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Modification of resistivity structure beneath the Biwako fault, the southeastern part of the Yamasaki fault system

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Introduction

The Yamasaki fault zone (YFZ) consists of the Nagisen Fault, the main part of the YFZ, and the Kusadani Fault. The main part of the YFZ is further divided into a northwestern (NW) group (the Ohara, Hijima, Yasutomi, and Kuresakatouge Faults) and a southeastern (SE) group (the Biwako and Miki Faults) based on their latest faulting events and mean left-lateral slip rates; AD 868 and 1.0 m/kyr for the NW group vs. AD400 - 600 and 0.8 m/kyr for the SE group (Okada, 1987; Earthquake Research Committee, 2013).

The audio-frequency magnetotelluric (AMT) method is a powerful tool for investigating the structure of active faults in the upper few km of the Earth crust. In particular, this method is more sensitive to the structure of a strike-slip fault, where vertical to high-angle fault planes and fracture zones are expected, than seismic reflection or refraction surveys.

Observation

An AMT surveys were made at 81 stations along 7 survey lines across the faults of the NW group, while the survey was made at only 8 stations along 1 survey line across the faults of the SE group. It is important to make clear the subsurface structure of the SE group to know the whole nature of the YFZ and difference between the NE and SE groups of the main part of the YFZ.

We focused on the Biwako faults of the SE group in this study. The Biwako fault is a vertical dipping, left-lateral strike-slip fault system along a general strike of N50W.

An AMT survey was undertaken in June 2014 at nine stations along the transect across the Biwako fault. This transect passed the site of trench excavation survey (Earthquake Research Committee, 2013). To apply remote reference method, the remote station of the magnetic field was set ~15km north from the northeastern end of the transect. Two horizontal components of electrical field and three components of magnetic field were measured.

Analysis

After calculated MT response functions based on the remote reference method (Gamble *et al*., 1978), we adopted the phase tensor analysis (Caldwell *et al*., 2004) to estimate dimensionality of the resistivity structure beneath the study area and to determine the direction of the regional strike, if the structure is two-dimensional. The two-dimensional resistivity model was constructed using the code of Ogawa and Uchida (1996) from the MT responses of both TE and TM modes.

Interpretation

The optimum model obtained is characterized by the clear resistivity boundaries correspond to the surface traces of west and east segments of the Biwako fault and by low resistivity zone dominated on the north side of the fault. We interpreted that the dominant low resistive zone on the north side of the fault is caused by aqueous fluid in wide damaged zone which is developed in the tensile region between the western and eastern segments. The clear resistivity boundary near the fault is caused by a fault core which can be a barrier to water flow across a fault plane. It is still unclear how the conductive region at the south side of this survey line generated.

Keywords: Biwako fault, Yamasaki fault system, active fault, resistivity structure, Magnetotelluric method