Deep Electrical Signatures Across The Achankovil Shear Zone (AKSZ), Southern Granulite Terrain Using Broad Band Magnetotellurics

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Magnetotelluric (MT) investigations were carried out across the prominent geological features such as Madurai block, Achan Kovil Shear Zone (AKSZ) and Keral Khondalite Block (KKB) in the southern granulite terrain (SGT). The traverse runs over a length of 240 km from Vattalkundu in the north to Kanyakumari in the south. It covers 31 MT stations along Vattalkundu-Kanyakumari (V-K) and 9 stations along Ambasamudram-Shankarankovil (A-S) using a wide band (1 k Hz - 1 k sec) data acquisition system. The regional geoelectric strike direction of N 40_o W identified from the MT study is consistent with the geological strike direction of the AKSZ. The 2D conductivity model derived from the data displays distinct high electrical resistivity (> 500 ohm-m) for the crust below the Madurai block from Vattalkundu to Kalugumalai with a gentle dip towards south. High resistive (> 500 ohm-m) crust with a north dip is delineated below the Keral Khondalite Block (KKB). The projected southward structural dip of Madurai block and northward structural dip of KKB from surface geological observations (Rajesh and Chetty, 2006) also ensures the results obtained from MT. Mid crust is relatively less resistive (< 500 ohm-m) and lower crust is more resistive (> 500 ohm-m). The AKSZ separates the Madurai block in the northern side and KKB towards the southern side. The results derived from the MT study are compared and discussed with other geophysical studies such as regional gravity and deep seismic study. The AKSZ is the zone where two (Madurai and KKB blocks) lithospheric plates collide each other where mantle upwelling structure is delineated. The proposed high temperature (940-1040^0C), high pressure (8.5-9 kbars) and metamorphosed rocks (Ishii et al., 2006) within the AKSZ also supports the delineated mantle upwelling structure. From our study, it is conjectured that the crust material thermally eroded through geologic time and reduced in volume on either side of the AKSZ by repeated intrusion of the high temperature material from the mantle depths. The presence of magmatic arcs (Santosh et al., 2009) in Madurai and KKB blocks also supports our results.

Keywords: Southern Granulite Terrain, Magnetotellurics, Deep electrical conductivity structure, Collision zone

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