北海道の内陸地震発生帯における比抵抗構造とその原因についての考察

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Resistivity structure around intra-plate earthquake zone in Hokkaido, Japan -What is represent the resistivity structure?-

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Introduction

Two intra-earthquake zones which occurred more than M5 earthquake in the past 5 decades are known in Hokkaido. One is Teshikaga region locating along active volcanic belt in eastern Hokkaido, where 11 times of more than M5 earthquake were occurred between 1959 and 1967 (Hirota, 1969). The other is the active fault zone of eastern margin of the Japan Sea where the 2004 Rumoi earthquake (M6.1) occurred. We conducted magnetotelluric (MT) surveys at the above intraplate-earthquake areas to clarify the crust structure. Based on the wide frequency band data, resistivity structures are analyzed by 2D inversion code of Ogawa and Ucida (1996). These resistivity structures were compared with gravity data and geological structure to demonstrate what the resistivity structure represents. A relation between seismicity and crust resistivity structure was discussed based on the these structures.

Teshikaga area:

Ichihara et al.(2006) demonstrate the 3 dimensional density structure on the assumption that following 3 geologic units homogeneous density.

Unit A (density: 1.81 g/cm^3): volcanic sediment in Quaternary and Paleocene.

Unit B (density: 2.22 g/cm^3): Sedimentary rock in Miocene.

Unit C (density: 2.64 g/cm^3): Igneous rock in Tertiary or older rocks.

The resistivity structure is well-correlated with distribution of the unit; resistivity in unit A, B and C is middle (20-200 ohm-m), low (1-10 ohm-m) and high ($>$200 ohm-m) respectively. These relations were also find in borehole data (NEDO, 1985). Therefore, we concluded that these resistivity distributions reflect geologic structure. After shock distribution of 1968 earthquake (Hirota, 1969) was plotted on Unit C and high resistivity zone. This area is imaged from surface, although most of Unit C or high resistivity body is located at deep area.

Rumoi 2004 earthquake area:

Inverted resistivity structure showed low resistivity (1-10 ohm-m) from surface to several km in depth and middle resistivity (10-100 ohm-m) at more deep area as general trend. The fault plane assumed by main and aftershock distribution (Maeda et al.,2005; Ichiyanagi, et al., 2005) is located under convex shape of high resistivity body. This convex structure is inferred as anticline because geologic data indicate axis of anticline just above this structure. The result also indicated that low seismicity at the low resistivity zone including extension of the fault. Comparison of these resistivity structures and 5 km depth of bore borehole data (Japan National Oil Cooporation, 1986) indicate that surface area ($<$6 ohm-m) consist of Tertiary sedimentary rock (Kotanbetsu formation etc.) and Cretaneous sedimentary rock (Ezo formation), and deeper area consist of volcanic rocks in Jurassic or older rocks.

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