Ocean Bottom Electoromagnetic Observation in the Mariana Region

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The Mariana region, 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 sea mounts possibly 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 may exist below this region; the Mariana Islands, Mariana Trough and the serpentine sea mounts. These upwellings are related to create various tectonic features in the Mariana region. However, the deep structure beneath this region is not clear yet.

Several geophysical methods were applied in the reserch cruise by R/V Yokosuka, JAMSTEC in 2001 to obtain a deep and dynamic image of the Mariana region; bathymetry mapping, gravity and magnetic survey, seismological and electromagnetic observation. This survey has a role of pilot observation for a US-Japan and international cooperative seismic and electromagnetic research planed in 2002-2005. In this study, we report the installation of Ocean Bottom Electro-Magnetometers (OBEM) in the Mariana region, and the expected result by synthetic calculation.

We deployed 10 OBEMs (6 of them by Earthquake Research Institute, Univ. Tokyo and 4 of them from Kobe Univ.) in the Mariana region. The deep conductivity structure beneath the slow spreading axis of the Mariana Trough is focused intensively in this study. Also, regional and mantle conductivity structure across the whole Mariana region (through the trench, the arc and the backarc area) will be revealed by this OBEM array. These OBEMs will be recovered in 2002.

In order to know how the electromagnetic(EM) measurements by OBEM are sensitive to a deep conductivity structure below the Mariana region, synthetic calculations of EM field on apriori models are carried out. As a result, 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. 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. An effect of a deep subducting slab deeper than 100 km depth is not large, but may be observed at the period greater than 5000 sec.