ism. Detailed geochemical analyses of the sediments have confirmed the enrichments.

Although the study area off the Lesser Antilles was sampled in detail in all likely hydrothermal locations, no massive sulphides were found on the sea floor. There are indications, however, that they may be present at shallow depth under the sea floor, beneath a cover of gossan or manganese crust. Nevertheless overall hydrothermal activity in the area appears to be less than, for example, in the western Pacific arcs.

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Geophysical Experiments in the Mariana Region: Report of the YK01-11 cruise

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The Mariana region (Fig.1), the eastern part of the Philippine Sea, is characterized by several tectonic features. The Mariana Trench is a result of downward going of the subducting Pacific plate. The Mariana Islands and the Mariana Trough are one of the typical island arc and backarc, respectively. The Mariana Trough is a present active backarc basin and the West Mariana Ridge is considered as a remnant island arc. In addition, serpentine seamounts formed by upwelling serpentine diapir are often found in the forearc area (*e.g.*, Stern and Smoot, 1998). Three upwellings from deep interior of the earth probably exist below this region; the Mariana Islands, Mariana Trough and the serpentine seamounts. These upwellings are related to create various tectonic features in the Mariana region. However, the dynamics of the ocean bottom and the deep structure beneath this region are still unclear yet.

We conducted the YK01-11 research cruise by *R/V Yokosuka*, JAMSTEC in October 2001 to characterize tectonic features and to obtain a deep and dynamic image of the central Mariana region. Here, we briefly report the geophysical experiments in the YK01-11 cruise;

1) Surface geophysical surveys,

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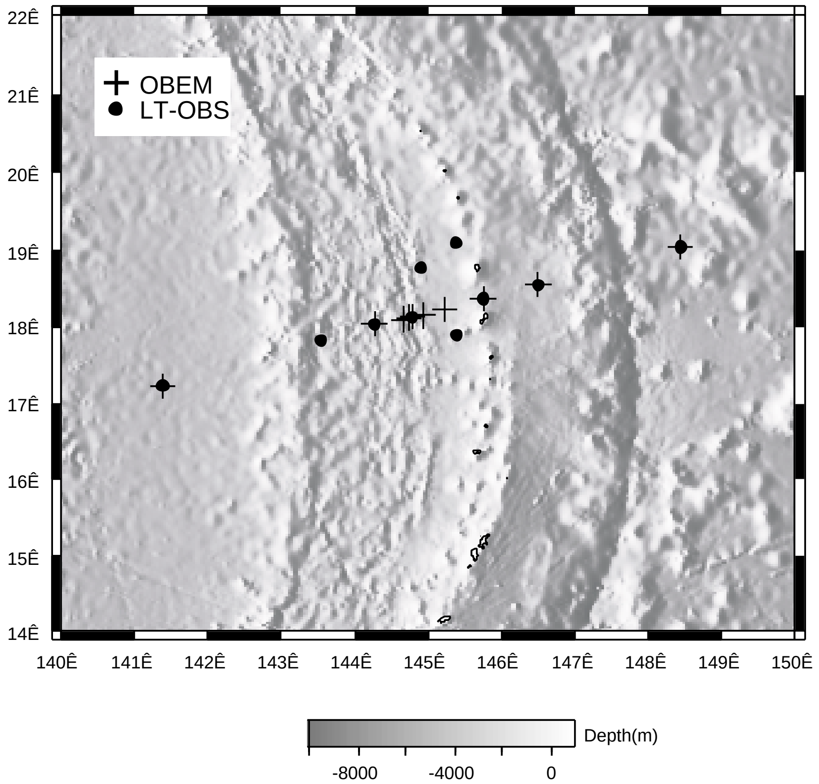

Figure 1. OBEM and LT-OBS positions deployed in the YK01-11 cruise. The bathymetry is based on a global database by Sandwell and Smith (1997) and Smith and Sandwell(1997).

2) long-term and semi-broadband ocean bottom seismometers (LT-OBSs) observation, and
3) ocean bottom electromagnetometers (OBEMs) observation.

Surface geophysical surveys are conducted to characterize the back-arc spreading evolution of the central Mariana Trough (16 N-19 N) and serpentine diapirs in the forearc (Fig. 2). Multi-narrow beam bathymetry, gravity field, and magnetic field data were collected. Gravity field data were obtained from the shipboard gravimeter. Magnetic field data are collected by the ship-towed proton precession magnetometer and the shipboard three-component magnetometers (STCMs: Isezaki, 1986), which can measure the vector of the geomagnetic field. The Mariana region is near the geomagnetic equator and total intensity anomaly amplitudes are often much reduced depending on the orientation of the ambient geomagnetic field and magnetic lineation (Isezaki, 1986). Therefore, the vector geomagnetic anomaly field is especially useful to understand its tectonics.

The morphology in the central Mariana Trough shows seven spreading axis segmentations on the basis of the present cruise and previous ones (KH92-1, YK96-13, and YK99-11). The non-transform offsets, that define the ridge segments, can be traced off-axis in the western side. The direction of the spreading fabric in the southern part of this area changes dramatically from NNW-SSE to almost N-S trend; that is interpreted as a result of the change in the spreading direction. Further analysis combined with crustal age and thickness estimations by vector geomagnetic anomaly and gravity data would lead whole tectonic evolution in this area. In addition, the morphologic feature in the forearc region indicates eight cones, and their magnetizations and densities will be estimated using gravity and geomagnetic anomalies. The results would lead to the sizes and the characters of the serpentine diapirs, which help us to understand the mechanism of their formation in the forearc region.

Ten LT-OBSs were deployed to investigate the image of deep structure beneath the Mariana trough, how the Pacific plate slab is subducting and stagnant. In addition, this seismic observation has a role of the feasibility study to know the deep seismic activity of this area, which has not been determined by on-land seismic observation networks. For this purpose, three of LT-OBSs (Fig. 1) are located off the main profile to surround the seismically active area where 600 km deep events are detected by a global seismic network. The LT-OBSs will be recovered in the winter of 2002 FY.

Electrical conductivity in the mantle depends on its temperature and/or existence of melts, so that the conductivity structure is useful to image a hot mantle material, upwelling regions, and a cold subducting plate. Therefore, ten ocean bottom electromagnetometers (OBEMs) were deployed in a line across the whole Mariana region through the Pacific plate, the trench, the arc and the backarc area (Fig. 1) to reveal regional and mantle conductivity structure. The deep conductivity structure beneath the slow spreading axis of the Mariana Trough is focused on intensively in this study, so that four of OBEMs are located within 15 km width from the spreading axis. These OBEMs will be recovered in the October of 2002.

Synthetic calculations of electromagnetic (EM) field on a priori models are carried out in order to know how the EM measurements by OBEMs are sensitive to a deep conductivity structure below the Mariana region. We calculated time variation of sea-floor electric and magnetic fields at arbitrary periods on several 2-dimensional conductivity models, and discussed a ratio and a phase difference between the electric and the magnetic fields. The calculation results indicate several important features:

1) A high conductive mantle wedge at the depth of 15 - 80 km will be well constrained by EM responses at the period of 100 - 5000 sec.
2) A high conductive zone below the Mariana Trough at the depth of 10 - 80 km will be also imaged by EM responses at the period of 100 - 1000 sec.
3) The effect of the subducting slab deeper than 100 km depth is not large, but it can be observed at the period greater than 5000 sec. The synthetic calculations encourage our OBEMs observation.

These geophysical surveys also have a role of pilot observation for later Japan-US international cooperative seismic and electromagnetic experiments planned in 2002-2005. Results of the surface geophysical mapping in the YK01-11 cruise will give us a model of an undergoing tectonic process in the Mariana Trough. The deep seimic activity will help to design future seismic observation networks by dense broadband ocean bottom seismometers. Our seismic and electromagnetic experiments will give a coarse structural image of the upper mantle in the Mariana region, which is a first step to get further detailed images of the upper mantle, such as possible plumes beneath the trough, and the Pacific plate as subducting and stagnant slab.

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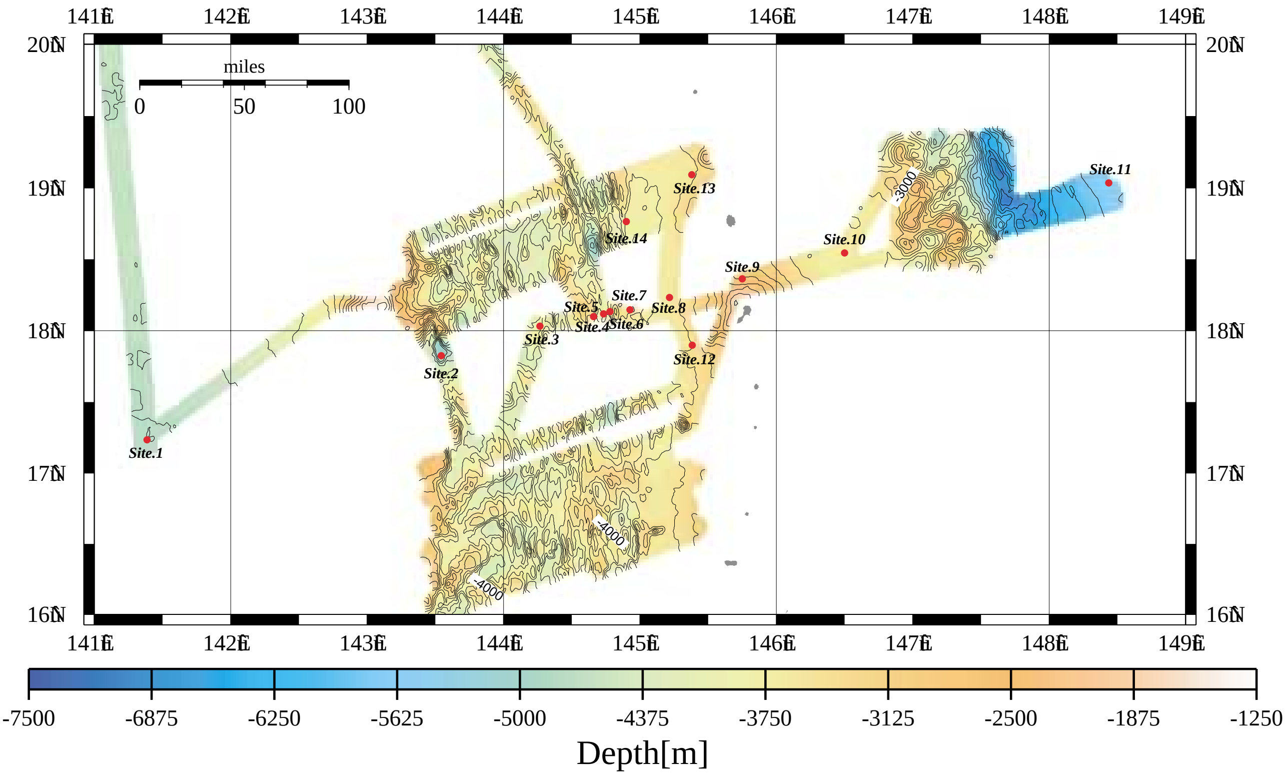

Figure 2. Bathymetric map obtained in the YK01-11 cruise.