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The Application of Pb Isotope Geochemical Method in Deep Ore Exploration Dashui Gold Deposit, Maqu County, Gansu Province

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1 Introduction

The basic geochemistry research shows that lead isotope study not only can be used for model age dating and metallogenic material resource investigation but also for geochemical exploration and prospecting evaluation (Cui, 2005). The lead isotope composition of different genetic type ore deposits has certain relation to metallogenic elements (He, 1994). Therefore, the isotope geochemical prospecting method not only can be used to detect blind ore deposits but also to investigate the origin of such deposits.

The detection of blind ore deposit which belongs to the frontier issue of the theoretical science of geochemical exploration is the focus and forefront in the field of geological exploration. Doe and Stacey (1974) and Gulson (1998-1990) first applied lead isotope to detect blind ore deposits in the 1960s. Thereafter this technique was widely used in domestic exploration. Xia (1982) first applied lead isotope geochemical method to the evaluation of uranium deposits in China. Huang (1995) also applied this method to the evaluation of gold deposits which are located in Hainan Province and the middle and lower reaches of Yangtze River. Rui (1991) used lead isotope shooting method to evaluate the deep ore body of Guanmenshan lead-zinc deposit. Zhu (1993, 1998) adopted successfully lead isotope shooting method to further the prospecting work in polymetallic ore belt in Altay area of Xinjiang. Also this method was put to use by Cui Xue-jun to predict the resource extent, form and depth of blind ore body of the gold deposit in Yinzuishan, Gansu Province. The lead

isotope method was applied to predict and evaluate the deep ore body of the gold deposit in Tongling area Anhui Province (Huang, 1989), Baoban gold deposit in Hainan province, Dongchuan copper deposit in Yunnan province (Chang, 1997), Hanshan gold deposit in the west section of north Qilian achieved excellent results. These achievements greatly promoted the development of lead isotope geochemical method and studies on methods of blind ore deposit detection.

2 Experimental

Dashui gold deposit of Maqu County, Gansu Province occurs in limestone of Maresongduo Formation in the Middle Triassic of the southern subzone of western Qinling area. The ore body has complicated shapes and is jointly controlled by fracture, post-mineralization dikes and paleo-karst features. Thus the deep prospecting of the deposit is difficult. In this study, we applied Pb isotope geochemical method to collect 327 Pb isotope samples on the exploration lines of No.110, No.105, No.103, No.86, No.82, No.78, No.76, No.74, No.72, No.70, No.69 and No.68. Using the data processing methods of Pb isotope 3D topological projection values (V1 and V2), concentration coefficient (K) and ore buried modulus (R) to detect the metallogenic cut-off depths of different exploration lines in Dashui gold deposit, to evaluate the concentration coefficient and the ore buried modulus to predict mining area resources.

3 Conclusions

(1) The best deep prospecting potential area is in the

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west part of mining area, which is in NE-SW direction and between No.69 to No.76 exploration lines. The metallogenic cut-off depth HD in this area reaches the maximum depth about 3000m. The average ore buried modulus R in the west area is 6.82, concentration coefficient K is 2.57. Therefore this region shows great prospecting potential in the deep part of ore body.

(2) The prospecting potential of deep ore body in the east region is limited. The metallogenic cut-off depths are commonly greater than 3400m above the sea level, which is close to the current exploration and mining depth. The average ore buried modulus R in the west area is about 1.3, concentration coefficient K is 1.14. Therefore the deep prospecting potential is low.

(3) It is also important to note that the potential of the revealed small deep ore bodies. There are some low grade gold veins ($V_2 > 100$) located at the exploration lines No.78 to 70 in the west area. The V_2 -H value of these ores deviates the correlation of main ore body. The same situation also occurs in the east area. It proves that the mineralization is multi-period. Some of these small ore bodies pinch out rapidly at depth and don't have any prospecting potential but some others probably have the potential. Therefore the further studies need to be done to demonstrate the inference.

(4) The deposit which has obvious characteristic of the metallization of secondary migration belongs to epithermal metallogenic system. The source is from the lower early Paleozoic strata

(5) According to the ore buried modulus on the exploration lines the average value of R can be evaluated as 3.02 ± 0.69 . The expected reserves of gold is 311 ± 44 tons in the mining area.

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