Magnetotelluric sounding results in eastern Tibetan Plateau

MA Xiaobing (马晓冰), KONG Xiangru (孔祥儒), LIU Hongbing (刘宏兵) & YAN Yongli (闫永利)

Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100101, China

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Abstract The results of Zayü-Qingshuihe MT sounding profile carried out in eastern Tibetan Plateau are presented in this paper. Using 2-D RRI method, the resistivity distribution with depth is obtained along the profile. It is featured by the resistivity zones in the horizontal direction and layers in the vertical direction. The Bangong-Nujiang suture zone and Jinshajiang suture zone are both important electrical conductivity-separating zones in the plateau, and the former is a zone with relatively low resistivity while the latter is an electrical conductivity gradient zone. The highly electrical conductive bodies in the mid and lower crust of northern Qiangtang and Bayan Har Terrain might be caused by regional melting due to shear heating during the process of subduction in tectonic evolution.

Keywords: Tibetan Plateau, MT sounding, electrical conductivity structure.

Since the early years in the 1970s, a lot of geological and geophysical studies have been carried out in the Tibetan Plateau\cite{1-4} with some knowledge about the plateau’s deep structure and dynamic process. The main survey profiles such as Yardong-Golmud, INDEPTH and Jilong-Sangehu, are mostly situated at the plateau’s west and mid parts where traffic is relatively convenient. About 1000 km width of the tectonic structure in the west and mid parts of the plateau is shortened nearly by half in the east part. In order to further study the distribution and deep conditions of each structure in the east of the plateau, a deep geophysical profile from Zayü to Qingshuihe was carried out.

1 Geological structure and survey line layout in the surveyed area

Institute of Geophysics, the Chinese Academy of Sciences (CAS) laid a deep geophysical survey line, which includes geo-electromagnetism, gravity and Magnetotelluric (MT) sounding from Zayü to Qingshuihe in the east part of the plateau in 1998. The MT survey profile started from 28.4° N, and ended at 34° N. 30 survey sites were deployed along the survey line (see fig. 1). The distance between two neighboring sites is generally about 20 km. Because it was extremely difficult to select the survey sites along the profile, and the distance between sites 21 and 23 reached 80 km.

The geological structure of the surveyed area is very much complicated. Its southern end is in Gandise terrain, and the north part goes into the Qiangtang-Qamdo terrain by the Banggong-Nujiang suture zone, while the Qiangtang-Qamdo terrain is subdivided into two parts along
the Lancang River, running into Bayan Har terrain on the further north by the Jinshajiang suture zone. The main part of the survey line is located at the uplifted block faulted regions with gently tilting in the eastern plateau. And the regions are mainly featured by swift mountains and deep valleys.

2 Data acquisition and processing

Two sets of MT sounding instruments MT1 made by American EMI Company and GMS05 made by German METRONIX Company were adopted in the field survey. MT1’s work frequency ranges from \(3.4 \times 10^2\) to \(3.0 \times 10^4\) Hz, and GMS05’s work frequency ranges from \(1 \times 10^3\) to \(2.5 \times 10^4\) Hz with data recorded in different frequency bands. All the data in the south of site 22 were recorded with MT1. Sites 23, 24, 26, 28, 30 and 32 were recorded with GMS05, while sites 25, 27, 29, 31 and 33 were recorded with MT1. Comparison experiment was made at site 34 to test the two instruments. The experiment shows that the apparent resistivity curves obtained with two instruments are basically similar, their forms are completely the same, and their phase curves basically coincide with each other. Therefore, the performance of the two instruments is close to each other and the records are reliable. Fig. 2 presents the comparison between the two instruments.

Of all the 30 survey sites, site 7 is rejected because of its shortage of high frequency records and low quality of low frequency points. Sites 20 and 21 are very close to each other in location, so only site 20 is selected in 2-D inversion.

The long period part of \(\rho_{yx}\) and \(\varphi_{yx}\) for sites 2—14 is poor in quality, so the weight for this part is also very low or it is rejected in inversion. The inversion starts from site 1 located at the south of Gandise and ends at site 34 located at Bayan Har terrain, with a total length of 621 km and 28 survey sites.

In 2-D inversion, it is required that the data depicting apparent resistivity and impedance phase curves of each survey site should have certain frequency values. Because two sets of in-