The deep electrical structure of the middle section of the Sanjiang tectonic belt and its adjacent regions

YU Nian[1], Wang Xuben[2], Li Dewei[2], Liu Yong[2], Chen Xiating[2], Xie Zhuoliang[2], Cai Xuelin[2]

[1]School of Electrical Engineering, Chongqing University, Chongqing, 400044, China, yunian@126.com
[2]Key Laboratory of Earth Exploration and Information Techniques of MOE, Chengdu University of Technology, Chengdu, 610059, China

The Sanjiang tectonic belt is located at the junction of the eastern of the Himalayan-Tethys and the Pacific tectonic domain, is part of the lateral collision zone of the southeastern margin of the Qinghai-Tibet Plateau. And influenced by the Pacific plate, it is a very complex area with active volcanism and good metallogenic conditions. The existence of the mid-lower crustal material flow in the Qinghai-Tibet Plateau, including the Sanjiang area, has been confirmed by deep geophysical and GPS research. But, is the current speculative crustal material flow accurate? What is the relationship between the deep structure and mineralization? Many issues require further study. So we conducted for a magnetotelluric (MT) profile, namely the Fugong-Luliang, in the middle section of the Sanjiang tectonic belt. By combining with geological structure, lithogeochemistry, and related geophysical data of this orogen, we analyzed the electrical contact relationship between the main blocks and structures passing through, and built a deep electrical structural model of the middle section of the Sanjiang tectonic belt and its adjacent regions.

Method

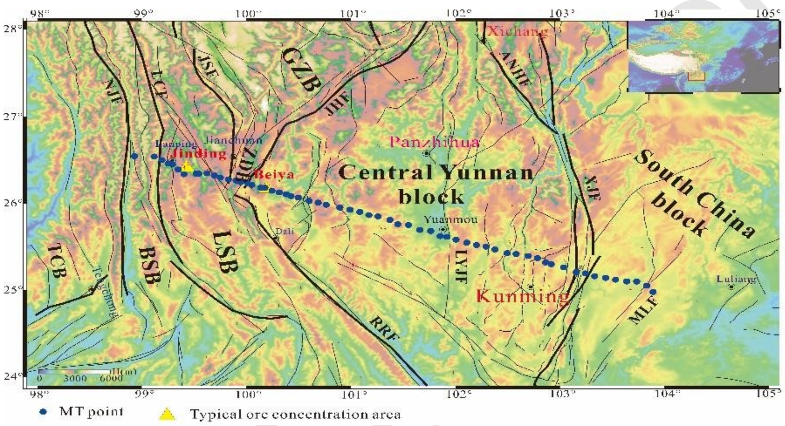

Figure 1. Tectonic map of the middle section of the Sanjiang and its adjacent regions with locations of MT points: TCB, Tengchong block; BSB, Baoshan block; LSB, Lanping-Simao block; GZB, Ganzi block; ZDB, Zhongdian block; NJF, Nujiang fault; LCF, Lanchangjiang fault; JSF, Jinshajiang fault; JHF,Jinhe fault; RRF, Red River fault; ANHF, Anninghe fault; XJF, Xiaojiang fault; LYJF, Lvyejiang fault; MLF, Mile fault

The length of the MT profile is 525km and consists of 60 measuring points, its direction is NW73° (Figure 1). We used a V8 multi-function electrical prospecting instrument manufactured by Canada Phoenix Corporation to record the time sequences for five components. Data processing and analysis involved calculating the electric strike and two-dimensional (2D) skewness of the area using MT phase vector decomposition. The deep electrical structure of the profile was finally obtained using a 2D nonlinear conjugate gradient joint inversion for apparent resistivity and impedance phase data.

Results

The profile crosses the eastern margin of the Sanjiang tectonic belt and the western margin of the Yangtze block(YZB), from west to east, it can be divided into BSB, LSB, ZDB, Yanyuan-Lijiang tectonic belt, Central Yunnan block, Kangdian tectonic belt and Eastern Yunnan tectonic belt. The Yanyuan-Lijiang tectonic belt, Central Yunnan block, Kangdian tectonic belt and Eastern Yunnan tectonic belt belong to the secondary tectonic unit of the YZB. The ZDB, LSB and BSB belong to the Sanjiang tectonic belt, and the former two belong to the western margin of the pro YZB and the latter is the northern margin of Gondwana.

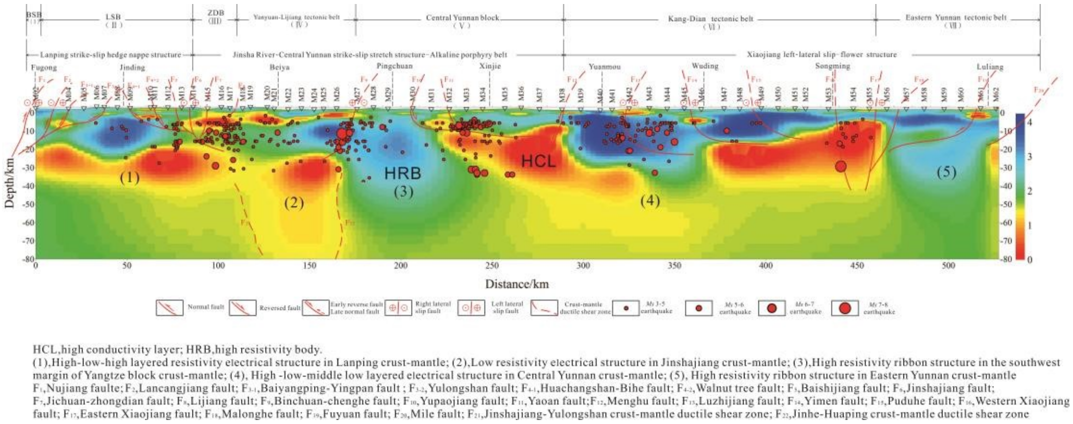

Figure 2. 2D electrical structure of the Fugong-Luliang MT profile and its structural analysis section.

The 2D electrical structure model has been established, and it can be divided into five types: high-low-high resistivity layered electrical structure in Lanping crust-mantle, low resistivity electrical structure in Jinshajiang crust-mantle, high resistivity ribbon electrical structure in the southwestern margin of YZB, high-low-middle low layered electrical structure in Central Yunnan crust-mantle, and high resistivity ribbon structure in Eastern Yunnan crust-mantle. These five types of electrical structure have a good correspondence with the surface geological tectonic units, and play a certain role in controlling the surface geological structure. Two crustal mantle ductile shear zones are identified according to the cutting resistance zone of the Moho surface: Jinshajiang and Jinhe-Huaping, the former may be the deep expression of the Jinshajiang collision suture, and the latter may be the deep boundary of the western margin of the YZB.

Discussion

Relationship between electrical structure and ore concentration areas. The distribution of major minerals in the 40km width is studied, and it mainly passes through 4 ore concentration areas: the LanpingBaiyangping-Hexi polymetallic ore concentration area, the Beiya super large porphyry-skarn ore concentration area, the Dayao-Lufeng mantle derived inorganic CO_2 gas bearing seedling belt and YimenAnning sedimentary modification mining area. The first one is mainly influenced by the irregular lowresistivity delamination of the upper crust in the Lanping strike-slip hedge nappe structure, and second one is mainly controlled by the deep crust and low resistivity zone of the Jinshajiang. It is suggested that the deep part of the giant alkali-rich porphyry belt in the southeastern margin of the Qinghai-Tibet Plateau, maybe the upper mantle thermal fluids and ore-bearing fluids ascended to the shallow crust along the low resistivity zone of the Jinshajiang crust-mantle.

Relationship between the electrical structure and earthquake. According to the regularities of distribution of earthquakes, it can be found that most moderate strong earthquakes occur in the upper middle crust electric boundary, or in the high resistivity area which near to low resistivity. The study area can be divided into five parts with active earthquake regions: JSF region, Binchuan-Chenghe fault region, Yaoan fault region, LYJF region and XJF region.

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