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Geochemical Characteristics of Tanjianshan Gold Deposit in Qinghai Province

CHEN Haiming, ZHOU Zonggui, GONG Yongjun and DAI Liguo

Faculty of Earth Resources, China University of Geosciences, Wuhan 430074, China

1 Introduction

Tanjianshan gold deposit is one of the major gold deposits discovered in Qinghai Province, situated at the eastern extremity of Shaishiteng Mountain in Dachaidan in Qinghai Province, in the western part of the northern margin of the Qaidam Basin. The main strata outcropped by the deposits are that Lower Proterozoic Dakendaban group, Mesoproterozoic Wandonggou group, Upper Ordovician Tanjianshan group, Upper Devonian Yak mountain group, Upper Triassic Ela mountain group and Quaternary sediments. Occurrence regularity of ore bodies exist in carbonaceous phyllite schist segment, most of which are altered phyllite or schist type. Ore minerals mainly contain arsenopyrite and pyrite, etc., the common structures of ore include cube-shaped or hypidiomorphic grain-like structure, rim and zonal structure, sieve-like structure, pentagonal dodecahedron euhedral or subhedral grain-like structure, ore structures mainly include: scattered disseminated structure, eye-shaped lumpy structure, veinlet-disseminated structure and dense disseminated structure. The wall-rock alteration of ore deposits are mainly pyritization, silicification and sericitization. The forming process of the primary ores of Tanjianshan gold deposit is divided into three phases: initial enrichment of sedimentary metamorphism, deformation and metamorphism and magmatic hydrothermal superimposition.

2 Geochemical Features

2.1 Geochemical features of rocks

Rock-forming elements in the ore basically inherit the composition of the original rock, the variation of volatile components is slightly larger, which is related to the migration and activation in the process of mineralization. The rock vein type ore K_2O has increased significantly, but a significant reduction in NaO_2 and CaO, which is connected with the alteration of plagioclase into hydromica. Element contents in two types of ore-forming are similar, is characterized by the highly enrichment of gold and arsenic, and the two elements in the original rocks also shows a higher degree of enrichment (Cui and Zhang, 2000). The silver in rock vein type ore is high in quantity, showing the characteristics of late Variscan epithermal mineralization.

2.2 Sulfur isotope

The sulfur isotopic composition among the schist type ore, rock and gold bearing pyrite are very similar, indicating that the sulfur in the schist type ore comes from the surrounding rock (Fig. 1). The sulfur isotopic composition of pyrite in the period of magma intrusive-thermal alteration (that is, the stage of pyrite-arsenopyrite-gold-quartz vein) fall in between the sulfur isotopic compositions of general magmatic origin of pyrite and schist type ore and surrounding rock, illustrating that the magmatic hydrothermal mineralization fluid of the sulfur is a mixture of different proportion of the two sulfur of magma and surrounding rock. The sulfur isotopic composition of pyrite in the period of magma intrusive-thermal alteration (that is, the stage of pyrite-arsenopyrite-gold-quartz vein) is less than that of the current late stage (carbonate rock-quartz vein stage), this is because in the early stage of mineralization, ore-forming solution possess a high degree of oxygen, heavy sulfur flows into oxygenated compounds.

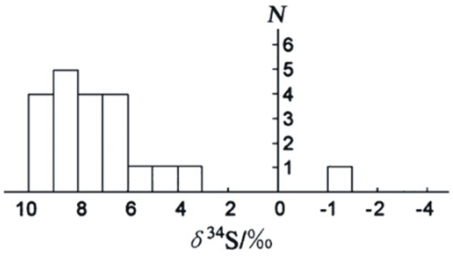

Fig. 1. Sulfur isotope distribution graph of Tanjianshan.

* Corresponding author. E-mail: 1025539383@qq.com

2.3 Lead isotope

The data of ore and lead isotope suggest that the lead isotopic composition may be a mixture of different proportions of the two source areas (Fig. 2). The projected points of ratios of lead isotope of schist-type ore and rock vein-type ore all lie between the two source areas (Xu et al., 1997).

2.4 Study of fluid inclusions

The general characteristics of mineral inclusions of Tanjianshan gold deposit are as follows: (1) few and small, poor level of development; (2) mainly for pure liquid inclusions and gas liquid inclusions, and the gas-liquid is relatively low; (3) the sparse distribution. The components of mineral inclusions in the metallogenic epoch of Tanjianshan gold deposit are tested, and then the statistical analysis on data obtained from the test is conducted, the conclusion is that the ore-forming hydrothermal of the three metallogenic periods of Tanjianshan gold deposit has different characteristics: sedimentary-metamorphic period is the result of primary built brine; deformation and metamorphic period is mainly metamorphic water, but the mineralization superimposed by magmatic hydrothermal; magmatic hydrothermal period is mainly the magma, but contaminated by the metamorphic water in the migration. The microscopic measuring temperature was conducted on the collected quartz samples. According to the temperature in the deformation and magmatic hydrothermal period, we can conclude that the ore-forming temperature of Tanjianshan gold deposit is about 232–278° C, and it belongs to middle and low-temperature gold deposit.

3 Conclusions

(1) Sulfur isotopic features suggest that the sulfur of schist-type ore mainly comes from wall rock stratum, but the sulfur of pyrite quartz vein and rock vein-type ore both from surrounding rock stratum, and from magmatic hydrothermal. Lead isotopic features also show that ore-forming materials of Tanjianshan gold deposit come from wall rock strata and Variscan intrusive rocks.

(2) The temperature of fluid inclusions indicates that metallogenic condition of Tanjianshan gold deposit is epithermal mineralization .

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