



Kairei Cruise Report

KR15-21

2015FY “Research project for compound disaster mitigation on the great earthquakes and tsunamis around the Nankai trough region”, northern Ryukyu arc

Dec. 27, 2015 - Jan. 5, 2016

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

•Contents

1. Cruise Information
2. Researchers
3. Overview of Observations
4. Notice on using

1. Cruise Information

(1) **Cruise ID:** KR15-21

(2) **Name of vessel:** Kairei

(3) **Title of the cruise:**

2015FY “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:** 2015/12/27 – 2016/1/5

(6) **Ports of departure / call / arrival:** Yokosuka port (JAMSTEC) to Yokosuka port (JAMSTEC)

(7) **Research area:** Northern Ryukyu arc

(8) **Research Map**

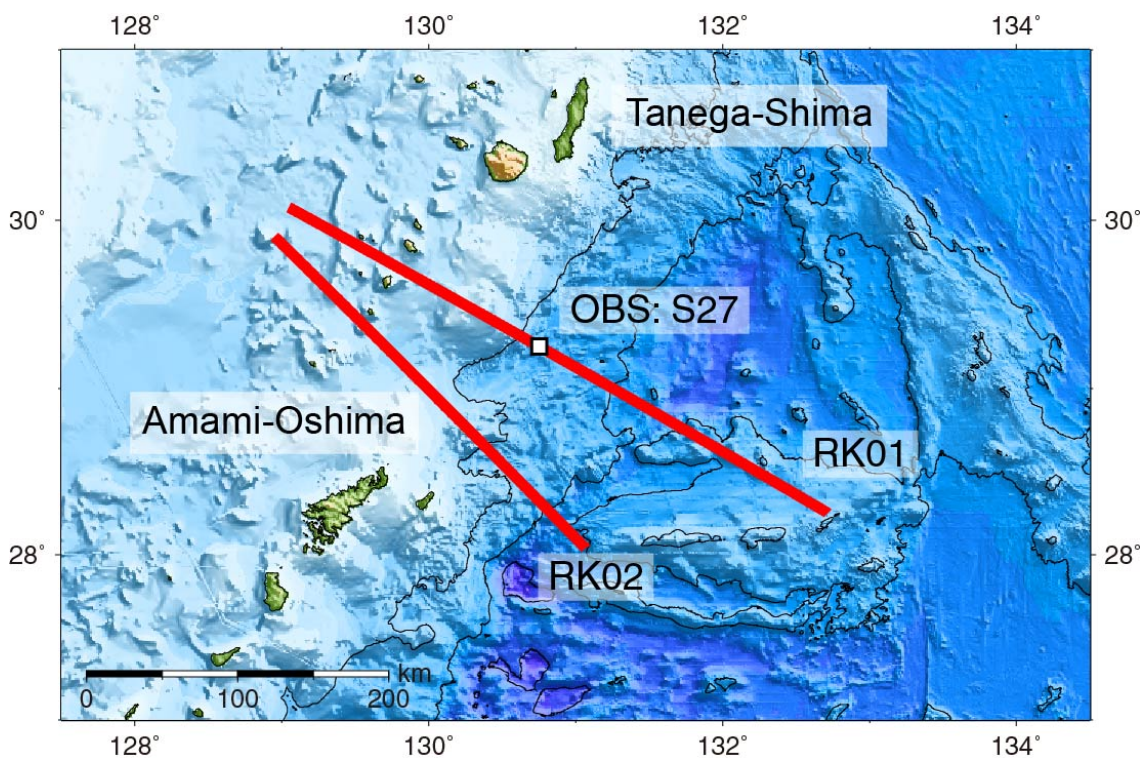


Figure 1. Map of study area. Red lines are MCS survey lines. White square is the OBS that was deployed during KR15-11 cruise.

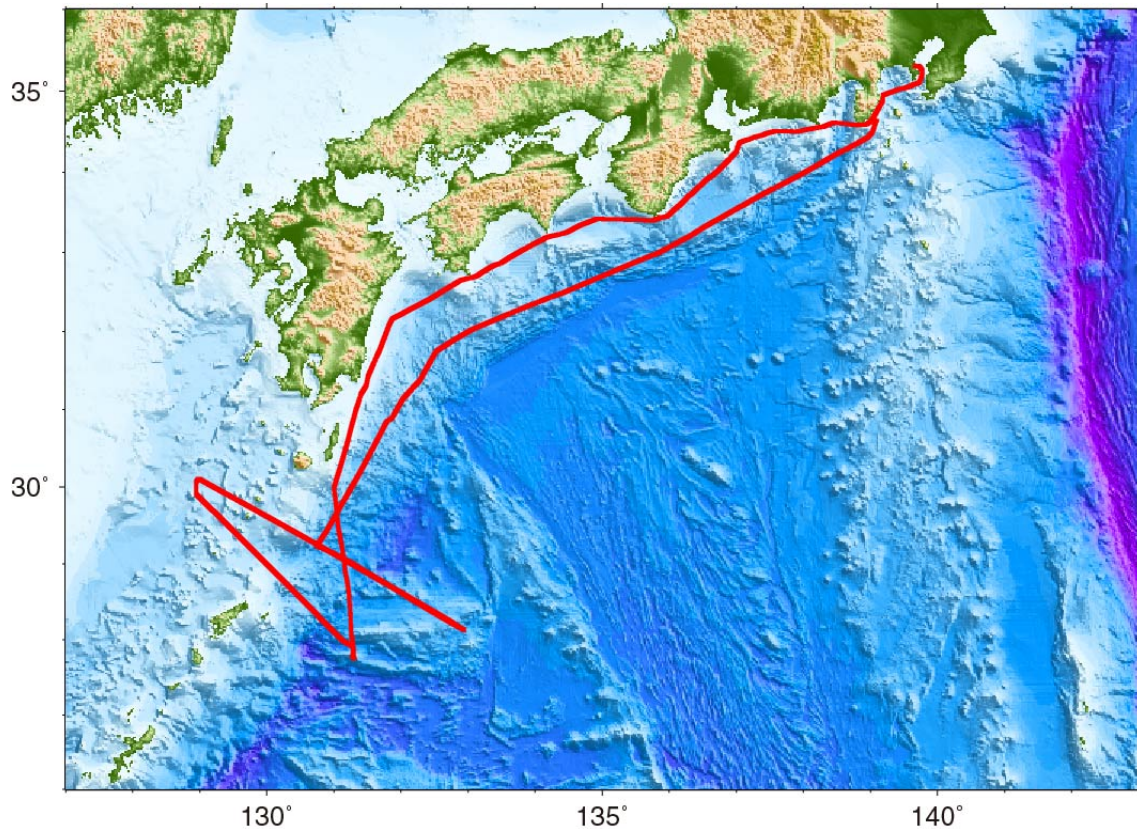


Figure 2. Ship track during KR15-21 cruise.

2. Researchers

(1) **Chief scientist [Affiliation]:** Tsutomu Takahashi [JAMSTEC]

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

(3) **Science party (List) [Affiliation, assignment etc.]**

Shuichi Kodaira [JAMSTEC]

Narumi Takahashi [NIED/JAMSTEC]

Yoshiyuki Kaneda [Nagoya Univ./JAMSTEC]

Tsutomu Takahashi [JAMSTEC]

Ryuta Arai [JAMSTEC]

Koichiro Obana [JAMSTEC]

Yojiro Yamamoto [JAMSTEC]

Seiichi Miura [JAMSTEC]

Yasuyuki Nakamura [JAMSTEC]

Gou Fujie [JAMSTEC]

Ayako Nakanishi [JAMSTEC]

Yuka Kaiho [JAMSTEC]

Tetsuo No [JAMSTEC]

Mikiya Yamashita [JAMSTEC]

Yasushi Ishihara [JAMSTEC]

Takashi Tonegawa [JAMSTEC]

3. Overview of Observations

(1) Objective

Seismic studies in Ryukyu subduction zone are usually based on the seismic data 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 arc, we launched 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 2013FY, we have conducted a seismic survey in southern part of Ryukyu arc. This observation successfully clarified high seismicity in the crust and precise geometry of subducting Philippine Sea plate. In 2015FY, we will conduct seismic surveys in northern part of Ryukyu arc that is adjacent to the mega-thrust fault zone of Nankai trough. This study conducts multi-channel seismic reflection (MCS) surveys in northern Ryukyu arc to clarify the plate geometry and crustal structure.

(2) List of observation equipments

(a) MCS survey

We used a multichannel seismic reflection (MCS) system of the R/V KAIREI (Miura, 2009). Source is the tuned airgun array that consists of 32 Bolt Annular Port airguns. This array has a maximum total capacity of 7,800 cubic inches (about 130 liters), and the standard air pressure was 2,000 psi (about 14 MPa). During the experiment, the air gun array depth was kept at 10 m below the sea surface. We shot an air gun array at a spacing of 50 m, which corresponds to a spacing of 20 to 30 s depending on the vessel speed (average of 4.5 kn).

During airgun shooting, we towed a 444-channel hydrophone streamer cable with a group interval of 12.5 m. (Sentinel Digital Streamer System, Sercel Inc.). Hydrophone sensors (Benthos Reduced Diameter Array hydrophone) with a 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 length of the cable was about 6 km. The towing depth of the streamer cable was kept at 12 m below the sea surface by the depth controller called Bird (I/O DigiCOURSE streamer depth controllers).

(b) OBS

The OBS at site S27 was deployed during KR15-11 cruise on 2015/7/29, but was not recovered during KR15-11 cruise due to no responses to acoustic calls from onboard. This OBS is “TOBS-24N, TOKYO SOKUSHIN CO., LTD” that is equipped with a 3-component short period geophone and hydrophone.

(c) Sub bottom profile, bathymetry, magnetic, and gravity observations

Sub bottom profile was acquired during MCS surveys. Bathymetry, magnetic, and gravity data were recorded continuously during the survey. The sub bottom profile and bathymetry surveys on the R/V KAIREI used a multi-narrow beam echo sounder (Sea Beam 3012, SeaBeam Instruments). Gravity data was acquired by a shipboard gravimeter (BODESEEWERK KSS31, Fugro Co. Ltd.). The magnetic survey used a three-component magnetometer (SFG-1214, Tiera Technica Corporation).

(3) Cruise log

2015/12/27 (Sun)	Departure from JAMSTEC, transit to survey area
2015/12/28 (Mon)	Transit to survey area
2015/12/29 (Tue)	MCS survey (RK02)
2015/12/30 (Wed)	MCS survey (RK02)
2015/12/31 (Thu)	MCS survey (RK02, RK01)
2016/1/1 (Fri)	MCS survey (RK01)
2016/1/2 (Sat)	MCS survey (RK01), OBS (S27) recovery
2016/1/3 (Sun)	Transit to JAMSTEC
2016/1/4 (Mon)	Transit to JAMSTEC
2016/1/5 (Tue)	Arrival at JAMSTEC

(4) Research Information

(a) Multi Channel seismic reflection (MCS) survey

MCS data are acquired along two survey lines (RK01 and RK02). End points of survey lines are as follows.

RK01 : 28° 15.14269' N, 132° 43.03083' E 2,235m
: 30° 4.5528' N, 129° 2.8710' E 896m
RK02 : 28° 2.4248' N, 131° 4.0715' E 4,126m
: 29° 54.1421' N 128° 57.0764' E 300m

Acquired data shows clear reflected waves from the plate boundary (top of the subducted Philippine Sea plate), and show many normal faults in Okinawa trough. Figure 3 is the seismic reflection image at the west end of RK02.

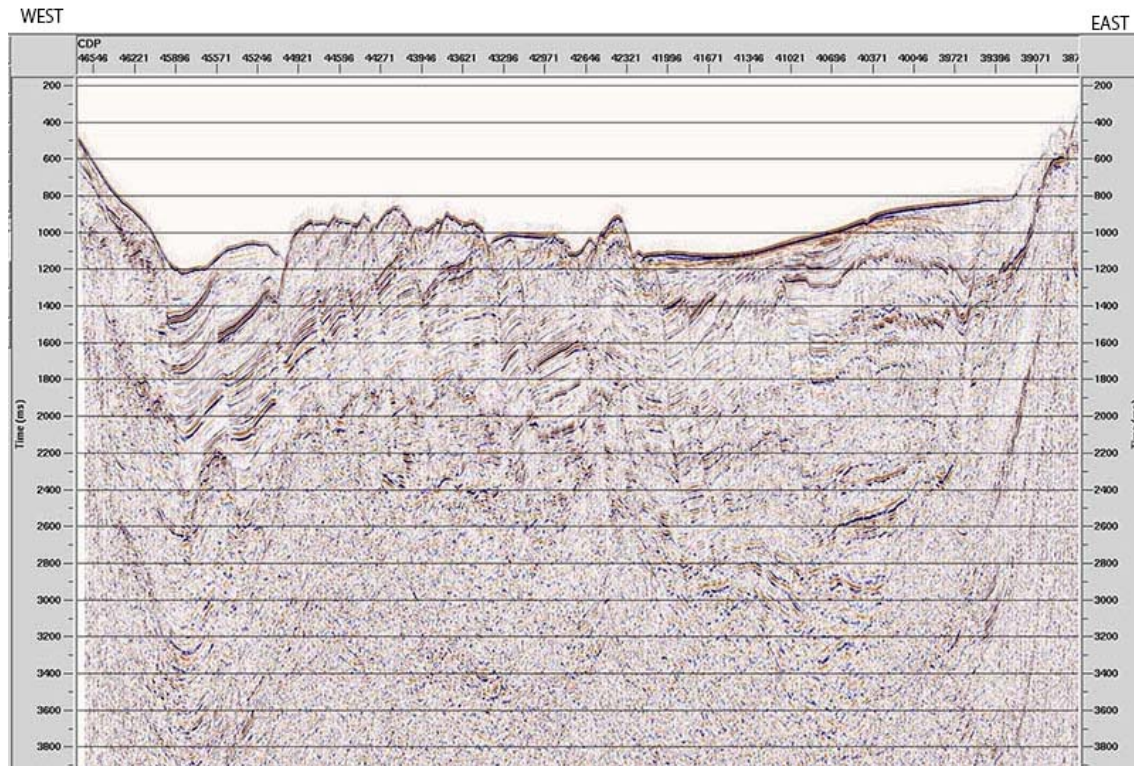


Figure 3. Seismic reflection image at the west end of RK02 lines

(b) OBS

We tried to recover the OBS (site S27). However, the OBS was not recovered due no response to acoustic calls and release commands from onboard.

Position of S27:

29° 14.9177' N, 130° 45.2408'E, 3110m

(c) Sub bottom profile, bathymetry, magnetic, and gravity observations

Sub bottom profiles were acquired during MCS survey along RK01 and RK02. Bathymetry, magnetic and gravity data are recorded throughout this cruise. Figure 4 shows the bathymetry data along RK01 and RK02.

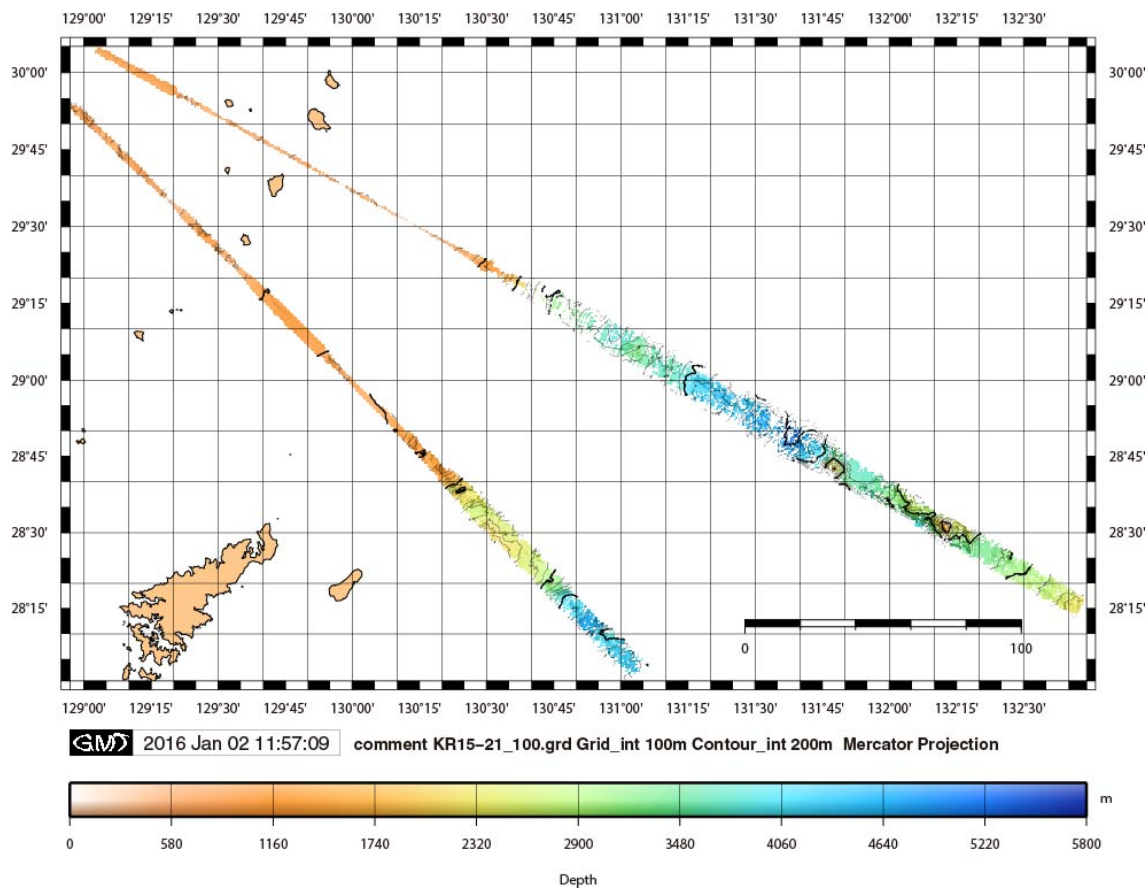


Figure 4. Bathymetry data recorded along RK01 and RK02

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. Eiko Ukekura, and the crew of the R/V KAIREI, and the marine technician team (Nippon Marine Enterprises, Ltd.) for their efforts in obtaining the MCS data and other geophysical data. We are grateful to participants of CEAT (Research and Development center for Earthquake and Tsunami) and MARITEC (Marine Technology Center) in JAMSTEC for their great support in this cruise.

This cruise is funded by programs called “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

- Miura, S., 2009. A history of JAMSTEC seismic data acquisition system. In: JAMSTEC-R IFREE Special Issue, 81–88 (in Japanese with English abstract).
- Wessel P, Smith WHF (1998) New improved version of generic mapping tools released, *Eos Trans. AGU*, 79(47), 579, doi: 10.1029/98EO00426.