Another Possibility of the Crustal High Conductivity Zone in the Western Tibetan Plateau

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SUMMARY

The Tibetan Plateau is known as a natural laboratory for geodynamic research due to its unique surface geometry and tectonic complexity. However, limited previous geophysical surveys in the western Tibet Plateau have left its deep three-dimensional structure poorly understood. To address this, magnetotellurics data from the SinoProbe (Jin et al. 2022) and INDEPTH-MT (Jin et al. 2007) projects were used to establish the first crustal-scale three-dimensional electrical structure across the region from the Himalaya to the Qiangtang block, which may provide new insights into the geodynamic characteristics of the western Tibetan Plateau, including its crustal evolution and material transport.

The electrical model shows that the mid-upper crust in the study area and the Bangong Lake-Nujiang suture zone are high-resistance structures. In the north-central Qiangtang block, a barrel-shaped high conductor extends from about 20 km depth to near the Moho surface. This high conductor was also observed in the middle crust of the Lhasa block, extending northwards from ~20 km below the Himalayan region to near the Moho surface of the Bangong Lake - Nujiang suture zone. Below the high conductor in the Lhasa's middle crust, a relatively high resistance body was observed.

To further understand the characteristics and origin of these high conductivity zones, the relationship between the conductivity of different minerals/geofluids with temperature, pressure, and water content was used (Ni and Keppler 2013), which were calibrated by petrophysical experiments. Through this analysis, the high conductivity zone in the Qiangtang block was found to represent a highly partial melting zone (i.e., a magma chamber) associated with mantle melt uplift. In contrast, the high conductivity zone in the Lhasa crust may indicate the crystal fractionation of lower crustal melts formed carbonated-silicate melts, suggesting the involvement of CO_2 in the evolution of the juvenile Lhasa crust.

Keywords: Magnetotellurics, 3D Inversion, Western Tibet Plateau, Deformation Mechanism

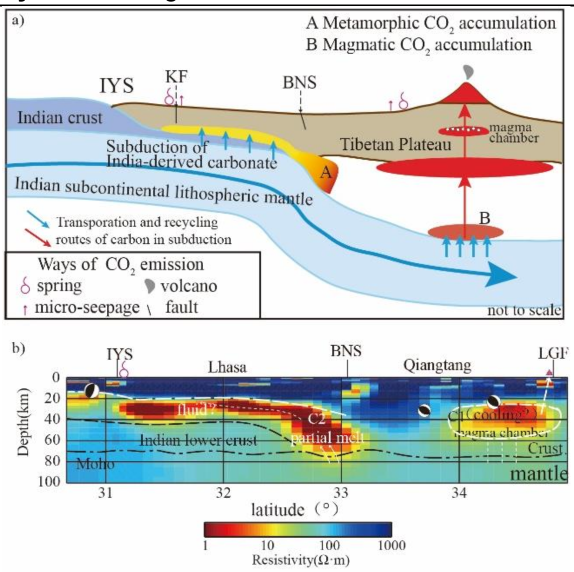

Figure 1. a) a cartoon of transportation and recycling routes of carbon-rich components in the western Tibetan Plateau; b) a typical vertical slice of resistivity model in the western Tibetan Plateau. IYS: the Indus-Yarlung suture zone; KF: the Karakoram fault; BNS: the Bangong Lake - Nujiang suture zone; LGF: the Longmu Co-Gozha Co fault.

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