

# KAIREI Cruise Report

## KR08-15

Research cruise by KAIREI

Philippine Sea and North Pacific



November 15 – December 2, 2008

Japan Agency for Marine-Earth Science and Technology  
(JAMSTEC)

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## 1. Cruise Information

### 1.1. Cruise number

KR08-15

### 1.2. Ship name

KAIREI

### 1.3. Title of the cruise

Research cruise by KAIREI

### 1.4. Title of proposal

Research on the stagnant slab by using BBOBS and OBEM

### 1.5. Cruise period

15, November – 2, December, 2008

### 1.6. Port call

Jamstec, Yokosuka – Yokohama

### 1.7. Research Area

Philippine Sea and North Pacific

### 1.8. Research Map

Refer Figure 1

## 2. Researchers

### 2.1. Chief Scientist

Hajime Shiobara [ERI, Univ. Tokyo]

### 2.2. Representative of Science Party

Hajime Shiobara [ERI, Univ. Tokyo]

### 2.3. Science party (underlined: on board)

Hajime Shiobara [ERI, Univ. Tokyo, chief]

Yoshio Fukao [IFREE, JAMSTEC, leader of the project]

Toshihiko Kanazawa [ERI, Univ. Tokyo, land support]

Hisashi Utada [ERI, Univ. Tokyo, land support]

Hitosi Kawakatsu [ERI, Univ. Tokyo, seismic data analysis]

Kimihiko Mochizuki [ERI, Univ. Tokyo, land support]

Hiroko Sugioka [IFREE, JAMSTEC, land support]

Aki Itoh [IFREE, JAMSTEC, BBOBS operation]

Tadanori Goto [IFREE, JAMSTEC, land support]

Kiyoshi Baba [ERI, Univ. Tokyo, co-chief]

Takafumi Kasaya [IFREE, JAMSTEC, land support]

Daisuke Suetsugu [IFREE, JAMSTEC, seismic data analysis]

Takehi Isse [ERI, Univ. Tokyo, BBOBS operation]

Masayuki Obayashi [IFREE, JAMSTEC, seismic data analysis]

Seiji Tsuboi [IFREE, JAMSTEC, seismic data analysis]

Azusa Shito [IFREE, JAMSTEC, seismic data analysis]

Makoto Ueshima [ERI, Univ. Tokyo, electromagnetic data analysis]

Hisayoshi Shimizu [ERI, Univ. Tokyo, electromagnetic data analysis]

Noriko Tada [IFREE, JAMSTEC, OBEM operation]

Yoko Tono [IFREE, JAMSTEC, OBEM operation]

Takeko Nishimura [Fac. Sci., Kobe Univ., OBEM operation]

Takeo Ichikita [Tierra Technica, OBEM operation]

### 3. Observation

#### 3.1. Observation

##### 3.1.1. Purpose and background

To investigate the stagnant slab beneath the northern Philippine Sea, we had conducted a three-year array observation from 2005 until 2008 by using broadband ocean bottom seismometers (BBOBS) and ocean bottom electro-magnetometers (OBEM). It is a key part of the "Stagnant Slab Project" started in 2004 for 5 years as a cross disciplinary project, because of the first direct dense observation to reveal the fine physical structure above the stagnant section of the Pacific slab lies in the mantle transition zone. And, the change of the slab morphology along the Izu – Ogasawara (Bonin) – Mariana arc shown by a global tomography is also an interest to be resolved with high resolution. The experiment was to be conducted in three phases, each consisting of one-year deployment, resulting in a three-year time series data available. The aim is to acquire improved images of the stagnant slab and surrounding mantle in terms of seismic parameters and electrical conductivity. Such images cannot be constructed from existing data.

Stagnant slab: While the oceanic plate is subducting from the trench into the mantle, it means a state of that the plate (slab) is lying at the mantle transition zone (stagnation).

##### 3.1.2. Observations

- (1) Recovery of 15 BBOBS and 14 OBEM deployed in 2007 by using a chartered ship (Figure 2).
- (2) Deployment of 1 BBOBS and 1 OBEM at the T08 site to keep observation networks. Their recovery is planned during the KAIREI cruise in the August of 2009.
- (3) Recovery of Ocean Bottom Doppler Current profiler (OBDC) at the T08 site. It was deployed during the KR08-06 cruise.
- (4) Back scattering observation of the multi beam sounder.

### 3.1.3. Method and instruments

BBOBS and OBEM have been originally developed in the Earthquake Institute, University of Tokyo. For the mobility, they are designed as a free-fall deployment and self pop-up recovery equipment. The data recording is controlled by a preset timer, and the recovery is activated by the acoustic command from the ship.

This study had been started from 2005 for three years, and each observation phase is one year. During phase 1 and 2, no instrument was lost. This cruise was the recovery of instruments deployed as phase 3 by using the chartered ship in 2007.

The OBDC has the same outside design as the BBOBS to be a self pop-up recovery system and to extend the observation period.

### 3.1.4. Research result

For the BBOBS, except T01 and T17 sites, they responded for the acoustic command, come up to the sea surface, and were safely recovered. As the BBOBS at the T17 site never responded but accepted the command, so it was recovered any way. The BBOBS at the T01 site normally responded but never come up, due to malfunction of one of two releasing units. But for the OBDC and all OBEM, they worked correctly and were safely recovered. The deployment of the BBOBS and the OBEM at the T08 site was completed normally.

As It takes time to complete analyses for both of BBOBS and OBEM data, we need about two years to obtain results. On the ship, we performed quality check of raw data, and they have good quality. The data recovery rates are 71% and 100% for BBOBS and OBEM, respectively. Reason for the low rate of the BBOBS is troubles in the sensor control unit.

## 3.2. Cruise log

2008/11/15

Weather: fine but cloudy/ Wind direction: North/ Wind force: 4/ Wave: 2 m/ Swell: 1 m/

Visibility: 5 nautical mile (12:00 JST)

08:30

Onboard

10:00

Departure from JAMSTEC

11:00-11:40            Briefing about ship's life and safety

2008/11/16

Weather: fine but cloudy/ Wind direction: WNW/ Wind force: 2/ Wave: 1 m/ Swell: 3 m/ Visibility: 8 nautical mile (12:00 JST)

Arrival at site (T16)

|       |  |
|-------|--|
| 08:13 | Send release command to OBS (536)                |
| 08:27 | OBS left from seafloor                           |
| 08:35 | Send release command to OBEM (ERI6)              |
| 08:42 | OBEM left from seafloor                          |
| 10:00 | OBS on surface                                   |
| 10:13 | OBS on deck                                      |
| 11:15 | OBEM on surface                                  |
| 11:44 | OBEM on deck                                     |
| 11:49 | Start MBES survey and transit to next site (T17) |

2008/11/17

Weather: fine but cloudy/ Wind direction: West/ Wind force: 4/ Wave: 2 m/ Swell: 3 m/ Visibility: 8 nautical mile (12:00 JST)

Arrival at site (T17)

|       |                                   |
|-------|-----------------------------------|
| 04:10 | Send release command to OBS (519) |
| 04:12 | OBS left from seafloor            |
| 05:54 | OBS on surface                    |
| 06:08 | OBS on deck                       |

Arrival at site (T20)

|       |                                      |
|-------|--------------------------------------|
| 18:28 | Send release command to OBEM (ERI12) |
| 18:40 | OBEM left from seafloor              |
| 21:45 | OBEM on surface                      |
| 22:11 | OBEM on deck                         |

2008/11/18

Weather: fine but cloudy/ Wind direction: SW/ Wind force: 2/ Wave: 1 m/ Swell: 1 m/ Visibility: 8 nautical mile (12:00 JST)

Arrival at site (T21)

16:33 Send release command to OBEM (JM6)  
16:40 OBEM left from seafloor  
19:26 OBEM on surface  
19:40 OBEM on deck

Transit to next site (T18)

2008/11/19

Weather: fine but cloudy/ Wind direction: SSW/ Wind force: 6/ Wave: 4 m/ Swell: 1 m/

Visibility: 8 nautical mile (12:00 JST)

Arrival at site (T18)

11:25 Send release command to OBS (514)  
12:00 Send release command to OBEM (ERI2)  
12:04 OBEM left from seafloor  
13:09 OBS on surface  
13:34 OBS on deck  
14:58 OBEM on surface  
15:24 OBEM on deck

Transit to next site (T15)

2008/11/20

Weather: cloudy/ Wind direction: WNW/ Wind force: 3/ Wave: 2 m/ Swell: 3 m/

Visibility: 8 nautical mile (12:00 JST)

Arrival at site(T15)

18:40 Send release command to OBS(500)  
18:42 OBS left from seafloor  
19:51 OBS on surface  
20:04 OBS on deck

Transit to next site(T12)

2008/11/21

Weather: fine but cloudy/ Wind direction: NE/ Wind force: 5/ Wave: 4 m/ Swell: 1 m/

Visibility: 8 nautical mile (12:00 JST)



Arrival at site (T12)

09:52 Send release command to OBS (524)  
09:56 OBS left from seafloor  
10:12 Send release command to OBEM (TT7)  
10:25 OBEM had left from seafloor  
11:22 OBS on deck  
12:41 OBEM on surface  
13:03 OBEM on deck  
14:37 Transit to next site (T08)

Arrival at site (T08)

21:09 XBT  
22:07 Deployment of OBEM (ERI14)  
22:20 Deployment of OBS (505)  
22:27 Send release command to OBCD  
22:43 OBCD left from seafloor  
23:19 OBS (505) landed on seafloor  
23:40 Send release command to OBS (511)  
23:44 OBS (511) left from seafloor

2008/11/22

Weather: overcast/ Wind direction: NNE/ Wind force: 7/ Wave: 4 m/ Swell: 3 m/  
Visibility: 6 nautical mile (12:00 JST)

00:21 OBCD on deck  
01:14 OBS (511) on deck

Arrival at site (T13)

11:18 Send release command to OBS (522)  
11:27 OBS left from seafloor  
11:48 Send release command to OBEM (ERI4)  
11:52 OBEM left from seafloor  
12:45 OBS on surface  
12:56 OBS on deck  
14:09 OBEM on surface  
14:36 OBEM on deck

Transit to next site (T10)

2008/11/23

Weather: fine but cloudy/ Wind direction: ENE/ Wind force: 5/ Wave: 4 m/ Swell: 3 m/  
Visibility: 8 nautical mile (12:00 JST)

Arrival at site (T10)

15:57 Send release command to OBEM (TT8)

16:11 OBEM had left from seafloor

18:34 OBEM on surface

19:01 OBEM on deck

Transit to next site (T14)

2008/11/24

Weather: fine but cloudy/ Wind direction: ENE/ Wind force: 5/ Wave: 4 m/ Swell: 3 m/  
Visibility: 8 nautical mile (12:00 JST)

Arrival at site (T14)

13:51 Send release command to OBEM (ERI10)

13:58 OBEM left from seafloor

16:09 OBEM on surface

16:28 OBEM on deck

Arrival at site (T11)

22:46 Send release command to OBS (516)

22:59 OBS left from seafloor

2008/11/25

Weather: rain/ Wind direction: NE/ Wind force: 6/ Wave: 4 m/ Swell: 3 m/ Visibility: 2  
nautical mile (12:00 JST)

00:19 OBS on surface

00:31 OBS on deck

Transit to next site (T01)

2008/11/26

Weather: overcast/ Wind direction: ENE/ Wind force: 5/ Wave: 4 m/ Swell: 3 m/

Visibility: 3 nautical mile (12:00 JST)

Arrival at site (T01)

|             |                                     |
|-------------|-------------------------------------|
| 16:22       | Send release command to OBS (805)   |
| 17:04       | Send release reset command to OBS   |
| 17:09       | Send release command to OBS         |
| 17:23       | Send release reset command to OBS   |
| 17:27       | Send release command to OBEM (ERI9) |
| 17:31       | OBEM left from seafloor             |
| 20:01       | OBEM on surface                     |
| 20:19       | OBEM on deck                        |
| 20:52-22:00 | Inspecting OBS situation            |

Transit to next site (T02)

2008/11/27

Weather: fine but cloudy/ Wind direction: SW/ Wind force: 4/ Wave: 3 m/ Swell: 3 m/

Visibility: 7 nautical mile (12:00 JST)

Arrival at site (T02)

|       |                                     |
|-------|-------------------------------------|
| 16:29 | Send release command to OBS (523)   |
| 16:36 | OBS left from seafloor              |
| 16:39 | Send release command to OBEM (ERI8) |
| 16:43 | OBEM left from seafloor             |
| 18:14 | OBS on surface                      |
| 18:28 | OBS on deck                         |
| 19:39 | OBEM on deck                        |

Transit to next site (T05)

2008/11/28

Weather: cloudy/ Wind direction: NNW/ Wind force: 5/ Wave: 3 m/ Swell: 3 m/

Visibility: 7 nautical mile (12:00 JST)

Arrival at site (T05)

|       |                                     |
|-------|-------------------------------------|
| 13:42 | Send release command to OBS (525)   |
| 13:47 | OBS left from seafloor              |
| 13:55 | Send release command to OBEM (ERI1) |

14:00 OBEM left from seafloor  
15:14 OBS on surface  
15:22 OBS on deck  
16:15 OBEM on surface  
16:36 OBEM on deck  
Transit to next site (T03)

2008/11/29

Weather: cloudy/ Wind direction: NNW/ Wind force: 4/ Wave: 3 m/ Swell: 3 m/  
Visibility: 8 nautical mile (12:00 JST)

Arrival at site (T03)

07:54 Send release command to OBS (520)  
07:58 OBS left from seafloor  
09:16 OBS on surface  
09:27 OBS on deck

Arrival at site (T07)

21:17 Send release command to OBS (517)  
21:22 OBS left from seafloor  
21:26 Send release command to OBEM (ERI7)  
21:30 OBEM left from seafloor  
22:52 OBS on surface  
23:07 OBS on deck

2008/11/30

Weather: fine but cloudy/ Wind direction: WNW/ Wind force: 6/ Wave: 5 m/ Swell: 3 m/  
Visibility: 8 nautical mile (12:00 JST)

00:01 OBEM on surface  
00:19 OBEM on deck

Arrival at site (T06)

10:03 Send release command to OBS (513)  
10:09 OBS left from seafloor  
10:17 Send release command to OBEM (ERI5)

|                       |                                     |
|-----------------------|-------------------------------------|
| 10:21                 | OBEM left from seafloor             |
| 11:21                 | OBS on surface                      |
| 11:29                 | OBS on deck                         |
| 12:28                 | OBEM on surface                     |
| 12:43                 | OBEM on deck                        |
| Arrival at site (T09) |                                     |
| 21:53                 | Send release command to OBS (515)   |
| 21:56                 | OBS left from seafloor              |
| 22:10                 | Send release command to OBEM (ERI3) |
| 22:19                 | OBEM left from seafloor             |
| 23:07                 | OBS on surface                      |
| 23:15                 | OBS on deck                         |

2008/12/1

Weather: fine but cloudy/ Wind direction: NW/ Wind force: 4/ Wave: 2 m/ Swell: 1 m/  
 Visibility: 8 nautical mile (12:00 JST)

|       |                 |
|-------|-----------------|
| 00:22 | OBEM on surface |
| 00:41 | OBEM on deck    |

Transit to port of Yokohama

2008/12/02

|       |                         |
|-------|-------------------------|
| 09:30 | Got off from R/V Kairei |
|-------|-------------------------|

Wind force criteria

0 = 0 - 0.2 (m/s)

1 = 0.3 - 1.5

2 = 1.6 - 3.3

3 = 3.4 - 5.4

4 = 5.5 - 7.9

5 = 8.0 - 10.7

6 = 10.8 - 13.8

7 = 13.9 - 17.1

8 = 17.2 - 20.7

9 = 20.8 - 24.4

10 = 24.5 - 28.4

11 = 28.5 - 32.6

12 = 32.7 -

#### 4. Acknowledgement

We thank for the captain and crew of R.V. KAIREI and scientific support staffs of NME in their correct work and warm support during this cruise.

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#### 5. Notice on using

This cruise report is a preliminary documentation as of the end of the cruise. It may not be corrected even if changes on content (i.e. taxonomic classifications) are found after publication. It may also be changed without notice. Data on the cruise report may be raw or not processed. Please ask the Chief Scientist for the latest information before using.

Users of data or results of this cruise are requested to submit their results to Data Integration and Analysis Group (DIAG), JAMSTEC.

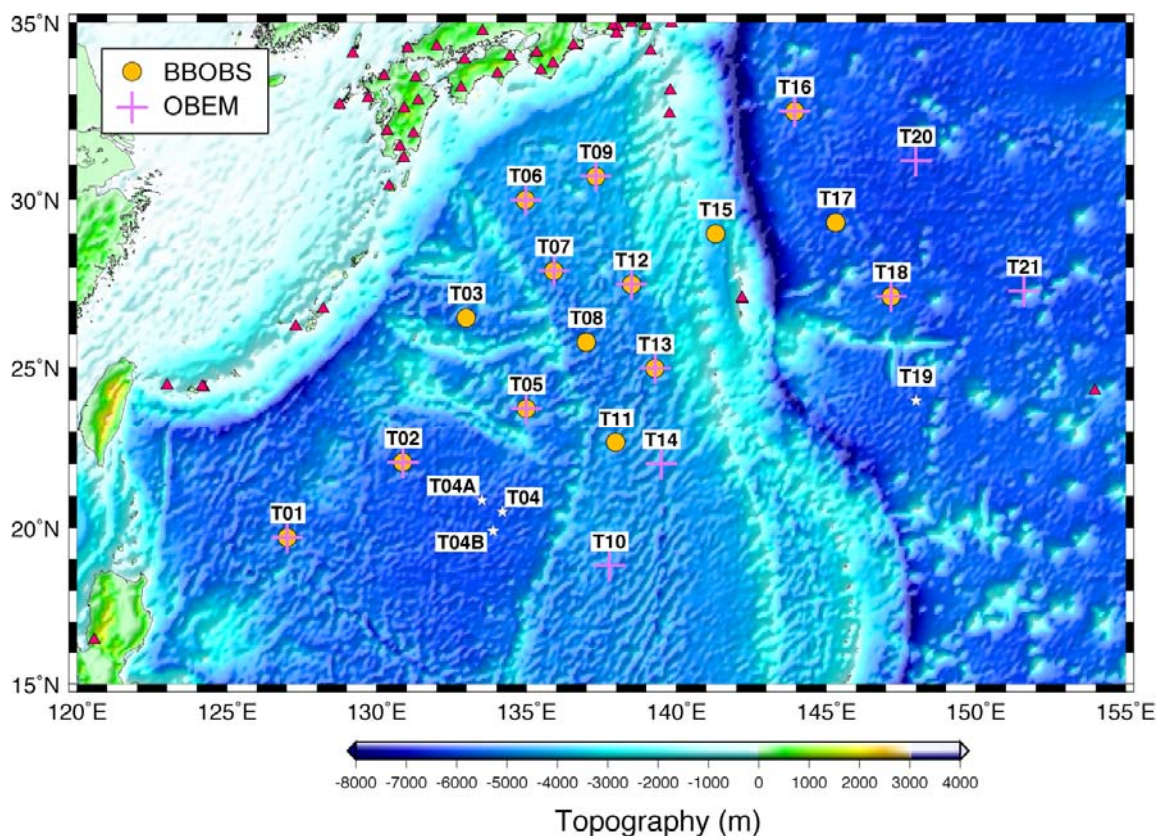


Figure 1. The location map of BBOBS and OBEM recovered during this cruise. Small white stars indicate the positions of BBOBS and OBEM previously deployed. Red triangles show locations of land broadband seismic stations.

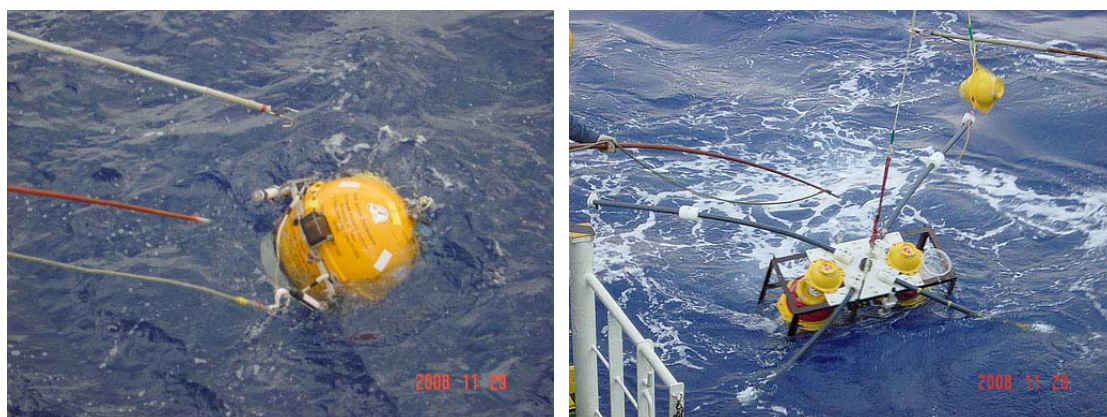


Figure 2. BBOBS (left) and OBEM (right) come up to the sea surface after one year observation. They released sinkers by the acoustic commands from the ship.