Multi-scale magnetotelluric evidence for a lithospheric mineralizing system beneath the Daping gold deposit on the southeastern edge of the Qinghai Tibet Plateau

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SUMMARY

The Ailaoshan metallogenic belt, situated at the southeastern margin of the Qinghai-Tibet Plateau, serves as a natural laboratory for studying the gold metallogenic system in the southwestern China under a composite orogenic environment due to its complex mineralization sources, diverse tectonic driving mechanisms, and multi-stage activation and alteration processes. Within this belt, the Daping gold deposit stands as a typical representative of Cenozoic orogenic gold deposits. However, divergent views persist regarding the metallogenic background and deep-seated sources of the Daping gold deposit, preventing a clear determination of whether it is driven by lithospheric delamination or mantle upwelling on the asthenosphere. Additionally, it remains challenging to ascertain the development depth and migration pathway of mineralization materials. To address these challenges, this study proposes the utilization of a multi-scale array of magnetotelluric observations in "ore concentration region", "metallogenic belts", and "ore deposits". Through three-dimensional inversion and compositional analysis, beneath the Daping gold deposit, there exists a pipe-like, narrow, vertical, low-resistivity anomaly in the upper to middle crust, which is connected to a large low-resistivity zone in the lower crust. A wide high-conductivity zone is imaged in the upper mantle. In the upper to middle crust, the resistivity characteristics provide constraints on the pathways for fluid migration beneath the gold deposit, while the high-conductivity zone in the upper mantle is interpreted as the source of ore-forming materials. Therefore, the electrical structure reveals the transport of ore-forming materials from the mantle to the subsurface beneath the gold deposit. We propose that these features are associated with the superimposed effects of tectonic systems, and we provide a potential interpretation for the metallogenic model.

Keywords: mineral systems; magnetotellurics; fluid pathways; electrical resistivity