Deep Geological Structures Associated With Terrrestrial Volcanic Hydrothermal Metallogenic System: Evidence From Geophysical Survey in Taohemu Superlarge Silver-Polymetallic Deposit, Inner Mongolia

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Abstract Taohemu deposit is a superlarge silver-polymetallic deposit discovered in the Great Xing'an Range metallogenic belt of China in recent years. The deposit occurs in the terrestrial volcanic rock sequences of Late Jurassic age. The ore bodies consist mainly of rhyolitic tuffs, brecciated tuffs, and volcanic breccias bearing Ag-Pb-Zn mineralization, and are largely conformable with the surrounding layered volcanic and volcaniclastic rocks with a gradual transitional relationship manifesting as strata-bounded features in general. The mineralization system appears to be generally controlled by a paleo-volcanic chamber. It is suggested that the late volcanic hydrothermal fluids flowed within the permeable layers of rhyolitic pyroclastics consisting mainly of volcanic breccias and breccia-bearing tuffs. This resulted in the formation of superlarge Ag-Pb-Zn polymetallic ore deposit metasomatism and fracture filling. The majority of the deposit occurs as shallowly dipping concealed ore bodies, as defined by sparsely distributed drill holes. Because of its short discovery history, new mineralization style and low degree of comprehensive research, the boundaries of most ore bodies have not been effectively delineated along vertical and lateral extensions. At present, it is crucial to strengthen the comprehensive studies on the deposit, conduct more detailed geological exploration, and establish the metallogenic and prospecting models. For this reason, we have designed and implemented long sections of magnetotelluric (MT) and controlled-source audio magnetotelluric (CSAMT) sounding across the Taohemu ore field and obtained a large number of geological structures and valuable underground exploration results that provided reliable geophysical support for promoting deep resource exploration.

Plain Language Summary The geological structures associated with metallogenic system is usually covered by surface vegetation and Quaternary layer. Furthermore, surface mineralization is not relevant to deep ore bodies. To reveal the shape of ore bodies and geoelectrical structures in this study area, we applied geophysical electromagnetic methods to achieve this purpose. The results showed that the ore bodies are largely conformable with the surrounding rocks as strata-bounded features in general tested by borehole information. The mineralization system appears to be generally controlled by a paleo-volcanic chamber.

1. Introduction

Taohemu deposit is a superlarge silver-polymetallic deposit recently discovered in the Great Xing'an Range metallogenic belt in the northeastern China. The deposit occurs in the terrestrial volcanic rock sequences of late Yanshanian in the Mesozoic era, and its mineralization system is largely controlled by paleo-volcanic chamber. The superlarge Ag (+Pb and Zn) polymetallic deposit with strata-bound characteristics are formed by metasomatism and fissure filling by late volcanic hydrothermal fluid along the permeable dacite pyroclastic layers (consisting of volcanic breccia and breccia-bearing volcanic tuff). In contrast to the porphyry copper-molybdenum mineralization system in Great Xing'an Range, the silver-polymetallic deposit has obvious peculiarity in genesis, host rock series, mineralization style, and ore-controlling factors. It is a new type of mineralization occurring in terrestrial volcanics at this area in huge magnitude. Therefore, the significance of the discovery of Taohemu deposit lies not only in discovering a large silver...
polymetallic deposit but also in finding a new type and style of mineralization, which is of great importance in promoting the search for the same type of deposits in the Late Mesozoic terrestrial volcanic sequences in the Great Xing’an Range and as well as in the eastern China.

Taohemu deposit is located in the middle and low mountain areas of the west Kerqin grassland on the eastern slope of the Great Xing’an Range, which is a transitional area from forest to grassland. The bedrock is mostly covered by soil with vegetation, which is unfavorable for field geological observation and surface prospecting. Under this natural landscape condition, the discovery of the deposit is mainly based on the indication of low-level regional geochemical anomalies. First, the distribution of the near-surface mineralized areas was roughly delineated by means of large-scale geological mapping, soil geochemical survey, induced polarization survey, and the inspection of sporadic outcroppings with alteration and mineralization. Afterward, the major mineralization in the area was undercovered by trenching and drilling. Only mineralization-alteration zones and small discontinuous ore bodies near the surface were exposed by surface trench. Likewise, majority of the concealed ore deposit could not be defined by the sparse drill holes; thus, the boundary of most ore bodies has not been effectively delineated and their vertical and lateral extent unknown. In addition, due to short discovery history and the brand-new mineralization type, the comprehensive research on the deposit is still in its initial stage. Therefore, in order to improve the understanding of the metallogenic process, especially to delineate the overall three-dimensional image of the concealed mineralization system, it is crucial to establish the metallogenic model and geological model of the deposit. The delineation of the mineralization system through effective geophysical study, in order to obtain deep geological structure and geophysical information about the mineralizing system, is of great significance. For this reason, we designed and implemented magnetotelluric (MT) and controlled-source audio magneto-telluric (CSAMT) sounding at Taohemu ore field. A large number of deep geoelectrical information and valuable survey results were obtained, which could provide reliable geophysical support to promote detailed deep resource exploration in the area.

2. Geological Information
2.1. Metallogenic Geological Background

Taohemu silver polymetallic deposit belongs to the Great Xing’an Range metallogenic belt, which is located in the interactive regions between EW-trending Paleo-Asian Paleo-Asian tectonic metallogenic domain and NNE trending Mesozoic-Cenozoic western Pacific tectonic metallogenic domain. Strong superimposition, interaction, and transformation resulted in favorable metallogenic settings, multiple metallogenic stages, high ore-generating intensity and varied types of mineralization in the Great Xing’an Range.

Previous studies have shown that the combination of multiple collages of terranes, multistage collisional orogeny, multilateral accretion during the Paleo-Asian Ocean ages, and subsequent basin-forming process of Mesozoic NNE trending intracontinental volcanic and intrusive magmatism due to strong superimposition, formed a complex tectonic framework currently seen, thus resulted in the complexity of regional metallogeny in the region (Bai & Liu, 1996; Bai et al., 2014; Liu et al., 2004).

As to the regional metallogenesis, the ore-forming events in this area can be roughly divided into two stages which are consistent with regional geological evolution: Paleozoic Paleo-Asian Ocean metallogenic stage and Mesozoic Pacific metallogenic stage. The former is mainly related to the formation of Sedex deposits along with the evolution of Paleozoic volcanic sedimentary basins and hydrothermal deposits related to intrusions. The representative deposits include Huuaobaote (HABT) lead-zinc-silver deposit (Zhou, 2014), Xiaobaliang (XBL) copper-gold deposit (Wang et al., 2007; Xu et al., 2008), Dajing (DJ) copper-polymetallic deposit (Qin et al., 2001; Ren & Cao, 1996; Zhao et al., 2002), Xiaoyingzi (XYZ) lead-zinc deposit (Tang. 2013; Wang et al., 2017), and Bairendaba (BRDB) silver-polymetallic deposit (Guo et al., 2004; Jiang et al., 2010; Zheng et al., 2006). The latter is mainly related to the hydrothermal metallogenic series of Yanshanian subvolcanic-magmatic intrusion. The representative deposits in Great Xing’an Range include the Wunugetushan (WNGTS) porphyry copper-molybdenum deposit (Chen et al., 2011; Li et al., 2007), the Dobaoshan (DBS) porphyry copper deposit (not shown in Figure 1) (Cui et al., 2008; Du, 1988; Ge et al., 2007; Liu et al., 1995), the Naoniushan (NNS) copper-polymetallic deposit (Geng & Wang, 1995; Geng & Yao, 2004), and the Erentaolegai (ERTLG) silver deposit (Chen, 2000; Lu et al., 2000). The newly discovered
Taohemu deposit in this area is a hydrothermal silver polymetallic deposit that is closely related to the late Yanshanian terrestrial volcanic eruption shown in Figure 1.

2.2. Lithology of Taohemu Ore Field

Taohemu ore field is located in the central south part of the Late Mesozoic volcanic belt in Great Xing’an Range Mountains, which is a part of Huolinguole volcanic basin. The volcanic sequences exposed in the area are mainly intermediate-acid volcanic rocks and pyroclastic rocks of the Manketouebo Formation (J₃mk) and overlying conformably the Manitou Formation (J₃mn), which are the host rocks of Taohemu polymetallic deposit. Quaternary sediments are accumulated in the valleys in the area. There are also rhyolite of upper Baiyingaolao Formation (J₃b), and lacustrine clastics of upper Permian Linxi Formation (P₂l) which

Figure 1. Simplified regional faults distribution and location map of the study area. F1: Great Xing’an range ridge fault; F2: Erlian-Hegenshan fault; red frame indicates the location of the study area. The purple pots represent known metal deposits. HABT: Huaaobaote lead-zinc-silver deposit; XBL: Xiaobaliang copper-gold deposit; DJ: Dajing copper-polymetallic deposit; XYZ: Xiaoyingzi lead-zinc deposit; BRDB: Bairendaba silver-polymetallic deposit; WNGTS: Wunugetushan porphyry copper-molybdenum deposit; NNS: Naoniushan copper-polymetallic deposit; ERTLG: Erentaolegai silver deposit.
unconformably underlain the Jurassic volcanic sequences, outcropped sporadically in the periphery of the area. (Inner Mongolia Land and Resources Exploration and Development Institute, 2016; Xie & Yu, 2016; Zhou et al., 2014).

The volcanic layers of the Manketouebo Formation outcropped in the area has general strike of 285–310° with dip angles of 10–30°. They are mainly rhyolitic lava and rhyolitic pyroclastic rocks. The common lithologies include rhyolite, perlite, and tuff. The rocks are strongly weathered with kaolinization, chloritization, carbonation, and other alteration. The Manitou Formation overlaying conformably the Manketouebo Formation, is mainly composed of dacite pyroclastic rocks. Common lithologies include dacitic tuff, dacitic crystalline tuff, and dacitic volcanic breccia, as shown in Figure 2.

The volcanic activities, from effusive and explosive acidic lavas and tuffs of the Manketouebo Formation, through strongly explosive intermediate-acidic volcanic breccias and tuffs of Manitou Formation, to effusive acidic lavas of Baiyingaolao Formation, indicate an effusive-explosive-effusive cycle in the development of the Jurassic volcanism. The magmas evolved from acidic, through intermediate-acidic, to acidic in their compositions. There are plenty of volcanic breccias and agglomerates existing in the ore field and its vicinities both on surface and underground, which strongly indicates the presence of paleo- edifices.

The intrusive rocks in the ore field are not well developed, only a small number of shallow emplaced intermediate-acidic dikes, such as granite porphyry dikes, syenite porphyry dikes, quartz diorite dikes, and diorite porphyry dikes, are found locally. Likewise, the fault structure is not well developed in the mining area. Only in the northeast and the midwest, two fault zones with a length of about 500 m and a width of 0.5–2 m are found. The volcanic rocks in the fault zone are fractured and altered by chloritization,
carbonation, and kaolinization. The size of the fractured breccia clasts varies from 3 to 15 mm, and more than 80% of them are within 3–8 mm, with subangular and subrounded shapes. In addition, several NW and NE trending mineralization alteration zones are developed in the area. They are important surface manifestations of mineralization in this area, which will be described in detail in the following section.

2.3. Mineralization and Wall Rock Alteration

Although soil and vegetation coverage are common in the area, there are still some bedrock outcrops. Through large-scale geological mapping and trenching, nine NW and NE mineralization alteration zones of varying scales, have been found in the mining area. These mineralized alteration zones are 100–1,500 m in length (generally 100–200 m) and 0.5–15 m in width (generally 0.5–2 m). The alteration zones are mainly characterized by rock fragmentation, joint, and small fissures, iron staining on the fracture surface, star-like spot limonite, and honeycomb-like iron-manganese, with kaolinite, epidote, phlogopite, and carbonate alteration. Mineralization and alteration are unevenly distributed, and gradually transitional to the surrounding rock. According to the underground mineralization revealed by drilling, it is supposed that there is no direct spatial relationship between the surface exposed mineralized alteration zones and the concealed underground ore bodies. This indicates that the near-surface mineralized alteration zones may have resulted from the weathering of small fissure zones or volcanic clastic rock zones near the surface. The geological profile A–A’ (its location can be seen in Figure 2) and borehole information are be shown in Figure 3.

Drilling data show that the 13 main ore bodies found in the ore field are concealed ones, which are layered and shallowly dipped. The ore bodies main strike directions are 130–135°, dipping NE with angles of 15–20°. The ore bodies extend vertically from 75 to 552.7 m into the subsurface, with a cumulative mineralized intercept of 410 m. The highest grades of Zn, Pb, and Ag are reported to be 16.77%, 7.82%, and 4,586 g/t, respectively. There are six ore bodies in the study area with their true thickness exceeding 10 m and the largest one is 124.63 m in true thickness averaging 1.42% Zn, 0.98% Pb, and 162.24 g/t Ag, respectively. According to the preliminary resource estimation, the ore tonnage of the Taohemu deposit measures about 218 × 10^6 t, containing 18,000 t of silver, 1,028,000 t of zinc, and 217,800 t of lead, respectively, manifesting its superlarge deposit magnitude.

All ore bodies of Taohemu deposit are hosted in rhyolitic crystal-clastic tuffs of Manketouebo Formation. The hanging walls and the footwalls of most ore bodies are rhyolitic tuff or rhyolite. The gradual gradation from ores to their country-rocks is common in most places and therefore distinguishing them could be taken by sample analysis. Metal minerals of primary ore are galena, cerussite, sphalerite, chalcopyrite, pyrite, arsenopyrite, and some silver-bearing minerals. Gangue minerals are mainly quartz, potassium feldspar, sericite, and carbonate minerals. The ore has porphyritic, cryptocrystalline, and tuffaceous texture, and massive, laminated, and disseminated structure. The common types of wall rock alteration are silicification, sericitization, pyritization, chloritization, and carbonation, which are mainly developed in the small fissures of the ore body and in their immediate surrounding rocks.

3. Geophysical Survey

3.1. Electrical Resistivity Difference of Rock Samples

Forty-eight rock samples were collected from boreholes in the mining area, and their electrical resistivity values were measured. The results are shown in Table 1. It can be seen that the rhyolite electrical resistivity values are higher, because quartz or siliceous filled in the rhyolite fissures in the later stage of volcanic eruption. The electrical resistivity values of breccia-bearing tuff and lead-zinc mineralized tuff are lower, and the resistivity value of both lithologies are close to each other. The resistivity values of Ag-Pb-Zn mineralized tuff are lower than that of nonmineralized breccia-bearing tuff and rhyolite, which indicates that the electrical difference between Ag-Pb-Zn mineralized tuff and surrounding rock satisfies the electrical precondition of electromagnetic exploration.

3.2. Survey Line Layout

Scalar mode CSAMT data acquisition was carried out, with the transmitting dipole laid parallel to receiving stations. The data acquisition layout can be seen in Figure 2. The thick black lines on the figure represents two CSAMT acquisition lines, L1 and L2, arranged in the east-west direction, with a line spacing of 500 m and a point spacing of 40 m. The transmitting dipole, as indicated by the arrow, is located in the south of
the survey area, with a length of 1.4 km. The current dipole is located 10 km away from line L1, and 10.5 km away from line L2. The maximum transmitting current is 15 A, and the frequency range is 7,680–1 Hz.

Unlike CSAMT, MT uses natural field sources for underground structure exploration. MT data collection was also carried out along lines L1 and L2, and the sounding spacing was 200 m. Tensor acquisition array was applied in MT sounding with data recorded in the north-south and east-west orthogonal directions for horizontal electric and magnetic components, and a vertical magnetic component. The recording time for every MT station is more than 18 hr.

Figure 3. Geological profile and borehole information in Taohemu polymetallic deposit. Modified from the attached figure (Inner Mongolia Land and Resources Exploration and Development Institute, 2016).
3.3. Sounding Curve Analysis

Before data acquisition, the acquisition equipment used, including the receiver boxes and inductive magnetic sensors, were calibrated, and the consistency comparison test was carried out to ensure data quality. There is no industrial interference in the work area and the human interference is relatively small since only a small number of herdsmen lives in the area, so the quality of raw data obtained is very good. Figure 4 is the comparison of CSAMT and MT observed and inverted data from four sounding points on the survey line. If X is north and Y is east, then the scalar data collected by CSAMT corresponds to the TM model data (YX) of MT. The red dot in the figure is CSAMT data, and the blue point is MT data. As observed from Figure 4, the original CSAMT curve can be clearly divided into far field (frequency range of 7,680–88 Hz), transition field (between 88 and 16 Hz), and near field (16–1 Hz frequency band with apparent resistivity values having an increase in value corresponding to 45° increase plot, and impedance phase value approaching 0°). The MT data with frequency range of 320–0.01 Hz is shown in the figure. This corresponds well with the CSAMT data in the middle-frequency band, and it can also be used to compare and identify the CSAMT data in the nonfar region, because the MT natural field data are all far-field data and there is no distinction between transition and near-field region. It is shown that the observed and inverted CSAMT and MT data are well fitted.

| Lithology                     | Samples number | Resistivity value range | Average resistivity value |
|-------------------------------|----------------|-------------------------|---------------------------|
| Silver-lead-zinc mineralized tuff | 19             | 25–557                  | 160                       |
| Breccia tuff                  | 16             | 89–432                  | 200                       |
| Rhyolite                      | 13             | 189–722                 | 374                       |

Table 1

Electrical Resistivity Value of Rock Samples

Figure 4. Comparison of observed and inverted CSAMT and MT data at four stations. Panel (a) is for 1,800 m station in line L1, panel (b) is for 1,800 m station in line L2, panel (c) is for 7,000 m station in line L1, and panel (d) is for 7,000 m station in line L2. In each diagram, the top is the comparison of frequency apparent resistivity curves, and the bottom is the comparison of frequency impedance phase curves. The red circle represents CSAMT data, the red dot is CSAMT inverted data, the blue circle indicates MT data, and the blue dot is MT inverted data.
3.4. Data Processing

3.4.1. CSAMT Data Processing

The exploration area is located in pastures with hills, a quiet electromagnetic environment. This resulted in good quality data as shown in Figure 4. During data processing, the distortion in the raw data was removed, and the response characteristics for the whole rock and available structures were distinguished by analyzing the difference between the sounding curves. The data were also spatially filtered to remove any effects of near-surface heterogeneity (Torres-Verdín & Bostick, 1992). Finally, a 2-D smooth-model inversion was performed to image the electrical structure along the profile with far-field data (An & Di, 2016; Di et al., 2018). The CSAMT data were inverted using SCS2D software to produce a resistivity model of the Earth. To calculate resistivity and impedance phase for a given model section, SCS2D uses a two-dimensional, finite-element algorithm to calculate far-field CSAMT data. The electrical characteristics of CSAMT raw data can be seen in Figure 5, which shows apparent resistivity and phase pseudo-section for CSAMT lines L1 and L2.

3.4.2. MT Data Processing

Before the two-dimensional inversion of MT data, it is necessary to analyze the two-dimensional deviation and electrical tectonic strike, and to rotate the MT data profile to the direction of regional tectonic strike. At this time, the MT data can be decomposed into TE and TM mode data as independent polarization data. The current in the TE mode is parallel to the direction of tectonic strike. In the TM mode, the current is perpendicular to the direction of major strike. According to the known information and structural trend analysis, the tectonic strike is nearly north-south, as shown in Figure 6.

The nonlinear conjugate gradient (NLCG) method (Rodi & Mackie, 2001), which is widely used at present, is chosen as the two-dimensional inversion method. The whole inversion process is completed under WinGLink visualization integrated software system. In order to obtain reliable inversion results for two-dimensional inversion, we use single polarization model (TE, TM) and dual polarization (TE + TM) mode for a large number of inversion calculations using different inversion parameters. Some researchers (Cai et al., 2010; Zhang et al., 2012) have done a lot of research on the influence of different polarization mode data on two-dimensional inversion results. It is generally believed that TE polarization mode is more sensitive to deep structures, while TM polarization model is more sensitive to shallower structures. But when the influence of three-dimensional structure is obvious, TM model alone is used in inverse process. Compared with TE model or TE + TM model, the inversion results of the false structure will be significantly reduced, which can more accurately reflect the distribution of underground electrical structure. In summary, after repeated inversion and comparison, the best fitting TM polarization mode inversion results are selected as the final interpretation section.

The initial model used in the inversion is a uniform half-space of 100 ohm-m. The threshold error of TM mode data is 5% of resistivity and 5% of impedance phase. Only electrical structure above 4 km depth was considered. Therefore, 141 horizontal grids and 45 vertical grids were used in the inversion process. There...
is an important parameter regularization factor $\tau$ in the NLCG inversion algorithm, which can compromise model smoothness and data fitness. Therefore, different regularization factors were selected with the range between 0.1 and 100 for multiple inversion. This can be used to determine the most reliable regularization factor based on L-curve analysis, reflecting a trade-off between the model smoothness and the data fitness. Figure 7 shows an L curve with different smoothness factors. The horizontal axis is roughness and the vertical axis is the root-mean-square (RMS) error. As shown in the figure, when the smoothness factor $\tau$ is 10, it corresponds to the turning point of L curve, which can not only ensure the smoothness of the model, but also meet the requirements of data fitting. Figure 8 also shows the pseudo-section of observed data and inverted model response of TM mode. Comparing them, the measured data can be well fitted by the theoretical response, indicating that the two-dimensional inversion structure along the profile has high reliability.

4. Inversion Result Interpretation

The 2-D inversion results for CSAMT data along lines L1 and L2 are shown in Figure 9. The electrical characteristics of both lines are very similar. The shallow subsurface is inhomogeneous as indicated by high- and low-resistivity values, while the deep part is a good continuous low-resistivity body, especially at depths of 400–600 m in section 5,500–9,000 m. There is a low-resistivity anomaly with a horizontal layered shape, and the resistivity value less than 100 ohm m between the depths of 400 and 600 m. It is deep and thin in the west, and shallow and thick in the East, which is consistent with the distribution of the known ore bodies. Near 9,300 m, it develops a
Figure 8. Comparison of observed data and model response of TM mode along lines L1 and L2. Panels (a)–(d) represent line L1, and (e) and (f) indicate line L2.

Figure 9. 2-D resistivity model of CSAMT data in lines L1 and L2.
high resistivity interface, which is interpreted as a fracture tilting westward at nearly 40°. Between the distances of 9,300 and 13,000 m, the electrical structure has three-layered electrical characteristics, showing high-low-high resistivity stratification.

Inversion results of 2-D MT mode data are shown in Figure 10. Figures 10a and 10b are the RMS values and 2-D inversion model of line L1, Figures 10c and 10d are the RMS values and 2-D inversion model of line L2. It can be seen that the site-by-site RMS is less than 3, and most of them are nearly 1, indicating that the data are well fitted. From the inversion results, the distribution characteristics of ore bodies interpreted by CSAMT results have changed, resulting from different frequency bands used by the two methods. The interpreted fracture on line L1 is more obvious than that on line L2.

Figure 10. 2-D MT inversion models of TM mode data in L1 and L2.

Figure 11. Metallogenic model of Taohemu silver-polymetallic deposit.
5. Discussion

The terrestrial volcanic-subvolcanic hydrothermal silver-polymetallic deposits in northern China occur mainly in the continental volcanic-subvolcanic region. The metallogenesis of the deposit is controlled by major regional faults and the location of volcanic eruption and subvolcanic rocks. The intersections of regional faults are often the distribution area for mineral deposits and ore fields and are restricted by volcanic domes and crater collapse structures (Xie & Yu, 2016; Zhou et al., 2014).

The lithology of volcanic rock sequences in the study area is mainly intermediate-acid lava tuff, tuff, agglomerated breccia tuff, breccia tuff, lava agglomerate, sedimentary volcanic breccia, rhyolite, andesite, and so on.

Other rocks include tuffaceous siltstone, tuffaceous gravel, sandstone, gneiss, medium-fine-grained granite, and coarse-grained granite. These rocks are often severely fractured, or form part of tectonic breccia or cryptoexplosive breccia.

During the waning stage of Late Jurassic volcanic activity in this area, a large amount of ore-bearing fluids accumulated in deep magma chambers moving upward along the volcanic conduit, and percolate through rhyolitic pyroclastic rocks (rhyolitic tuff, breccia-bearing tuff, and volcanic breccia) of Manketouebo Formation. Due to their inherent high porosity and permeability, ore-bearing fluids went through the pyroclastic rocks, and then formed strata-bounded ore bodies.

It is suggested that the Taohemu deposit should be a late volcanic hydrothermal silver-polymetallic deposit. If this is true, the mineralization intensity would gradually become weak and finally fade away with increasing distance from the hydrothermal center (volcanic channel). Therefore, the overall three-dimensional shape of the deposit should be a large lenticular body with a thick central portion and gradually thinning edges (Figure 11).

6. Conclusion

1. An electrical model of Taohemu deposit, which better reflects the ore body and its deep structural features, was obtained through two-dimensional inversion of MT and CSAMT data in the area.
2. Taohemu silver-polymetallic deposit occurs in rhyolitic volcanic rocks and volcanic clastic rocks of the Manketouebo Formation of the Late Jurassic. The ore bodies and mineralized bodies are mainly tuffs, breccia tuffs, and volcanic breccias with Ag-Pb-Zn mineralization.
3. Mineralized breccia and breccia-bearing tuff seen in boreholes and on the surface indicate that there may be a volcanic chamber or crater developed in the Taohemu Ore field and surrounding areas.
4. The distribution characteristics of ore body is strata-bounded, and the metasomatism is controlled by paleo‐volcanic chamber, which have been interpreted by geophysical results addressed in the text.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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