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背弧海盆下の上部マントル比抵抗構造が示唆する沈み込むスラブからの水放出
Water release from subducting slab inferred by upper mantle electrical resistivity structures beneath back-arc basins

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We present and compare four 2-D electrical resistivity structures of the upper mantle beneath three back-arc basins; the Lau Basin, the southern Mariana Trough, and the central Mariana Trough. The magnetotelluric (MT) method is a base to estimate upper mantle resistivity structures. The electromagnetic variation data on the ocean bottom were obtained from observations using OBEM (Ocean Bottom Electro-Magnetometer) and OBM (Ocean Bottom Magnetometer). We carried out the time-series data analysis is to estimate the MT responses and corrected topographic distortions in the MT responses. We have basically performed a smooth model inversion analysis using the processed MT responses to estimate a resistivity structure with minimum model smoothness, and also have considered a prior constraint in the inversion analysis for the subducting slab inferred from a seismic research. In the Lau back-arc basin, we obtained 12 months length data by 2 OBEMs and 7-9 months length data by 11 OBMs on the 2 observation lines across eastern Lau spreading center at 19.7 S and 21.3 S; the length of both observation lines are 150 km. It is worth noting that it is the first experiment to use OBSMs (ocean bottom seismograph with magnetometer); that is OBM attached to ocean bottom seismograph. Matsukura (2014) analyzed these data to derive 2-D upper mantle resistivity structures beneath the two observation lines. In the southern Mariana Trough back-arc basin, we carried out an electromagnetic observation along a 120 km length observation line across the spreading axis, and we obtained about 85 days length data by two OBEMs and for about 60 days by six OBEMs. Shindo (2013) reported preliminary results from these data, and we reanalyzed the data to derive a 2-D upper mantle resistivity structure beneath the observation line. We also compared these structures with a 2-D upper mantle resistivity structure beneath the central Mariana subduction system including the central Mariana Trough back-arc basin (Matsuno et al., 2010). All the 2-D upper mantle resistivity structures beneath three back-arc basins indicate that the mantle resistivity directly above the resistive subducting slab start decreasing at a characteristic depth; conductive region of less than 50 ohm-m exists at the deeper region. The depth is 140 km except 60 km for the central Mariana Trough back-arc basin where the subducting slab is so steep that the conductive region has ascended nearly vertically to the shallower depth or that the vertical resolution could not be good enough. This result suggests that the conductive region of less than 50 ohm-m is probably due to water release from the subducting slab and that the water release becomes dominating in the mantle above the slab when the slab reaches 140 km depth.

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