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Geological Characteristics and Genesis of Badaguan Cu-Mo deposit in Chen Barag Qi, Inner Monglia

ZHANG Jing, SHAO Jun, BAO Qingzhong, ZHOU Yongheng and WANG Hongbo

Shenyang Institute of Geology and Mineral Resources, CGS, Shenyang 110034, China

1 Regional Geological Introduction

Derbugan metallogenic belt, which controls lots of molymetalic deposits, is an important Cu-Mo-Au-Pb-Zn molymetalic metallogenic belt in northeast region located in adjacent area of China, Russia and Monglia (Zhu et al., 2001).

Cu-Mo deposits, such as Wunugetushan, Badaguan, Babayi, are concentrated among Manzhouli and Chen Barag Qi. However, there is big ore-prospecting space in the area no matter in number or scale compared with Cu-Mo deposits in Erguna-Upper heilongjiang-Gangren metallogenic belt in adjacent Russia.

The study aims to deepen the research level of Badaguan Cu-Mo deposit and lays the foundation for researches of regional metallogenic regularity (Fig. 1).

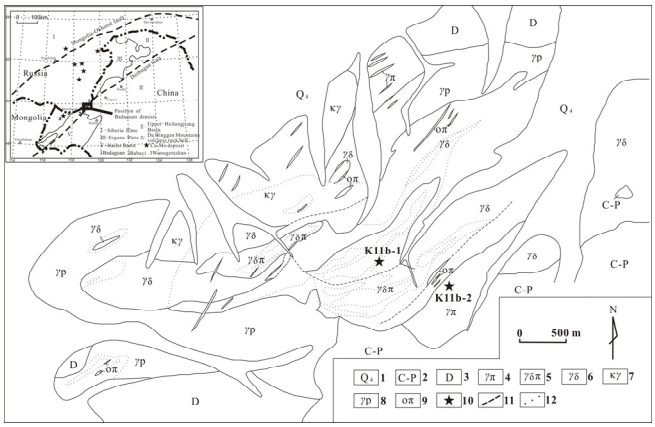

Fig. 1. Geology map of the Badaguan Cu-Mo deposit.

2 Geological Characteristics of Deposit

Badaguan Cu-Mo deposit is located in NNW of Halar with 130 km distance. The geotectonic position belongs to connecting parts of Erguna Block and Halar Basin. Derbugan fault which controls distribution of magmatic rocks(T-K) is in west of the deposit, and NW-direction secondary faults which control distribution of ore-body developed well.

The exposed strata are simple, mainly including Daminshan Group(D_{2+3}), Xiaohelihe Group(C-P) and Mesozoic volcanic rocks. Magmatic activities were strong in the region, and one of the products is Badaguan granite complex, which controls formation of the deposit and mainly includes gneissic granite, alkali granite, granodiorite, granodiorite porphyry and granite porphyry chronologically. Cu-Mo mineralization mainly exists in quartz vein formed in schistosities of granodiorite porphyry, which is the mother rock. Wall rock alteration mainly in inner granodiorite porphyry developed strongly, and regularly formed quartz sericitized zone, phyllitery quartz sericitized zone,transitional zone and propylitization zone from the mineralization center to peripheral. Most of orebodies were hosted in quartz sericitized zone.

Orebodies mainly hosted in inner granodiorite porphyry or contact zone could be classified into copper orebody (associated with Mo) and molybdenum orebody (associated with Cu). Primary minerals are pyrite, chalcopyrite, molybdenite and a little chalcocite.

3 Samples Collection

Geochemical samples and zircon U-Pb isotope dating samples(K11b-1, granodiorite porphyry; K11b-2, granite porphyry) were collected from underground II of Badaguan deposit combining tested samples(named as CK)of previous'. Molybdenite Re-Os isotope dating samples were also collected from veins of quartz ± molybdenite ± pyrite ± chalcopyrite in underground II.

4 Rock Geochemical Characteristic

4.1 Major elements, trace elements and REEs

* Corresponding author. E-mail: 441005231@qq.com

SiO_2 and MgO contents of Badaguan granite complex are 62.48%–84.05% and 0.05%–2.99%.

$Na_2O + K_2O$ = 4.16%–8.48%. Na_2O/K_2O = 0.70–2.62. Al_2O_3 content is 6.46%–16.27% and most of samples were fell into the range of peraluminous in A/NK-A/CNK diagram. Most of samples fall into the range of calc-alkaline in SiO_2-AR diagram. Based on the above tested data, Badaguan granite complex is identified as medium-high Si, peraluminous and calc-alkaline magmatic rock.

SREE of K11b-1 is 55.42 ppm, with $(La/Y)_N$ = 17.22, LREEs enriched and weak anomaly of δEu(0.88). It is enriched in Cs, Rb, Ba, K(LILE)and depleted in Th, Ta, P, Ti(HFSE). SREE of K11b-2 is 450.58 ppm, with $(La/Y)_N$ = 3.07 and negative anomaly of δEu(0.17). It is enriched in Rb, K(LILE), Hf(HFSE) and depleted in Cs, Ba(LILE), P, Ti(HFSE).

4.2 Tectonic environment discrimination

Samples K11b-2 and CK-2 were fell into the range of RRG+CEUG&POG in Al_2O_3-SiO_2 discrimination diagram. Samples K11b-2 and K11b-1,CK-2 were fell into the range of 7 and 6 in R1-R2 discrimination diagram. Samples K11b-2 and K11b-1 were fell into the range of WPG and VAG(Syn-COLG)in both Rb-Y+Nb and Nb-Y discrimination diagrams.

5 Isotope age

Two zircon samples are 50–150 um in size, and Th/U ratios are from 0.47 to 1.50, which indicate magma genesis. The weighted average age of K11b-1 is 206.5 ± 1.6 Ma (MSWD = 0.74). Sample K11b-2 has two weighted average ages, which are 184.2 ± 3.72 Ma (n = 6) and 137.0 ± 3.12 Ma (n = 13). It shows that sample K11b-2 invaded in Late-Yanshanian and captured zircons from rocks of Early-Yanshanian. Weighted average age and isochronal age of selected 4 molybdenite samples are 205.8 ± 3.4 Ma (MSWD = 0.48) and 210 ± 7.2 Ma (MSWD = 1.03). Both ages are coincident in range of error and could be the mineralization age of the deposit.

6 Discussion and Conclusion

6.1 Tectonic background of rock formation

Previous research results show that the Badaguan region was in orogenic environment in the period of P-J_1,which is the result of Mongolia-Okhotsk Ocean closing and collision between North China- Mongolia Plate and Siberia Plate.

Badaguan granite complex was the product of multistage magmatic activities from Late Indo- Chinese epoch to Yanshanian. There are big differences between K11b-1 and K11b-2 in REE patterns. Tectonic environment discrimination diagrams show that granodiorite porphyry, alkali granite formed in syn-COLG and granite-porphyry formed in WPG. Considering U-Pb dating results and tectonic environment, we can conclude that granodiorite porphyry was related to the syn-COLG environment out of Okhotsk Orogenic Belt. Meanwhile, granite porphyry was related to the WPG environment after the orogenic movement.

6.2 Metallogenic characteristics

We could infer that the granodiorite porphyry is the mother rock of the deposit from aspects of position coincident between ore body and the rock,similar characteristics of metallogenic porphyry compared to other porphyry Cu deposits in China(high Si, A/CNK＜1.3 and calc-alkaline), age isochronism between rock, molybdenite and stable isotope results from the previous'. Considering other geological characteristics of the deposit, the genesis of the deposit is identified as orogenic Cu-Mo deposit related to porphyry in Late Indo-Chinese epoch (Chen et al., 2008).

Compared to adjacent Wunugetushan Cu-Mo deposit, Badaguan was earlier than Wu (177.4 ± 2.4 Ma), whose metallogenic environment was expand. Considering the tectonic evolution, we could infer that both deposits were under a large scale metallogenic cycle, which reflects mineralization related to Okhotsk continued for a span. The age of 184.2 ± 3.72 Ma (1Ma distance in error range compared to metallogenic mother rock of Wu) from granite porphyry this time seems to give us inspiration that we could look for granite porphyry formed in Early Yanshanian as new type of ore-hosted geological body in the Badaguan ore district.

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References

Chen Zhiguang, Zhang Lianchang, Wan Bo et al., 2008. Geochemistry and geological significances of ore-forming porphyry with low Sr and Yb value in Wunugetushan copper-molybdenum deposit, Inner Mongolia. *Acta Petrologica Sinica*, 24(1): 115–128(in Chinese with English abstract).

Zhu Qun,Wu Guang, Zhang Jiongfei et al., 2001. Research progress of metallogenic classfication and exploration technology in Derbugan metallogenic belt. *Chinese Geology*, 28(5): 19–27(in Chinese with English abstract).