Imaging of the North Anatolian Fault Zone by Magnetotelluric Method beneath the Marmara Sea

Tulay KAYA[1]; Yasuo Ogawa[2]; Takafumi Kasaya[3]; S. Bulent Tank[4]; Yoshimori Honkura[5]; Mustafa Kemal Tuncer[6]; Naoto Oshiman[7]; Masaki Matsushima[8]
[1] EPS,Titech; [2] VFRC, Titech; [3] IFREE, JAMSTEC; [4] EPS, Titech KOERI, BU; [5] Earth & Planetary Sciences, Tokyo Inst. Tech.; [6] Geophysics,I.U; [7] DPRI, Kyoto Univ.; [8] Dept Earth & Planetary Sciences, Tokyo Tech

Relative motions of the Arabian and African plates with respect to stable Eurasian plate resulted in westward movement of the Anatolian block and produced two main fault zones in Turkey. The most active one, the North Anatolian Fault Zone (NAFZ), hosted destructive earthquakes during the history causing not only damage in the buildings but also thousands of causalities. The migration of large earthquakes along the NAFZ from east to west in 20th century, occurrence of the last earthquakes (1999 Izmit and Duzce) by the side of Marmara Sea, and owning the fault segment which has not ruptured since 1766 made the Marmara Sea a potential location for the next large rupture on the NAFZ. Seismic, geodetic and other studies showed complexity of the structure suggesting various estimates about the extension of the NAFZ through the Marmara Sea. In this study, we benefit from the high depth resolution of the Magnetotelluric (MT) method to resolve the electrical resistivity structure beneath the Marmara Sea and disclose its relation with the geologic structure. In order to investigate extension of the NAFZ beneath the Marmara Sea we deployed long period ocean bottom electromagnetic data at 16 sites which form 4 profiles perpendicular to the possible traces of the NAFZ. Variation of the geoelectric strike from east to west demonstrates different oriented faults in the Marmara Sea. The highly conductive anomaly in electrical resistivity models extends from crustal depths to the lithosphere and merges with the melted mantle material. This conductive anomaly is surrounded by relatively resistive anomalies which imply continuation of the fault structure from land to the Marmara Sea. Our results clear the location of the highly conductive and resistive anomalies that has crucial implications in two aspects; conductive anomaly may trigger the micro-seismic activity and resistive anomalies are the asperity zones where stress accumulation result in large earthquakes.