ネットワークMT法による
新潟-神戸ひずみ集中帯の深部比抵抗構造

Resistivity structure across the Niigata-Kobe tectonic zone, Japan, revealed by the Network-MT survey

臼井嘉哉・上嶋誠・小河勉（東大地震研）・山口覚（神戸大理）・村上英記（高知大理）・丹保俊哉（立山カルデラ砂防博）・藤浩明（京都大理）・吉村令慧・大志万直人（京大防災研）・最上巴恵（神戸大理）・小山茂・望月裕峰（東大地震研）

Yoshiya Usui・Makoto Uyeshima・Tsutomu Ogawa(ERI, U. Tokyo)・Satoru Yamaguchi (Kobe U.)・Hideki Murakami(Kochi U.)・Toshiya Tanbo (Tateyama Caldera Sabo Museum)・Hiroaki Toh (Kyoto U.)・Ryokei Yoshimura・Naoto Oshiman (DPRI, Kyoto U.)・Tomoe Mogami (Kobe U.)・Shigeru Koyama・Hiromine Mochizuki (ERI, U. Tokyo)

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The dense GPS network revealed the Niigata-Kobe tectonic zone (NKTZ, e.g. Sagiya et al., 2000), which is the region with large strain rate. In order to reveal mainly why the strain rate is high in the NKTZ, the Network-MT observation have been performed in the Chubu district from December 2005 to December 2008 (Fig.1). In the Network-MT observation, we used the telephone lines to measure the voltage differences, so that we can estimate the impedance tensors with high S/N ratio. We investigated the 2D resistivity structure across the NKTZ.

We calculated impedance tensors with using the voltage differences observed at the sites from Fuchu (FCH), Toyama Prefecture to Akigami (AKG), Gifu Prefecture. As the magnetic field data, we used the one observed at Kamitakara (KTJ), Gifu Prefecture for every observation point. In addition, the magnetic field data of Wajima (WJM), Ishikawa Prefecture were utilized as a remote reference (Gamble et al., 1979). As a result, the impedance tensors with small errors were obtained from 8 to 20 thousand

seconds with the aid of a robust data processing code (Chave and Thomson, 1989) (Fig.2). From these impedance tensors, we estimated the regional strike of the resistivity structure there as N65E-S65W by the approach provided by Swift (1967)

Along the profile orthogonal to the strike, we investigated the 2D resistivity structure by using an inversion code with smoothness constraints (Ogawa and Uchida, 1996). In the inversion calculation, we only used the data of the TM mode. As mentioned in the caption of Fig.3, in the crust, our model has several similar characteristic structures with those in the model provided by Yoshimura et al. (2007). Therefore, both of the models are confirmed to be reliable at least about its structure in the crust.

In future, we are going to reveal the deeper structure. For that purpose, it is necessary to evaluate the effects of the three dimensional land-sea distribution of the Toyama bay. Additionally, we will discuss the relationship between the resistivity distribution and the NKTZ.

近年の稠密ＧＰＳ観測網によって、新潟－神戸ひずみ集中帯(NKTZ)と呼ばれる、歪み速度が周囲よりも大きい領域の存在が明らかになった（Sagiya et al., 2000）。NKTZ にひずみが集中するメカニズムを解明することを主な目的として、平成 17 年 12 月から平成 20 年 12 月まで、中部地方背孤域でネットワークＭＴ法による観測が行われた。ネットワークＭＴ法ではＮＴＴのメタル通信回線を用いて地電位差を測定するため、SN 比の大きなインピーダンステンソルを推定することが可能である。本研究では上記観測で得られたデータをもとに、新潟－神戸ひずみ集中帯を横切る断面で２次元比抵抗構造を推定した。

観測された地電位差のデータのうち、婦中 - 秋神測線のデータを使用してインピーダンステンソルを求めた(第１図)。磁場データについては各観測点とも上宝観測点(KTJ)のデータを用いた。また、リモート・リファレンス処理(Gamble et al., 1979)を行うため、輪島観測点(WJM）を参照点として使用した。ロバストな手法を取り入れたＭＴ応答演算プログラム（Chave and Thomson, 1989）を用いた結果、8 秒から 2 万秒までの周期で連続的で誤差の小さいインピーダンステンソルを得ることができた(第 2 図)。Swift (1967)の方法を用い、得られたインピーダンステンソルから観測点周辺の比抵抗構造の走向を N65E-S65W と推定した。

比抵抗構造の走向に直交する断面を設定し、2 次元比抵抗構造を推定した(第 3 図)。ここで、モデル解析には平滑化拘束つき線形化最小自乗法インバージョンコード（Ogawa and Uchida, 1996）を用いた。インバージョン計算には TM モードのデータのみを使用した。第 3 図の説明に記したように、得られたモデルのうち地殻程度までの浅部構造は先行研究のモデル（Yoshimura et al., 2007）と調和的である。従って、少なくとも浅部構造については、2 つのモデルの信頼度は高いと言える。

今後、深部構造の信頼度を検証する予定である。そのためには、富山湾の 3 次元的な海陸分布がもたらす影響を正しく評価する必要がある。また、確定した構造をもとに、比抵抗構造と新潟−神戸ひずみ集中帯の対応関係について議論する予定である。

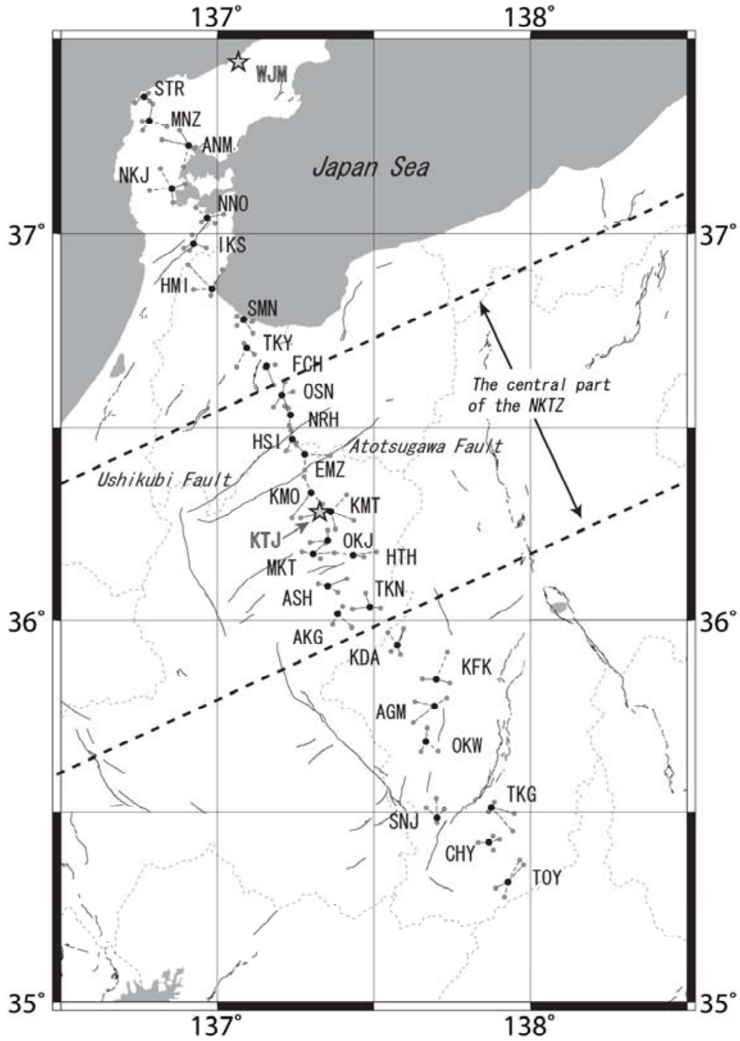

Fig.1: The sites of the Shitsuura-Toyama survey line of the Network-MT survey in the Chubu Region; black circles represent the repeater stations of the Nippon Telegraph and Telephone Corp. (NTT) and gray ones denote the self-made electrodes. The broken lines connecting the black circles and the gray ones stand for metallic wires of NTT. We used the data of voltage differences observed at the sites from Fuchu (FCH), Toyama Prefecture to Akigami (AKG), Gifu Prefecture. As for the magnetic field, the data observed at Kamitakara (KTJ) were used for every site. Additionally, the magnetic field data of Wajima (WJM), Ishikawa Prefecture were utilized as a remote reference (Gamble et al., 1979).

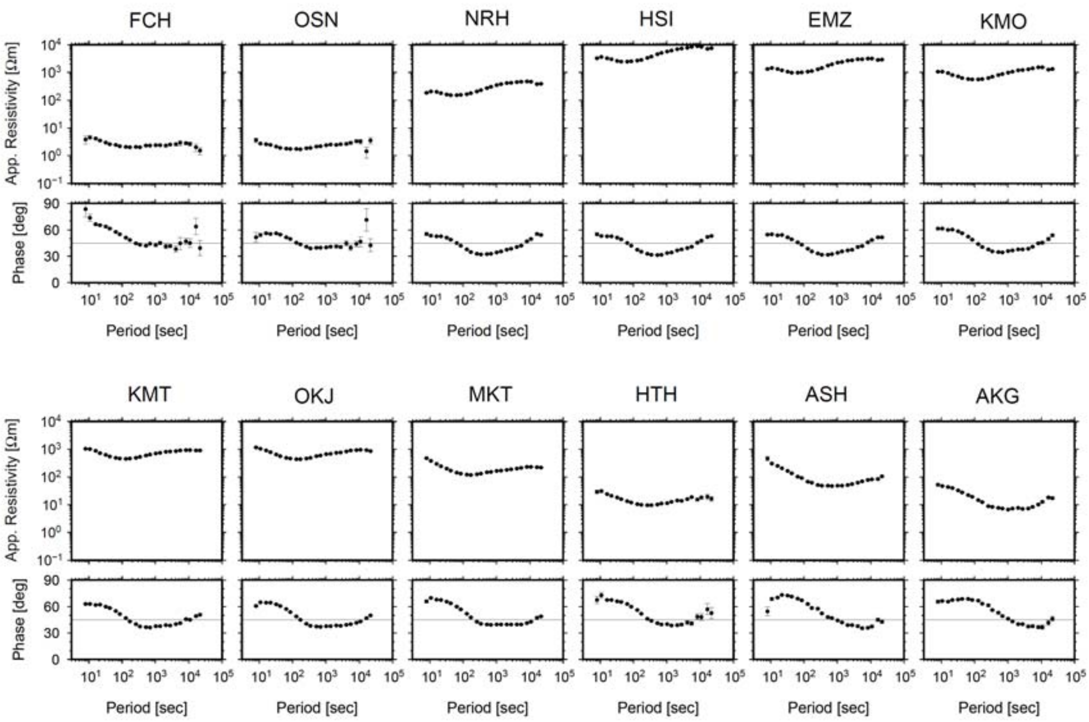

Fig.2: Apparent resistivities and phases of the sites from Fuchu (FCH), Toyama Prefecture to Akigami (AKG), Gifu Prefecture. We only used the data of the TM mode in investigating the structure. Therefore, the sounding curves only of the TM mode are shown here. In our study, small errors were achieved from 8 to 20 thousand seconds for almost all the apparent resistivities and phases.

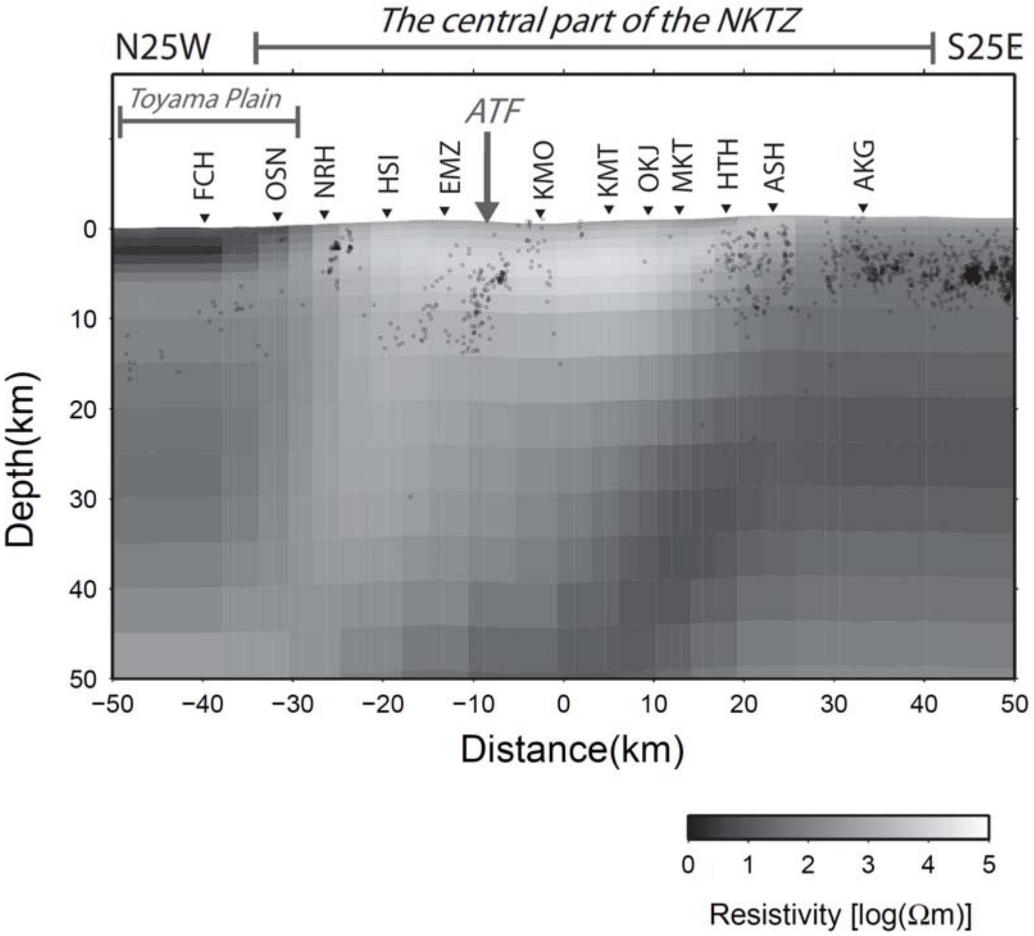

Fig.3: The 2D resistivity structure across the NKTZ. The dots represent the hypocenters of the earthquakes within 5km from the profile, determined by the Kamitakara Observatory of the Disaster Prevention Research Institute, Kyoto University from Jan., 2000 to May, 2004. The high resistivity zone near the ATF resembles the model provided by Yoshimura et al. (2007). Additionally, the low resistivity zones located at the surface and at the lower crust of the Toyama plain are found in both models, as well as the one beneath the sites to the south of the ATF.

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