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Deep Structures of the NW Himalaya Collision Zone: Constraints from Long Period Magnetotelluric Data

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The paper reports the results of long period magnetotelluric (LMT) surveys undertaken in the North West Himalaya to probe the crustal and upper mantle structures associated with subduction/collision of the India-Asia Plates. The measurements were carried out on a roughly 250 km long profile, extending from Zanskar-Tethyan Sedimentary Sequence, Tso-Morari Crystalline, Indus Formations and Ladakh-Karakoram Batholiths running across the Indus-Tsangpo Suture Zone. Multi-site, multi-frequency analysis suggests electric strike N40°W, in agreement with the geological grain of NW Himalaya. 2-D inversion of LMT data have mapped two shallow highly conductive zones, close to the northern-southern flanks of the Tso-Morari Dome, where evidence of ultra high pressure diamond-coesite bearing eclogites have been reported. The combined inversion of LMT and tripper are able to constrain better the deep structures of the collision zone that remained unexplored in previous broadband MT campaigns. The most conspicuous feature of the inverted electrical section is a dipping mid-crustal conductor, perhaps simulating the geometry of the subducting Indian Plate near the collision boundary. South of the ITSZ, the mid-crust conductor is present at a depth of 15 km that dips steeply at the ITSZ and runs as an extended layer beneath the Ladakh and Karakoram Batholith, in the depth range of 30 km. In the electrical section, both Ladakh and Karakoram batholith are seen as 15 to 20 km thick resistive layer overlying conducting crust. The presence of mid crustal conductivity layer may suggest mechanical de-coupling of the Ladakh-Karakoram batholith from the lower units of thickened crust beneath the NW Himalaya. The resistivity of the mid-crustal layer increases gradually from the south of the ITSZ to the north, whereas the ITSZ itself is seen as vertical conducting zone rising from mid-crustal depth to shallow depths. Interpreted electrical structure across the ITSZ in this part of the Himalaya shows good similarity with the results reported from the Tibetan region, although the over all conductance of mid crustal conductor is much lower in the NW Himalaya. The possible implication of this in terms of inter-connected fluids, likely cause of elevated conductivity, and possible thermal structure along two sectors of the Himalaya are discussed.