Interpretation of Deep Geologic Structures of Futagawa-Hinagu Faults Belt from MT Resistivity Distribution

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Some recent large earthquakes in Japan occurred in the areas where past seismic activity of faults had not been recorded well. For this reason, clarifying deep geologic structures and physical properties becomes more and more important for understanding genetic mechanism of earthquakes. This is useful for estimating accurately seismic distribution and planning earthquake disaster prevention planning. Micro-earthquakes activity is important for interpretation of active fault structure. The active fault is estimated to have a heterogeneous structure because of biased micro-earthquake distributions on the same active fault. Therefore, micro-earthquake distributions provide a key for the heterogeneity. Non-volcanic earthquakes on active faults occur in the depth of several kilometers. Such great depths cannot be clarified from field geological investigations. Thus, geophysical prospecting methods such as seismic and magnetotelluric surveys are indispensable. Magnetotelluric method is applied to detect physical feature and boundary of strata from resistivity distributions. The source of magnetotelluric survey is natural electromagnetic field and has a wide frequency range, which enables investigation for deep structures. In addition, the method can be applied to mountains area because of its compact system. The development grade of the crush zone, which consists of fault gouge or fault breccias, can be detectable because resistivity of magnetotelluric method parameter depends on clay content by the lithologic feature, weathering, water content, and hydrothermal alterations.

Futagawa-Hinagu fault belt was selected as a case study site. These faults with 80-km length in total run from Mt. Aso to the Yatsushiro plain through the southern Kumamoto plain. The precise seismic observation network has clarified that the micro-earthquake activities are largely different between the Futagawa and Hinagu faults: two faults seem to be different system. Therefore, it is important to clarify differences of deep structures of both faults. From the resistivity structures of Hinagu fault, it is estimated that geology distribution, fracture, continuity, form, and position of a fractured zone. Based on the spatial density of the hypocenter distributions from 1995 to 2005, the Futagawa-Hinagu faults zone can be divided into four areas I to IV toward the south. By considering the resistivity distributions, geothermal structures and crust distorted structures in Kyushu area, the crush form and origin were discussed in each area. As a result, As a result, those differences of fracture structure, dynamic physicality and stress background were clarified in spite of looking like continuous in the view of terrain.