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A Comparative Study of the Electrical Structure of Circum Tibetan Plateau Orogenic Belts and its Tectonic Implications

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The Tibetan Plateau, as known as "roof of the world", was created through the on-going continent-continent collision between the Indian and Eurasian plates since ∼55 Ma. As the process continues, the plateau is growing both vertically and horizontally. The horizontal expansion of the plateau is blocked by the Yangtze block in the east, the Tarim block in the north, and the Ordos block in the northeast, and consequently lead to the formation of the circum Tibetan plateau orogenic belts. To better understand the mechanism behind this process, we conducted a comparative study by collecting 7 magnetotelluric (MT) profiles over the margins of the Tibetan plateau, namely, the INDEPTH 100, 700 and 800 lines in the southern Tibet, the INDEPTH 4000 and 5000 lines across the Altyn Tagh fault on the northern margin of the plateau, as well as other two profiles across the Haiyuan fault and the Longmenshan fault on the northeastern and eastern margins of the plateau deployed under the framework of project SinoProbe.

The electrical features of the stable blocks surrounding the Tibetan plateau are generally resistive, while crustal conductive layers are found to be wide spread within the plateau. The southern margin of the Tibetan plateau is characterized by large scale underthrust of the Indian lithosphere beneath the plateau. This intense converging process created the thrust fault system distributed along the southern margin of the Tibetan plateau over 1000 km. Crustal conductive layers discovered in southern Tibet are generally associated with the southward crustal flow that originated from the lower crust within the plateau and exhumed along the thrust belts in the Himalayas. On the eastern margin of the Tibetan plateau, the electrical structures suggest that the Yangtze block wedged into the Tibetan lithosphere and caused decoupling between the crust and upper mantel. Large scale conductors discovered beneath the Songpan-Ganze block reflect that the eastward crustal flow was blocked and piled up along the eastern margin of the plateau due to the block of the Sichuan Basin, which further result in the uplift and expansion of the eastern Tibetan plateau. The northeastern and northern margins of the Tibetan plateau is bounded by large scale left-lateral strike-slip Haiyuan and Altyn Tagh faults. In these regions, the plateau interacts with the surrounding stable blocks in a way of oblique strike-slip. The deformation of the northern Tibetan lithosphere is dominated by crustal thickening, where no features of decoupling or large scale underthrusting were seen. Crustal conductors in these regions are generally not very well connected, which suggest the absence of crustal flow. Deep metamorphism fluids could be an alternative interpretation of the crustal conductors in these regions.

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