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Electrical conductivity structure beneath the Yasutomi and Kuresaka-touge faults and its relation to fault activity

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The Yamasaki Fault System (YFS) of southwest Japan is a typical strike-slip fault system. The system consists of the Nagisen fault, the main part of the YSF, and the Kusatani fault. The main part of the YFS extends over 80 km and its general trend is WNW-ESE. It can be grouped into the southeast active faults group (Biwako and Miki faults) and the northwest active faults group (Ohara, Hijima, Yasutomi, and Kuresaka-touge faults) according to rrecent fault activity. The latter one bifurcated to the Yasutomi and Kuresaka-touge faults at the eastern end of the Hijima fault . Hyogo (2001) reported that the Yasutomi fault is main one and the Kuresaka-touge fault is a secondary one.

In this paper, we present a two-dimensional conductivity model along three transects (W-, C-, and E-line) across these two faults and discuss relationship between fault activity and subsurface fault structure beneath the two faults.

Audio-frequency magnetotelluric (AMT) surveys were made at 11 points along the W- and C-lines respectively, and 12 points along the E-line. MT responses of the frequency range between 10000 - ˜10 Hz were obtained at each station, using remote reference processing (Gamble et al., 1979). We determined dimensionality and strike direction of each line by Phase Tensor analysis (Caldwell et al., 2004). As a result, all of the lines were determined to have dominant two-dimensional nature. The apparent resistivity and phase for both TM and TE modes were inverted simultaneously using the code of Ogawa and Uchida (1996).

Strong conductive zones are recognized benaeth a surface trace of the Yasutomi fault along the W- and C-lines between 2 - 4km in depth, which are located on the north to the surface trace of the Yasutomi fault. Along the C-line this conductive zone slightly extends to the south of the surface trace of the fault. Beneath a surface trace of the Kuresaka-touge fault, characteristic weak conductive zones are recognized between 0.5 - 2 km in depth along three transects. Conductivity of the zones decreases to eastward. We interpret that this feature is caused by decreasing fractures in the damage zone beneath the Kuresaka-touge fault to eastward. This idea is supported by surface feature of the Kuresaka-touge fault. One is horsetail spray structure which is one of the characteristic structure of the tip damage zone is recognized in the eastern half of the fault. Another ones is the proposal of Nakata et al. (1998). They proposed that fault rupture propagates to the end of branching fault, in our case, from west to east. Finally, we interpreted that different conductivity feature between the Yasutomi fault and the Kuresaka-touge fault is caused by different activity of the the two faults as pointed by Hyogo (2001).

Keywords: conductivity structure, active fault, Magnetotellurics, Yamasakii fault