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Resistivity structure around the Ishikari-teichi-toen fault zone, Hokkaido, Japan (3)

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In order to understand source processes of inland earthquake, it is important to reveal a crustal structure and distribution of fluids beneath the fault zone. Resistivity sounding using magnetotelluric (MT) method can detect resistivity structure down to a few dozen km, depending on a frequency band, and resistivity is a sensitive quantity to the presence of fluids. The Ishikari-teichi-toen active fault zone is located on the eastern edge of Ishikari lowland. This region corresponds to the geological and tectonic boundary between the central and southwestern Hokkaido, and is realized as a strain concentration zone compressed in the E-W direction. In order to image a resistivity structure including the lower crust, the MT survey was carried out in this region.

Prior to a 2-D analysis, we calculated MT responses by 3D resistivity model assuming the ocean and conductive sediments, in order to estimate the effect due to low resistivity of the ocean. As a result, a significant effect was clarified in TE mode at a frequency band below 0.03 Hz. Therefore, 2-D analysis treated the TM mode of a whole frequency band and TE mode above 0.03 Hz. The 2-D resistivity inversion code developed by Ogawa and Uchida (1996) estimated resistivity sections along four survey lines that were perpendicular to the fault zone.

The four inverted resistivity sections indicated a similar tendency, which consisted of three layers; resistive (0-2 km), conductive (2-7 km) and resistive (>7 km). The structure shallower than 7 km was consisted with seismic velocity structure, showing characteristics of the detachment and fold due to the thrusting activity. The conductive layers are significant (<10 ohm-m) below the middle part of the lowland but they do not extend to the east beyond the fault zone. This boundary can correspond to the extension of the main fault and be interpreted as a detachment of thrusting structure. The deeper part was almost uniform resistivity of a few ohm-m, except the conductor at the southwestern part, which was probably related to the activity of the Shikotsu caldera. On the other hand, the conductor implying fluids in the crust was not found beneath the fault zone. However, the MT response including such structure (i.e. deep conductor) could be removed during the 2-D analysis, because we reduced the MT data to prevent the sea effect, which was caused by the conductive seawater surrounding the study area. A full 3-D inversion analysis can resolve this problem effectively.

Keywords: high strain rate zone, Ishikari-teichi-toen fault zone, resistivity structure, magnetotelluric