山崎断層系の地下比抵抗構造

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Along strike variations in the electrical structure of the Yamasaki Fault System, southwest Japan

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The Yamasaki Fault System (YFS) of southwest Japan is a typical left-lateral strike-slip fault system that extends for over 80 km along a general strike of N60W-S60E. The northwestern part of the system consists of the Ohara, Hijima, Yasutomi, and Kuresakatouge faults and the southeastern part of this fault system consists of Biwako and Miki faults. Many micro-earthquakes have been recorded along the fault system (Shibutani, 2004), along with large historical earthquakes such as the magnitude 7.1 Harima Earthquake of 868 AD (Okada et al., 1987). Hickman et al. (1995) pointed out that fluids are intimately linked to a variety of faulting process. These include the long-term structural and compositional evolution of fault zones; fault creep and the nucleation, propagation, arrest, and recurrence of earthquake ruptures. Magnetotelluric (MT) method can be a powerful tool in investigating the nature and distribution of fluid in and around the fault as resistivity of rock is sensitive to distributions of fluid; total amount of fluid, its resistivity, and mode of connectivity. In 1982, Electromagnetic Research Group for Active Fault found (1982) found a low resistivity zone along the Yasutomi fault by various kinds of geomagnetic and geoelectric surveys. They have pointed out that the low-resistive zone is a good indicator for a fault activity and its existence strongly suggests that the fault is active. Recently, Unsworth et al. (1997, 1999) and Bedrosian et al. (2002) reported that the effectiveness of MT in delineating the fracture zones as conductive features in the San Andreas Fault Zone in California, USA.

Audio-frequency Magnetotelluric (AMT) surveys were undertaken along four lines, which are laid across the Ohara fault, joint part of Ohara and Hijima fault, Hijima fault, and Yasutomi and Kuresakatouge faults. We, hereafter, call these lines OHR line, OHJ line, HJM line and YST line, respectively. AMT method is one of magnetotelluric methods and uses natural magnetic field fluctuation with 10000 - 1 Hz. Therefore, it is suitable for surveying relatively shallow (surface - a few kilometers in depth) structure. We made observations at 10 sites along the OHR line (~10 km), and at 15 sites along the OHJ line (~8km), and at 10 sites along the HJM line (~6 km), and at 14 sites along the YST line (~8 km), respectively. Using remote reference processing (Gamble et al., 1979), MT responses of the frequency range between 10000 - 1 Hz were obtained at each site. Prior to dimensionality and regional strike analysis, MT responses at some frequency bands were omitted, because they were severely affected by artificial noise. We determined dimensionality and strike direction of each line. As a result, all of the lines were determined that the dominant two-dimensional nature. Then, we determined strike directions of each line by Phase Tensor analysis (Caldwell et al., 2004) and geological strike. The apparent resistivity and phase data for both TM and TE modes were inverted simultaneously by using the code of Ogawa and Uchida (1996), in which a static shift is also a model parameter. The model that has the minimum ABIC was defined as the most plausible model after some tens of iterations. Following features can be pointed out as important features. (1) Sharp resistivity boundaries were recognized beneath the surface location of the fault traces at all lines. (2) Near surface conductors were imaged along the HJM and YST lines. (3) Deep conductors are recognized along all three lines at the similar depth. A model along the OHJ line is under testing.

In this presentation, we will report magnetotelluric surveys and resistivity structure along the lines across the main segments of the YFS; Ohara, Hijima, Yasutomi and Kuresakatouge faults.