The resistivity structure beneath the main shock area of the 1983 Tottori earthquake

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In the San-in district, the inner zone of Southwest Japan, many microearthquakes occure within a narrow width along the coastline of the Sea of Japan (Nishida, 1976; Tsukuda et al., 1976). The 1943 Tottori earthquake (M=7.4) and the 1983 Tottori earthquake (M=6.2) occured in this distribution. So did the 2000 Western Tottori earthquake (M=7.3). Thus, some large earthquakes also occured there.

The Yoshioka-Shikano Fault, with E-W direction and along the coastline, were formed in the 1943 Tottori earthquake. Geomagnetic and telluric current observations were conducted on and around this fault by Miyakoshi and Suzuki (1978). Geomagnetic observation sites were arranged in an almost perpendicular direction to the fault. It was found that the A values, N-S component of the transfer function, tend to increase landward by the electromagnetic coastal effects of the Sea of Japan, but the A values decreased on the northern edge of the Yoshioka-Shikano Fault. Miyakoshi and Suzuki (1978) interpreted the spatial distribution of A values as the effect of the prismatic conductor with the triangular cross-section, which swelled up in the crust beneath the seismically active fault, and noticed the possibility that the cause of this conductive region might be explained as the result of the groundwater intrusion into the cracked zone in the fault.

On the other hand, the 1983 Tottori earthquake occured close to the hot spa area, Togo Spa and Misasa Spa, in the midland of Tottori Prefecture. In the survey on precursors of this event, the uplift of the water level and increase of the temperature in hot springs were reported in the whole region of Tottori prefecture (Mino et al., 1984). That fact could imply the correlation between seismic activity and groundwater.

In 2000, a wide band MT observation had conducted across the main shock area of the 1983 Tottori earthquake. In the eight sites, the Phoenix V5 or MTU-5 systems (384-0.0005Hz) were installed with the almost N-S direction arrangement. Data acquisition in each site was performed in 15 hours a day and 3-7 days. We used TBASIC, the accompanied program with the observation machinery, for MT data processing and 2-D inversion code of Ogawa and Uchida (1996) for 2-D modeling.

On the result of 2-D inversion for TM mode, relatively conductive region swells up into the upper crust, which is more resistive and the thickness is under 20km. The resistivity contrast of two regions is 100 Ohm-m to 1000 Ohm-m at order. The main shock and aftershock area of the 1983 Tottori earthquake spreads in the more resistive region to the north of the swelling conductor region. Moreover, above the seismic region and the conductor, the conductive layer (under 10 Ohm-m) expands widely to a depth of 2-3 km. This shallow conductive layer seems to correspond to the spa area. The swelling conductive region in the upper crust could reserve hot water and supply it to the upper conductive layer, that is the spa area, through the resistive region. The detail is unknown, but the seismic region, the conducive region in the upper crust and the spa area, are they correlative eath other?