Electrical structure in the central Mariana back arc system

Kiyoshi Baba[1], Nobukazu Seama[2], Tada-nori Goto[1], Masahiro Ichiki[1], takafumi kasaya[1], Yoshifumi Nogi[3], Katrin Schwalenberg[4], Hisanori Iwamoto[5], Noriko Tada[6], Tetsuo Matsuno[5], Kiyoshi Suyehiro[1], Hisashi Utada[7], YK01-11 YOKOSUKA Shipboard Scientific Party, KR02-14 Kairei cruise scientific party

[1] JAMSTEC, [2] RESEARCH CTR INLAND SEAS, KOBE UNIV., [3] NIPR, [4] Univ. Toronto, [5] Earth and Planetary Sci.,Kobe Univ, [6] Earth and Planetary Sci.,Kobe Univ

, [7] ERI, Univ. of Tokyo

A marine magnetotelluric (MT) experiment was carried out in the central Mariana area from 2001 to 2002 to elucidate electrical structure of the subduction-arc-back arc system. The electrical conductivity is mainly subject to temperature, partial melt, and volatiles such as water in the mantle. 10 ocean bottom electromagnetometers (OBEMs) were deployed along the line crossing the central Mariana trough during the cruise YK01-11 in October 2001. This OBEM array covers the Pacific plate (Site 11), Mariana forearc (Site 10), volcanic arc (Site 9), trough (Site 3-8) that is currently active back arc basin, and Parece-Vela basin (Site1). Two of them (Site 8 and 9) were recovered during the cruise using R/V M. Ewing in April 2002. Goto et al. (2002) analyzed these data and showed that relatively conductive mantle beneath the trough and resistive beneath the arc. Three of the other OBEMs (Site 1,3, and 11) were successfully recovered in October 2002 during the cruise KR02-14.

In this study, we analyzed the data collected at Parece-Vela basin (Site 1) and the western and eastern flanks of the Mariana trough axis (Site 3 and Site 8). Time series electric and magnetic field variations were proccessed using the robust remote reference technique with jackknife error estimates (Chave and Thomson, 1989) after editing noisy data sections, correcting inclination and clock of the instruments, and removing of daily and tidal fluctuations.

Obtained MT responses have typical feature for marine MT that is higher apparent resistivity in the period range from several thousands to 10 thousand seconds deceasing at longer period which indicates the transition from the resistive upper most mantle to conductive athenospheric mantle. Additionally, the apparent resistivities at these sites decrease at the periods shorter than 1000 seconds indcating the presence of cunductive crust probably due to sediments. The MT response at Site 8 shows strong galvanic effect. Recovered azimuth of the regional strike by galvanic distortion decomposition (Groom and Bailey, 1989) is N38W, which approximately agrees with the direction of the spreading axis of the trough.

We inverted the MT responses using Occam's one-dimensional (1-D) inversion (Constable et al., 1987). 1-D models at Site 1 and Site 3 obtained from the TM mode resoponses are very similar with resistive upper most mantle and high conductive peak at the depth of about 100km, while those obtained from the TE mode responses are less conductive at the depth.

We further attempt two-dimensional (2-D) analysis to study lateral variations of the conductivity in more detials. Incorporating anisotropy in the conductivity may also be needed as a recent marine MT study in the southern East Pafic Rise (Baba et al., 2002) revealed an anisotropic conductivity structure.