A research report on the fundamental investigations of an electrical resistivity structure beneath Chugoku and Shikoku regions, southwestern Japan(2019)

*Ichiro Shiozaki[1], Tomofumi Uto[1], Makoto Uyeshima[2], hiroshi hataoka[3], Hideki Murakami[4], Naoto Oshiman[5], Yoshihisa Iio[5], Kazuya Ando[6]

1. Graduate School of Engineering, Tottori University, 2. Earthquake Research Institute, University of Tokyo , 3. Technical Department, Tottori University, 4. Research and Education Faculty , Kochi University, 5. Disaster Prevention Research Institute, Kyoto University, 6. San'in Kaigan Geopark Museum of the Earth and Sea

In order to contribute to a reduction in damage caused by earthquakes and volcanic eruptions, heterogeneities of crustal and upper mantle structure should be clarified based on fundamental investigations of electrical resistivity structure in Chugoku and Shikoku regions, southwestern Japan arc. Our research group has shown that there is a clear relationship between resistivity and seismicity in the San'in and Shikoku regions. In the eastern part of San'in region, it was found that a conductive area exists in the deep crust part under the seismic region, which is a resistive area, along with the seismic activity area stretching nearly in the east and west direction. Assuming that inland earthquakes occur because of local stress concentration caused by heterogeneity beneath a seismic activity band(Iio, 2009), it is necessary to improve spatial data and to clarify the heterogeneity in this area hereafter.
On the other hand, in the Shikoku district, it was suggested that the distinctive low resistivity region exists in the upper crust mainly from the survey results in the outer belt, and that there is a clear relation between the low resistivity and low seismicity in the central and the western area. In order to understand the earthquake phenomenon, it is important to clarify the generation environment and the principle as well as the activity style of the slow earthquake (Obara(2017)).

In this background, broadband MT observation was conducted in the eastern part of Chugoku district from late October to late December 2019. The study area is the eastern extension area (seismic activity is relatively weak) of the Shikano-Yoshioka fault, and there are sites that locate near the Amedaki - Kamato faults and the Yamazaki fault zone. The geomagnetic 3 component and electric field 2 component variations were measured at a total of 11 points using the Phoenix instruments MTU-5 and MTU-5 A. As a general feature, shapes of the sounding curves, such as apparent resistivity and phase value, are similar and both curves suggest the existence of a high-resistivity region (At least kΩ m order) in the deep part. Also, the YX component value of the phase difference tends to increase from about several 100 seconds. Assuming the existence of a 2D structure in the EW direction, model analysis was carried out using the code of Ogawa and Uchida (1996). As a preliminary result, the model shows that the crust was generally estimated as a high resistivity region and the deep low resistivity region of 10 Ωm or less indicated in the Sanin region has not been shown except for the shallow part. Seismic activities may appear to have occurred in the higher resistivity region compared to the surrounding resistivity values.
In the Shikoku region, 3-D resistivity model analysis is being carried out by utilizing and integrating existing data. In particular, it is important to clarify the relationship between the resistivity structure and the mode and environment of slow earthquakes in the eastern and western regions of Shikoku.

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