Resistivity structure of underground shallow part of fault zone by CSAMT method-A case in MIDORI district of NEODANI fault zone-

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In recent years, investigations of active faults have come to be performed a lot from the viewpoint of earthquake prediction. However the most of conventional investigation were performed by topographical method. We tried that we examined active faults with method of a geophysical prospecting to reveal the subsurface structure and physical properties in detail. We adopted CSAMT (Controlled Source Audiofrequency Magnetotelluric) method to reveal resistivity structure of underground shallow part of Neodani fault zone.

The Neodani active fault is a part of the Nobi fault system extending about 80 km in the Chubu district in central Japan. The Neodani active fault last ruptured in 1891 Nobi earthquake (M8), which was associated with a maximum 7-8m left-lateral slip and 6m dip-slip. This was the largest earthquake ever in inland Japan.

An electromagnetic survey estimate underground specific resistance structures as same as a general electric survey. An electromagnetic survey uses electromagnetic field variation as a signal source whereas an electric survey uses direct currents. Magnetotelluric (MT) method of an electromagnetic survey is effective for a survey of a wide area and a deep part (several kilometers depth) by using a natural geomagnetic field variation as a signal source. CSAMT method that we used for this investigation is an electromagnetic survey method is similar to MT method using an artificial electromagnetic signal source of an audio frequency band (1Hz- around 4kHz). Then, survey depth becomes shallower because of high frequency band area than MT method. However the signal is stable and reliability of measurement data and efficiency of measurements are high.

In present survey, survey area is about 1km$*$1km covered by 8 survey lines including total 70 measurement sites at Midori Neo, Gifu prefecture. We used 10 frequencies from 2 to 1024 Hz in 2 dimensional analysis and got the subsurface specific resistance structure along each survey line.

As a result, we got the following things.

(1) Distribution of ratio resistance shows the tendency that is low at a deep place and high at a shallow place, respectively. At a shallow place, we were able to identify two points of the following as ratio resistance distribution from position relations with the faults. 1. Midori fault is located in a border of low ratio resistance portion and high ratio resistance portion. 2. Neodani fault and vice-Neodani fault are recognized as low ratio resistance department in high ratio resistance department. Both the Midori fault and vice-Neodani fault were diverged from the Neodani fault. For relations with ratio resistance distribution of a deep part, we were able to confirm two points of the following. 1. The Midori fault is located in a border of low ratio resistance part of a northeast side and high ratio resistance part of a southwestern side. 2. The Neodani fault and the vice-Neodani fault are recognized in the low ratio resistance zone.

(2) It was recognized that a rock by comparison with electric well logging data and relations of ratio resistance was as follows. Especially, meters above the sea level and relations of ratio resistance data are as follows. From the ground to +85m: over 200ohm-m, from +85m to +20m: about 100ohm-m, deeper than +20m: under 50ohm-m, respectively. And, by comparison with a rock core, crush and fault gouge zone are confirmed in the vicinity from +70m to +20m from meters above the sea level as an influence range of fault. It is recognized that crush and fault gouge zone bring low ratio resistance value from this.

(3) We specified a southern extension of the Neodani fault that place was not clear. And we were able to almost confirm the spot where this and the Midori fault diverged. And also, we confirmed that low ratio resistance part recognized by east side of Neogawa river was caused by the vice-Neodani fault that diverged from the Neodani fault.