

Bathymetric and gravity survey of the eastern Nankai Trough

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During the "Shinkai 6500" dive program, the underway geophysical survey in the eastern Nankai Trough was carried out aboard the R/V "Yokosuka" in 1996, and swath bathymetry and gravity data were collected. Total time of the survey was about 112 hours, therefore the length of the geophysical survey tracks amounts 1,456 nautical miles (2,694 km).

Key words : Bathymetry, Gravity, Nankai Trough, Kaiko-Tokai

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1. Introduction

The Nankai Trough is a subduction zone located in the south of the Honshu Island in Japan (Figure 1). The Philippine Sea Plate subducts beneath the Honshu Island. In 1996, the dive program using the research submersible "Shinkai 6500" and the mother ship R/V "Yokosuka" was carried out in the eastern Nankai Trough (#321-#327 dives; Y96-10 Leg 1, see references e.g. Ashi, 1997; Henry et al., 1997; Mazzotti et al., 1997 for results of the dive studies). This dive program takes a part of Japanese-French cooperation "Kaiko-Tokai" project. The scientific objective of this project is to study subduction tectonics of the eastern Nankai Trough and its vicinities.

During the night time and maintenance day of the submersible, the R/V "Yokosuka" conducted the sea surface geophysical survey. The data collected includes swath bathymetry and gravity. In the context of the "Kaiko-Tokai" project, the French R/V "L'Atalante" and the Japanese R/V "Hakuho-maru" carried out the survey in early 1996 (Lallemant, Huchon, Tokuyama et al., 1996; Tamura and Igarashi, 1996; Segawa et al., 1996). Therefore, the survey ship tracks for surface geophysical data were designed to complement the coverage of the "Kaiko-Tokai" area.

2. Data Collection and Results

2.1. Bathymetry

The swath bathymetric data were collected by using the HS-10 Multi Narrow Beam echo sounder surveying system, Furuno Electric Co. The HS-10 has a 45 degree cross-track swath which covers a total of 2 times water depth and collects depth and backscattering intensity data. The survey ship tracks are shown in Figure 2. The were designed to survey over the "Shinkai 6500" dive sites, to extend westward the survey area conducted aboard the R/V "L'Atalante" and the R/V "Hakuho-maru" in 1996, and to survey the south of the Zenisu Ridge. The global positioning satellite (GPS) navigation was used to provide the geographical reference. WGS-84 geographical coordinates and Japan Standard Time (JST) were used for shipboard operations throughout this survey. The sound velocity profile in the water column for calculation of water depth is shown in Table 1. The velocity of the top layer (4-50 meters) were varied within ± 3 m/s automatically, reflecting measurements of water temperature. The resultant map is shown in Figure 3.

2.2. Gravity Anomaly

The gravity data were collected along the ship tracks.

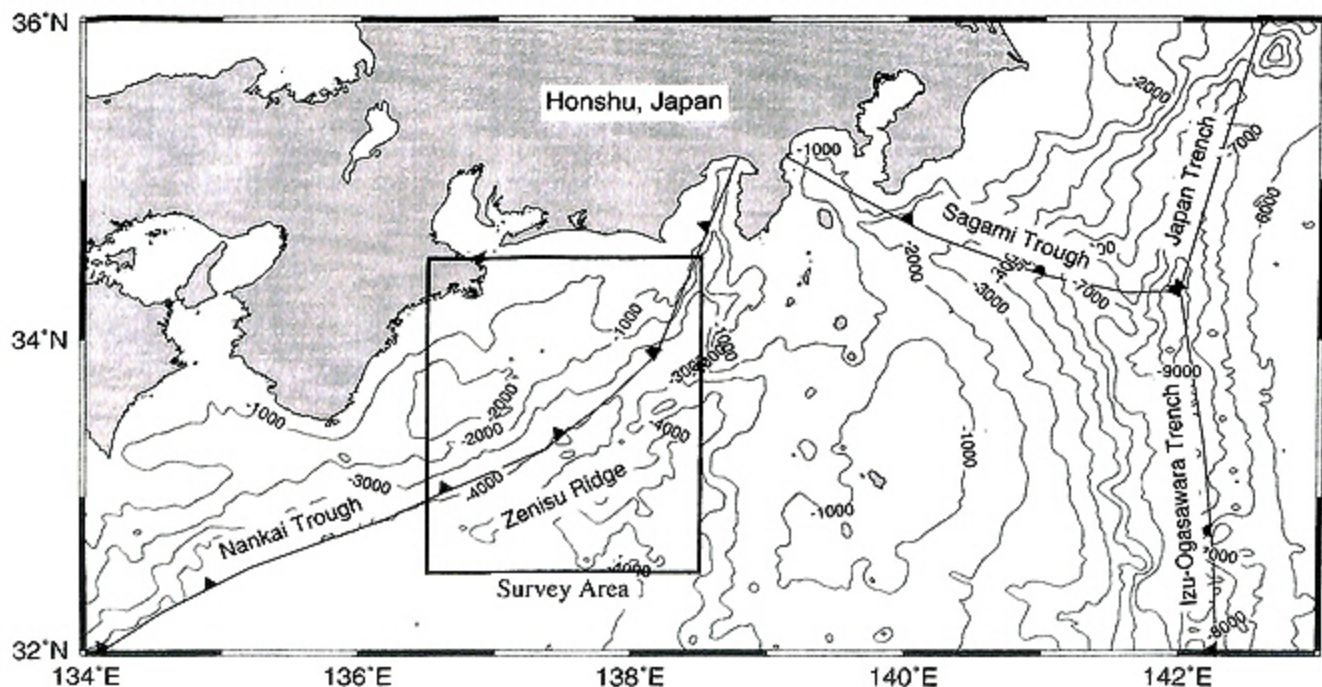


Fig. 1 Location of the survey area. The box shows the survey area.

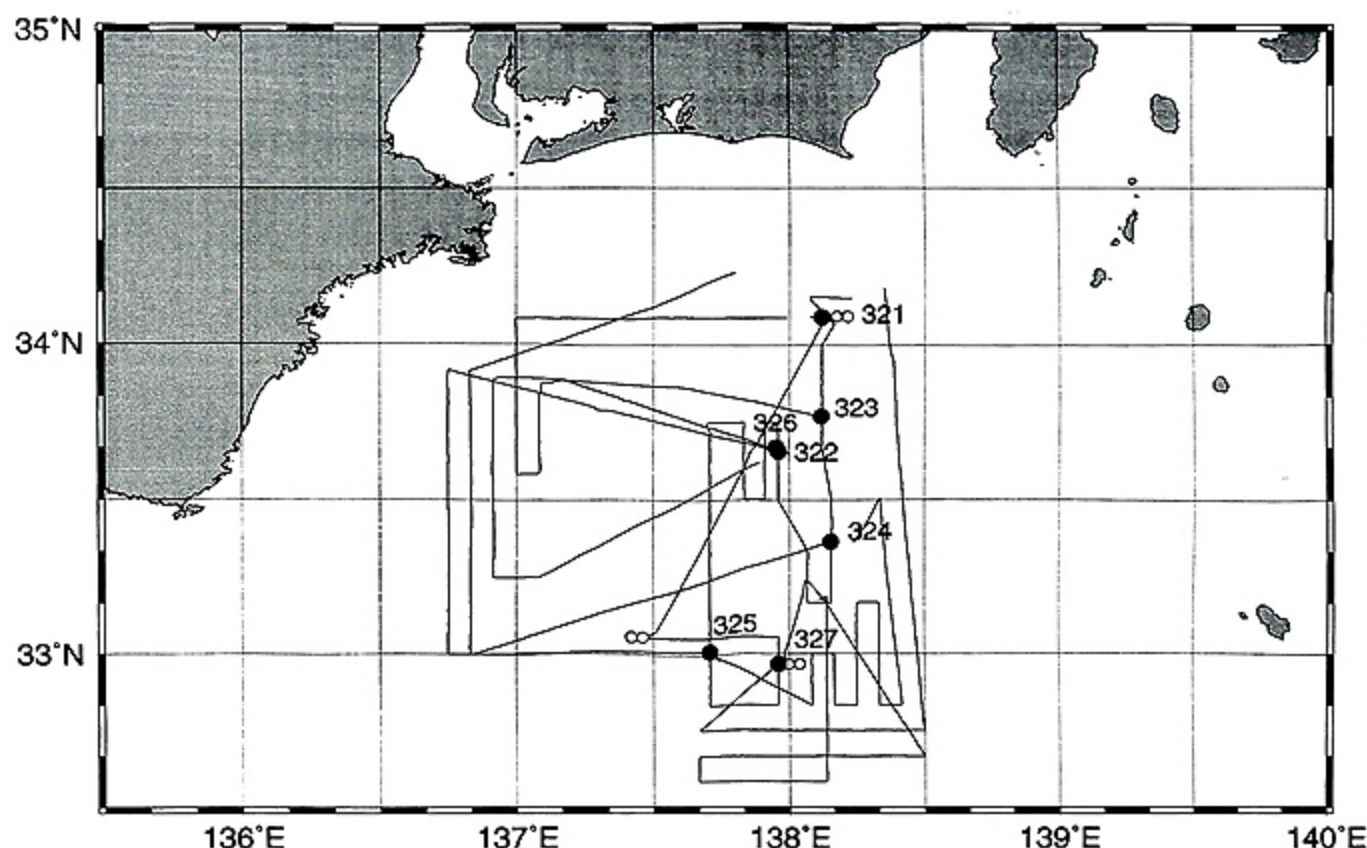


Fig. 2 Survey tracks during the Y96-10 Leg 1 cruise of the R/V "Yokosuka". Solid circles show the "Shinkai 6500" dive sites.

Depth	Temp.	Sal.	Sound Vel.
4	27.9	35.0	1540.9
50	22.0	35.0	1527.6
200	20.6	34.5	1525.8
440	16.3	34.5	1517.3
760	7.5	34.5	1492.3
1000	4.4	34.5	1483.9
1200	3.3	34.5	1482.6
1800	2.2	34.5	1488.0
4000	1.5	34.5	1522.8
8000	1.9	34.5	1597.2

Depth: water depth (m)
 Temp.: water temperature (C)
 Sal.: salinity (permill)
 Sound Vel.: sound velocity (m/s)

Table 1 Sound velocity profile in the water column used in the survey cruise.

The R/V "Yokosuka" is equipped with the LaCoste & Romberg shipboard gravimeter S-63. The shipboard gravity data were tied to gravity data at the JAMSTEC pier and the Aburatsubo gravity base station measured by using the LaCoste & Romberg gravimeter G-1039 (Table 2). 29 track crossings for estimation of cross-over errors were obtained during this cruise. Cross-over errors have standard variation of 2.05 mgal (Figure 4) and average drift of -0.24 mgal/day. The free-air gravity anomaly is calculated by subtracting the theoretical gravity formula of the Geodetic Reference System 1967 (Figure 5).

3. Conclusions

During the Y96-10 Leg 1 of the R/V "Yokosuka", swath bathymetry and gravity anomaly data were collected in the eastern Nankai Trough. The survey ship tracks cover over the "Shinkai 6500" dive sites, the western extension of the survey area conducted aboard the R/V "L'Atalante" and the R/V "Hakuho-maru" in 1996, and the south of the Zenisu Ridge. To combine the results of this survey with the previous data from the R/V "L'Atalante" and the R/V

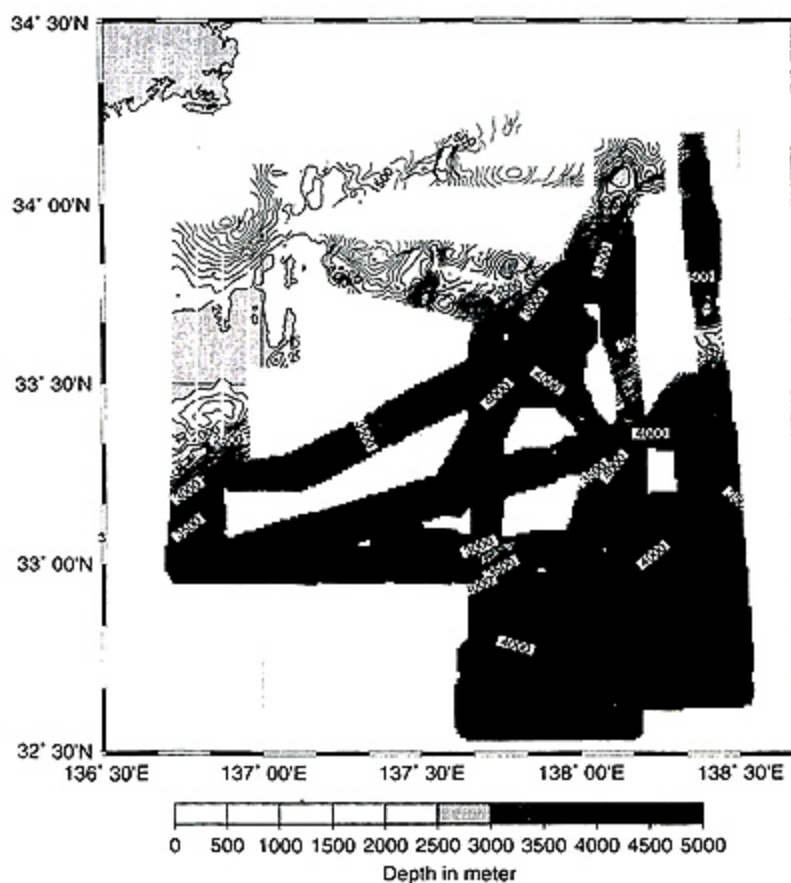


Fig. 3 Bathymetric map. Dark color shows deeper water depth. Contour interval is 100 m.

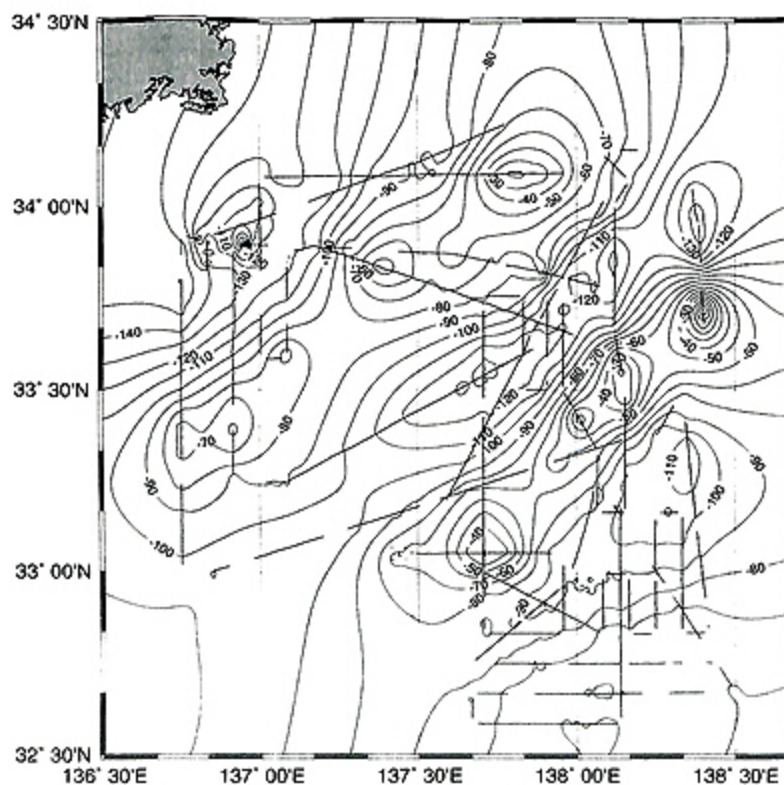


Fig. 5 Free-air gravity anomaly map. Contour interval is 10 mgal.

Date	G-1039	Gravity	S-63
21/Jul./96 16:47 JST,	3243.695,	979771.88	
24/Jul./96 09:30 JST,	3230.441,	979758.18,	10812.5
05/Aug./96 17:41 JST,	3230.392,	979758.13,	10808.2

Date: Date of measurement
 G-1039: Dial value of land gravity meter (mgal)
 S-63: Digital gravity of shipboard gravity meter

Table 2 Calibration of the shipboard gravity meter.

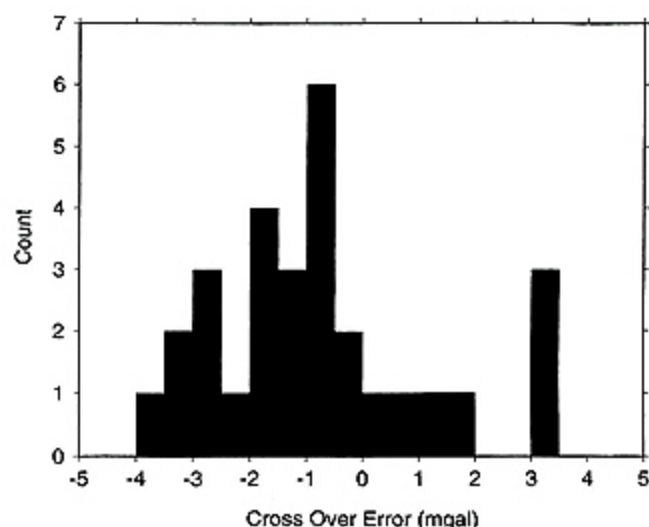


Fig. 4 Histogram of crossover errors of free-air gravity anomalies for 29 track crossing in the survey area.

"Hakuho-maru" in 1996 is of help to the study of subduction tectonics of the eastern Nankai Trough.

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