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Geological Features and Pospecting Model of the Pb-Zn Deposits Occurring in Abag Region along the Sino-Mongolian Border

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1 Geological Setting

The Pb-Zn deposits occurring in Abag region along the Sino-Mongolian border, which is located at south of the Sino-Mongolian border in middle-east of Inner Mongolia, and the central geographic coordinates is 114°15'-115°15' 00"E, 45°15'00"N. The deposit concentrated region is about 80km in length and 30km wide, which has many medium to small scale Pb-Zn-Cu-Bi(Ag-Au)deposits and Cu, Pb, Zn, Sn, Bi mineralization spot such as Hardat Tolgoi deposit, Gaoerqi deposit, Moruogeqin deposit, Ganzhuershande deposit and Azar hada deposit. Pb-Zn (Ag, Au) deposit has produced in Niquihe formation, and has same ore-forming geological background and same type deposit. Exposed strata in the area were Tongshan formation, Niquihe formation, Baoligaomiao formation and Abaga formation. Intrusive rocks in the area were mainly Late Carboniferous and Early Permian Syenogranite and feldspar granite. The Late Carboniferous Syenogranite contacted with the Niquihe formation by a irregular contact zone, the inner and outer contact zones showed lead-zinc mineralization. Niquihe formation was developed with folds, complex structural features. Angles of late filling ore bodies were different in different tectonic positions. NE, NW and EW direction faults in this area were developed, different direction faults can be filled by late ore fluid resulted in the formation of ore bodies. Basalt which covered ore bodies was distributed in a wide range.

2 Descriptions of the Selected Ag and Ag-Pb-Zn Deposits

2.1 Hardat Tolgoi Ag-Pb-Zn deposit

The Hardat Tolgoi Ag-Pb-Zn deposit is located in the northern Abag Qi, inner Mongolia, south of Sino-Mongolia bor-der, occurred in the Erenhot-Dong Ujmqin Qi polymetallic ore belt subordinate to the giant Central

Asian ore belt. The exposed strata are Niquihe formation, Baoligaomiao formation and quaternary. Magmatite is the Late Carboniferous and Early Permian granites, controlled by northeast - southwest regional tectonic. Hardat Tolgoi mine is divided into 3 ore belt with number of I, II and III. The ore body which mainly occurs near the footwall fault is strictly controlled by tectonic alteration zone. Ore bearing rocks are feldspar quartz sandstone, altered tectonic breccia, volcano clastic rock and a small amount of granite and diorite. The relatively large ore body has character with thin and poor on the upside while thick and rich on the other side but with the trend of become thin and poor in deep. Shapes of orebody include vein, lenticular and irregularlenticular bedded.

Along the strike and dip orebody vary significantly with obvious character of branched and compound, relatively expansion and contraction, but the shape and occurrence are closely related to mineralization alteration broken zones. At present, a total of 29 ore body and 3 ore belt have been identified. One of the main orebody with No. III-1 and with shape of stratoid, trend of NWW has occurrence 206°∠79°. This ore body which is about 550m in length extends 461m along the tendency, and its thickness is 6.19 m.

The wall rock alteration: the wall rock alterations near the ore mainly are silicification, sericitization, chloritization, epidotization, ferritization while the wall rock alterations far the ore mainly are biotitization, sericitization kaolinization. The metal minerals include argentite, sphalerite, galena, pyrite, and a small amount of chalcopyrite, limonite, cerussite, pyrolusite and so on. Gangue minerals include quartz, calcite, chlorite and plagioclase.

For this ore body, its average grades are 0.68wt% Pb, 1.46wt% Zn and 16.2×10^{-6} Ag. The amount of resources are Pb 1.22 million tons, Zn 2.61 million tons and Ag 29.1 tons, accounting for the total amount of resources 32.82%.

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2.2 Gaoerqi Ag-Pb-Zn deposit

The deposit is located in the northeast of about 15km of Hardat Tolgoi. At present, 3 main mineralization alteration zone and twenty-three orebodies have been identified. Among them, the No. 3 ore body which occurred in I mineralization alteration zone is the biggest. For this ore body, it is nearly 900m in length along the strike and it extends 600m along the tendency. The average thickness is 6.39m and the general attitude is $3^{\circ} < 35^{\circ}$. The shape of orebody is stratoid which mainly occurred in the metamorphic feldspar quartz sandstone while small amount of stratoid orebody occurred in the porphyritic fine-grained granite. The main metal minerals of primary ore include sphalerite, pyrite, pyrolusite, pyrite, chalcopyrite, argentite and gold. Gangue minerals are quartz, feldspar, sericite, chlorite, kaolinite, calcite and a small amount of fluorite etc.. Ore useful components for lead, zinc, associated with the useful component for silver, gold, indium, harmful components of fluorine.

Orebody shapes mainly are net-veined and dense block. The average ore grades are $36.11 \times 10^{-6}\%$ Ag, 1.33wt% Pb and 1.51wt% Zn. The amount of resources are 158.64 tons (Ag), 58600 tons (Pb), 66500 tons (Zn), while Pb+Zn metal reserves which is the main resource accounted for 60% in the deposit. Among them, massive rich ore in No. 3 orebody has an average grade $129.52 \times 10^{-6}\%$ Ag, 5.34wt% Pb, 4.98wt% Zn, while the amount of resources are 77.15 tons (Ag), 31800 tons (Pb) and 29600 tons (Zn).

3 Prospecting Model and Conclusions

Although the number and scale of deposits founded in China are less than that in the southern Mongolia area, but the Paleozoic metallogenic conditions is very similar with the southern Mongolia area, so it has good prospecting of mineralization. Through the study of the deposit, the author summarizes the following ore-prospecting models along the China and Mongolian border.

(1) Pay attention to mineralization in Devonian system. In recent years, most deposits in northern Abagaqi-Dongwuqi prospecting area mainly have been found in Devonian volcano Sedimentary strata. We should pay attention to the field observation and detailed description of variety alteration mineralization, establish the concept of "mineralization is the sign of ore prospecting".

(2) Identifying the fault structure is the key to the prospecting. In fact, there is a close relationship between the formation of deposits and structures. The NW fault of northern Abag is the important ore prospecting indicators.

(3) Geochemical anomaly is a fast and effective method for ore prospecting. Pay particular attention to anomaly of copper polymetallic inside and outside the contact zone of buried or semi-buried granite in the Paleozoic and late

Paleozoic strata.

(4) The ore and surrounding basalts were potential for prospecting. In this paper, the Pb-Zn deposits are covered by Quaternary basalts. And the orebodies in Gaoerqi Pb-Zn deposit which occurred in the Niquihe formation have characteristic of shallow burial, thick ore body and high grade. So it will be expected to have a good effect to prospect which based on the study of ore controlling conditions of the deposit and exploration of stratum under the basalt rocks.

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