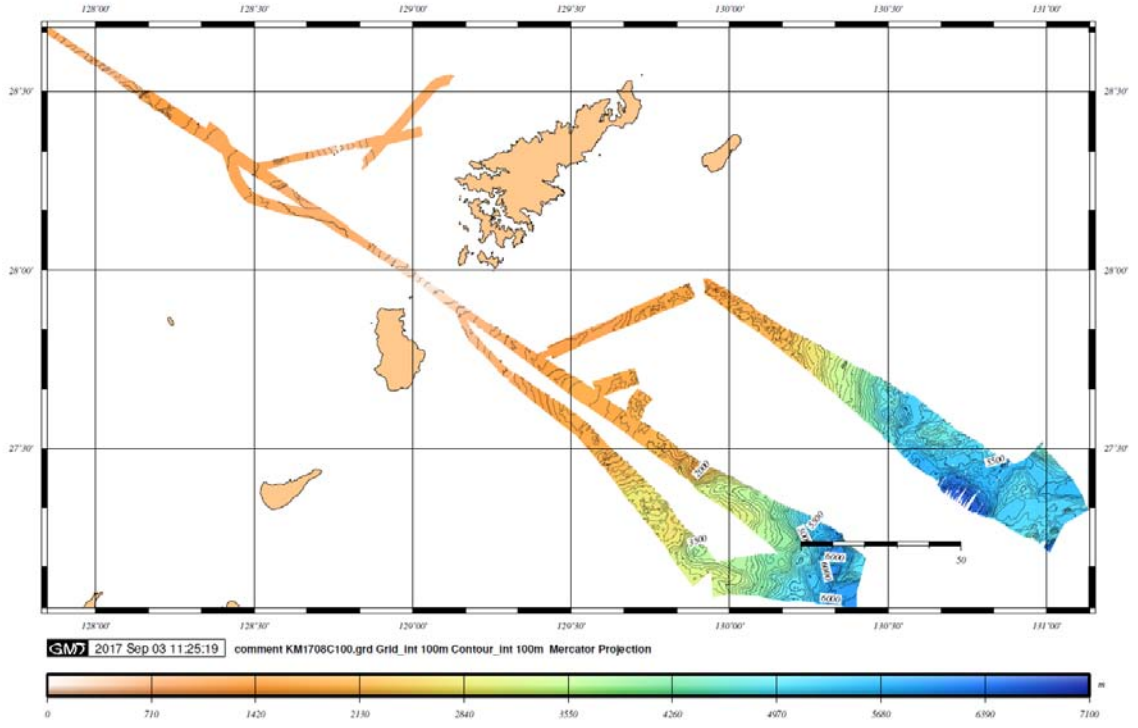

Figure 5. Bathymetry data acquired during KM17-08C cruise

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 Scientists 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

We thank the captain, Mr. Rikita Yoshida, and the crew of the R/V KAIMEI for their efforts in OBS deployment, OBS recovery, air-gun and MCS operations and other geophysical data observation. We are grateful to participants of the Research and Development center for Earthquake and Tsunami, and Marine Technology Center in JAMSTEC for their great support in this cruise. This cruise is funded by a program "Research project for compound disaster mitigation on the great earthquakes and tsunamis around the Nankai trough region" which is part of the Special Coordination Funds for Promoting Science and Technology of the Ministry of Education, Culture, Sports, Science, and Technology. We used "The Generic Mapping Tools" by Wessel and Smith (1998) to construct the figures.

References

Wessel P, Smith WHF (1998) New improved version of generic mapping tools released, Eos Trans. AGU, 79(47), 579, doi: 10.1029/98EO00426.