Cruise Summary

1. Cruise Information

Cruise number:

KR08-10

Ship name:

R/V KAIREI (with ROV KAIKO 7000II)

Title of the cruise:

2008 Deep Sea Research

Research cruise with KAIREI and research dives with KAIKO 7000II

Chief Scientist:

Makoto YAMANO Earthquake Research Institute, University of Tokyo

Deputy Chief Scientist (Leg 2):

Tada-nori GOTO Institute for Research on Earth Evolution (IFREE), JAMSTEC

Representative of Science Party:

Makoto YAMANO Earthquake Research Institute, University of Tokyo

Title of proposal:

S08-66

Studies on the thermal structure and the water distribution in the upper part of the Pacific plate subducting along the Japan Trench

Cruise period:

August 18, 2008 – September 11, 2008

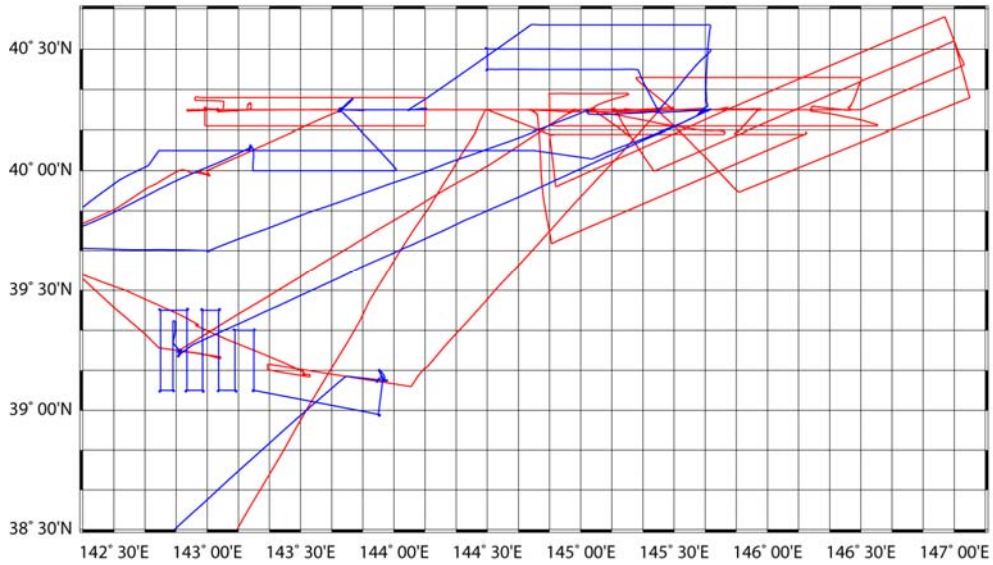
Port call:

2008 Aug. 18 Dept. from Yokosuka (JAMSTEC)
Sep. 1 Arriv. at Miyako
Sep. 2 Dept. from Miyako
Sep. 10 Arriv. at Yokosuka (JAMSTEC)

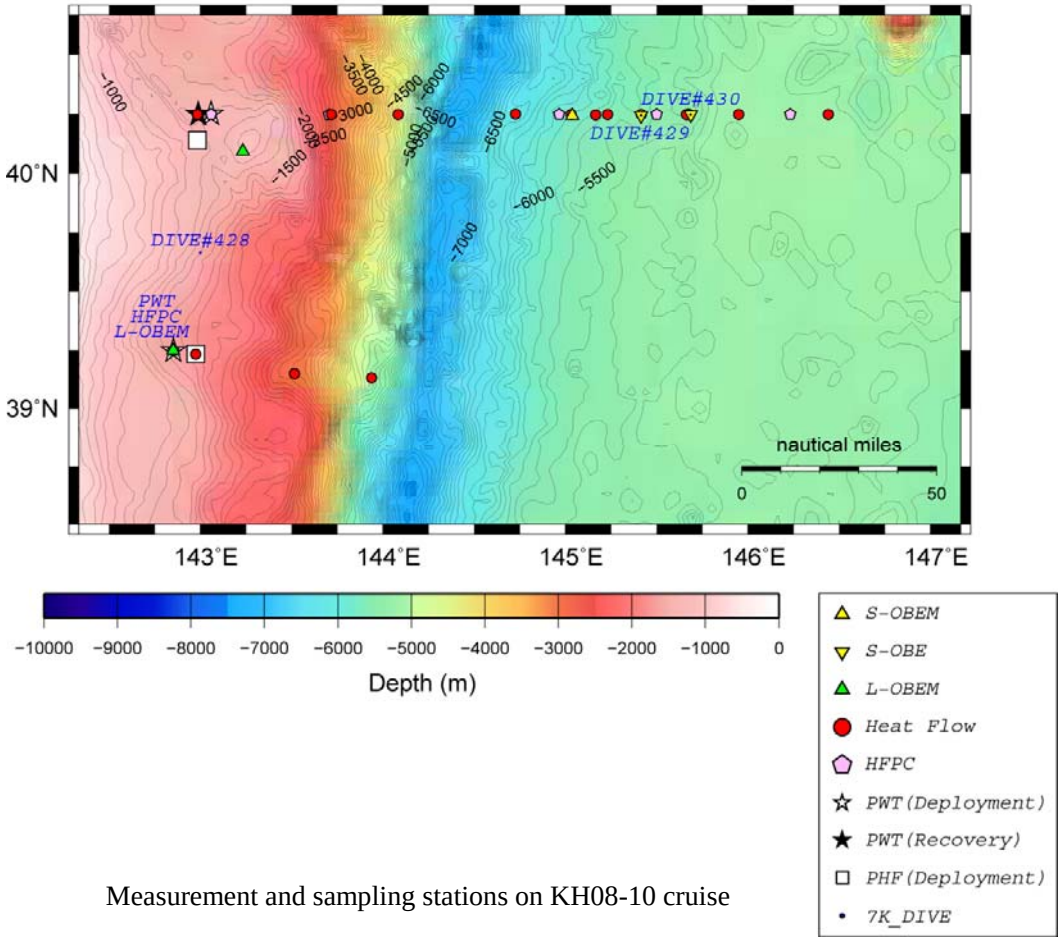
Research area:

Japan Trench area

Research map:



Ship track of KH08-10 cruise. Red and blue lines are track of Leg 1 and Leg 2 respectively.



Measurement and sampling stations on KH08-10 cruise

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2. Overview of Observation

Overview of observation

[Research objectives]

We intend to clarify the temperature structure and the water distribution in the upper part of the Pacific plate subducting beneath the northeast Japan arc through heat flow measurements and electromagnetic surveys in the Japan Trench area. Based on the obtained results, we will investigate intra-plate volcanism on the Pacific plate, heat transfer and water movement in the oceanic crust associated with development of normal faults on the seaward slope of the Japan Trench. We also intend to examine relation between the temperature structure and water distribution along the subducting plate boundary and mechanical properties of the seismogenic zone.

[Research items]

(1) Heat flow measurement

Heat flow measurement with ordinary deep-sea heat flow probes and stand-alone heat flow meter (SAHF) designed for use in submersible dives.

(2) Long-term temperature monitoring on the seafloor

Long-term monitoring of the bottom water temperature and temperature profile in surface sediment using pop-up type instruments for determination of heat flow in areas with relatively shallow water depths.

(3) Piston core sampling with heat flow measurement (HFPC)

Sampling of surface sediments with a piston corer and heat flow measurement at the same site using temperature sensors mounted on the core barrel.

(4) Ocean-bottom electromagnetic survey

Controlled-source electromagnetic survey with KAIKO 7000II system and magnetotelluric survey with high-frequency ocean-bottom electromagnetometers (HF-OBEMs) and long-term OBEMs (LT-OBEMs).

(5) Bathymetry and geophysical survey

Bathymetry mapping with a multi narrow beam system, gravity measurement, and measurements of total magnetic field and geomagnetic vector.

[Research results]

(1) Heat flow measurement

We carried out heat flow measurements at 16 sites with the deep-sea heat flow probe, at 6 sites with the HFPC and at 2 sites with the SAHF. At all the sites with the deep-sea heat flow probe, multiple penetrations were attempted for examining local variability of heat flow. Most of the sites are located on the seaward side of the Japan Trench along a parallel of 40°15'N, extending from the upper part of the trench slope to the top of the outer rise. The other sites are located on the landward side of the trench, either along 40°15'N or around 39°N. Temperature profiles measured at sites with water depths shallower than 2000 m are clearly disturbed by temporal variation of the bottom water temperature.

(2) Long-term temperature monitoring on the seafloor

We deployed pop-up heat flow instruments (PHFs), which can record temperatures in surface sediment for more than one year, .at two stations. We also deployed pop-up water temperature measurement systems (PWTs), which monitor variation of the bottom water temperature, at two stations and recovered a PWT deployed in October, 2007. All of these stations are located in shallow sea areas (shallower than 2000 m) on the landward side of the trench.

(3) Piston core sampling

Sediment core samples were collected at six stations using the heat flow piston coring system (HFPC), along the core barrel of which six temperature data loggers are mounted. The lengths of the obtained core samples range from 155 to 307 cm. Measurements of physical properties (magnetic susceptibility, thermal conductivity, and shear strength) were conducted on board as well as visual description and photographing. 7-cc-cube samples were taken from the working half and will be analyzed on shore.

(4) Ocean-bottom electromagnetic survey

We deployed LT-OBEMs at two stations on the landward side of the trench. They will be recovered after about one year. HF-OBE and OBEMs were deployed at three stations along the 40°15'N heat flow survey line on the seaward side of the trench and successfully recovered 12 to 15 days after deployment.

We tested a newly developed controlled-source electromagnetic (CSEM) system operated by the ROV KAIKO 7000II. On the dive #428, a test operation of the system was made about 500 m above the seafloor. On the dive #429, we extended the CSEM cable (70 m long) on the seafloor in the vicinity of a HF-OBE and shot artificial electric current through the cable.