An example of the graben-horst systems' structure in the Western Anatolian Extensional Province from magnetotelluric imaging: Denizli-Acıgöl-Çürüksu grabens

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ABSTRACT

Neotectonic is governed by Africa and Eurasia convergence and related active subduction zones (Aegean and Cyprus arcs) in eastern Mediterranean region. Currently, Anatolia has been shaped by these two arc systems and the resulting two important North and East Anatolian fault zones. Thus, different tectonic regions have been occurred through the geological time. The westernmost of these regions is called as Western Anatolian Extentional Province where crust extension takes place related to high angle slab subduction and a slab tearing associated with an asthenospheric rising. The reflection of this subsurface structure on the surface is seen as E-W Horst-Graben systems. Survey area is controlled by the WNW-ESE trending, approximately 7-28 km wide and 62 km long Denizli graben-horst systems and western part of Acıgöl graben developed upon metamorphic rocks of both Menderes Massif and Lycian nappes. Actively growing grabens are bounded by seismically active oblique-slip normal faults from North and South. The sedimentary basin overlies the Palaeozoic-Mesozoic metamorphic bedrock and comprises Early Miocene–Pliocene sediments consist of conglomerate, sandstone, claystone, limestone, marl and siltstone alternations, Quaternary sediments, and travertine occurrences.

Magnetotelluric data were acquired at 300 stations over a frequency range of 10,000 Hz to 0.001 Hz for geothermal research purposes. We re-evaluated the data to reveal the geology and tectonic structure of the region. We have investigated the main properties of the data with Phase Tensor analysis and 2D and 3D inversion were performed using Geotools and ModEM software to reveal subsurface conductivity structures. Low resistivity values are imaging Çürüksu, Honaz and Acıgöl grabens. Strike directions and Phase Tensor (PT) ellipses reflects the dominant effect of the major faults and conductive basin fills. And high frequency PT ellipses have 1D characteristic in compliance with the undeformed, nearly horizontal bedding of the neotectonic graben fills. PT ellipses showing inductive flow directions of normal faults related to the modern basin development for higher frequencies. Change of PT ellipse orientation to SW-NE approximately aligning with the regional palaeo-structure boundaries for lower frequencies. The depth of the basin fills and conductive feature of faults can be observed in 2D and 3D sections.

Keywords: Horst-Graben systems, geothermal, phase tensor.