Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SCG57-07 Room:A06 Time:May 27 16:30-16:45

Crustal structure and fluid distribution beneath the southern Hidaka collision zone based on 3-D resistivity modeling

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Erimo area, south end of Hokkaido Island is located on the south part of Hidaka collision zone where Kurile and the northeastern (NE) Japan arcs are collided. This area is an attractive research field to understand mechanism of continent evolution and deep inland earthquakes because 1) ultra-mafic rocks are outcropped although the delamination hypothesis of Kurile arc indicates uplift and down lift of upper-middle and lower crust rocks, respectively, and 2) inland earthquakes occurs anomalously depth (e.g. 1970 Hidaka earthquake M6.7). We conducted wideband and long-period magnetotelluric surveys at 27 sites in the Erimo area and obtained 3-D resistivity models based on inversion procedure. Reliable features of the inverted models and their interpretations are as follows. 1) A low resistivity zone (C-1) is distributed beneath the Hidaka main thrust (HMT) and extends to the upper most part of subducting Pacific slab. The high seismicity in the subducting slab in C-1 implies dehydration embrittlement. The C-1 around arcs boundary implies upwelling fluid along the HMT, which may affect the deep inland earthquake. 2) Ultra-high resistivity zone (R-1), which probably reflects dry metamorphic rocks, is distributed underneath the Hidaka metamorphic belt. The boundary between C-1 and R-1 is spatially consistent to the boundary between the delamination wedge and delaminated upper-middle crust (Ito, 2000). It supports the proposed collision model based on seismic surveys.

Figure caption: (a) Locations magnetotelluric stations. (b) A vertical cross-section of inverted resistivity model beneath the line X-X'. Gray lines denote geological boundaries based on seismic surveys (Ito 2000). White circles denote hypocenter between 2000 and 2012 by JMA. (c) Interpretation of the resistivity model.

Keywords: Hidaka collision zone, magnetotellurics, dehydration embrittlement, inalnd earthquake