SCG66-07 Room:101B Time:May 22 11:00-11:15

Estimation of electrical resistivity structures beneath the Lau back-arc Basin

SHIBATA, Yuki[1], SEAMA, Nobukazu[1*], MIZUMA, Keiko[1], KIMURA, Maho[1], KOBAYASHI, Seiya[2], MATSUNO, Tetsuo[1], NOGI, Yoshifumi[3]

[1]Kobe University, [2]The Graduate University for Advanced Studies, [3]National Institute of Polar Research

In the back-arc basin, some factors such as the proximity to the convergence boundary, dehydration from the slab and the corner flow within the mantle wedge, which do not appear at the mid ocean ridges, have been considered to affect the seafloor spreading process.

The Lau back-arc Basin is an active back-arc basin, which has been formed in association with the subduction of the Pacific plate at the Tonga Trench. There are 3 distinct spreading systems in the Lau back-arc Basin; Central Lau Spreading Center (CLSC), Eastern Lau Spreading Center (ELSC), Valu Fa Ridge (VFR). Clear transitions in spreading rate and topography have been observed along the spreading center in the 3 spreading systems. In the standard theory on the correlation observerd at the mid ocean ridge, the fast spreading ridge shows topography dominated by the axial high, not by the rift valley (Forsyth, 1992). In the case of the Lau back-arc Basin, however, the southern segment with slower spreading rate shows topography dominated by the axial high, not by the rift valley (Martinez et al., 2006). Thus the Lau back-arc Basin shows an opposite correlation in the relationship between spreading rate and topography to the mid ocean ridge. The distance from the spreading center to the trench and the island arc is suggested to be a cause for the opposite correlation (Martinez et al., 2006; Jacobs et al., 2007) because it varies along the spreading center. The aim of our research is to reveal differences in 2 resistivity structures along separated 2 survey lines and to investigate how the distance from the spreading center to the trench and the island arc has influence on the back-arc spreading process.

Resistivity in the upper mantle reflects mantle temperature, the presence of and the content of melt and volatile elements such as water. We used the Magnetotelluric (MT) method to obtain resistivity structures beneath the basin, by using time-variations of magnetic and electric fields measured on the seafloor.

For the estimation of resistivity structures beneath the Lau back-arc Basin with the MT method, we conducted an electromagnetic observation using 6 OBEMs (Ocean Bottom Electro-Magnetometer) and 11 OBMs (Ocean Bottom Magnetometer) in total on the 2 survey lines across ELSC. The southern survey line is located at 21.3 S, and the northern survey line is located at 19.7 S, and the length of both survey lines are about 150 km. The OBEM measures horizontal 2 and vertical 1 components of magnetic field and the horizontal 2 components of electric field, and the OBM measures the 3 components of magnetic field. We obtained about 12 months length data from 2 OBEMs and 7-9 months length data from 11 OBMs.

The estimated electrical resistivity structures show the following features: (1) Resistive regions of more than 300ohm-m distribute in the uppermost mantle beneath the both survey lines. (2) At the depth of 100-200km, mantle has the resistivity of less than 50ohm-m. (3) At the depth of 150km the resistivity directly above the subducting slab chages beneath the both survey lines, and conductive regions of less than 50ohm-m distribute at deeper region than that depth. Above the slab at the depth of 150km, northern line has a conductive region of less than 30ohm-m at shallower depth than 70km, southern line has the spreading center. Our conclusions from the investigation of the estimated resistivity structures are: (1) The depleted mantle which has undergone the partial melting during upwelling results in forming the resistive regions in the uppermost mantle. (2) The resistivity at the depth of 100-200km cannot be explained by the dry olivine, and requires the exsistence of water or partial melt. (3) It is suggested that dehydration from the slab at the depth of 150km produces the conductive region at shallower depth along the northern line and affects the degree of melting and water content beneath the spreading center along the southern line.

Keywords: Lau, back arc basin, Magnetotelluric method, Tonga Trench