Analysis of Geological Characteristics and Genesis of Gold Deposits in Asihazhang, Dulan County, Qinghai Province

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Abstract: The geotectonic structure of this area is located in the North Kunlun Magmatic Arc (Ⅳ-8-3) the East Kunlun Arc Basin (Ⅳ-8), the Qin-Qi-Kun Orogenic System (Ⅳ). The exposed strata in the area are the Lower Proterozoic Jinshuikou (Rock) Group, with structural faults spreading in the NW-NW direction, and the intrusive rocks formed during the Variscan period. The gold (mineralized) body in the area is mainly controlled by structure, and the NNE-trending secondary structure is the main ore-controlling structure in the area.

1. Introduction

The geotectonic structure of this area is located in the North Kunlun Magmatic Arc (Ⅳ-8-3) the East Kunlun Arc Basin (Ⅳ-8), the Qin-Qi-Kun Orogenic System (Ⅳ). The geological structure in the area is complex, with structural faults spreading in the NW-NW direction.

2. Strata

The exposed strata in the area are the Lower Proterozoic Jinshuikou (Rock) Group (Pt1j). This ore group is distributed in an NWW-EW direction as a set of intermediate and high-grade metamorphic rocks. The exposed area is relatively wide, and it is characterized by the development of a large number of metamorphic basic volcanic rocks (amphibians), metamorphic terrigenous clastic rocks (gneisses), and metamorphic magnesian carbonate rocks. Regionally, the total thickness of this rock group is greater than 13021.3m, and it is composed of granulite, gneiss, migmatite, mixed gneiss, mixed granite, dolomite marble, peridot marble and amphibolite. It is the basement.
tectonic layer of the Qaidam block and the East Kunlun tectonic belt, called the crystalline basement.

3. Structure

The structure of this area belongs to the North Magma Arc Belt of East Kunlun. Fault structures and ductile shear zones are relatively developed, and the fault structures are particularly prominent. The fault structures are dominated by compressive faults or compressive torsion faults, and they can be divided into three groups from its spreading direction: nearly east-west, north-north-west, and north-north-east. Their nature is mostly compression and torsion, with the characteristics of multi-phase activities, of which the north-north-east trending structure is the main ore-controlling structure in the area.

4. Magmatic Rocks

Intrusive rocks are relatively developed in the area, including Caledonian intermediate-basic rocks, various intermediate-acid intrusive rocks of the Variscan period and Indosinian intrusive rocks, which constitute the main body of magmatic activities in the area.

5. Features of Au-Bearing Structural Alteration Zone

The FpI gold-silver-bearing structural alteration zone is produced in the granodiorite rock mass and is controlled by the F1 structure. The surface exposure of this alteration zone is 1100m long, 0.4-1.2m wide, strikes 120-130°, leaning southwest, and the dip angle is 56-88°. The gold grade is generally 0.52-1.1g/t, with the highest grade of 1.76g/t; the silver grade is generally 25.9-60.33g/t, with the highest grade of 226g/t. The rocks in the structural alteration zone are broken and altered strongly, with metal mineralization such as pyrite mineralization, chalcopyrite mineralization, malachite mineralization and limonite mineralization. Pyrite is mainly produced in granular and granular aggregates, mainly produced in quartz veins, with a subhedral-euhedral crystal structure. The particle size of a single pyrite is generally 0.3-1.5mm, and the block diameter of a pyrite aggregate is generally 2-4mm. The chalcopyrite mineralization is produced in the form of agglomerates, mainly produced in the fracture surface of the quartz vein, and the size of the agglomerate is 2-5mm. Malachite mineralization is produced in flake and powder form, mainly produced in quartz veins and granodiorite fissures at the edge of the structure. Alteration phenomena such as silicification, sericitization, carbonation, chloritization and kaolinization are common.

The FpIIV gold-bearing structural alteration zone is produced in the plagioclase granite body and is controlled by the F7 structure. The surface exposure is 630m long, 1-2.18m wide, strikes 30°, leaning southeast, and dips at 61°. The gold grade is 2.48g/t. The mineralization alterations in the structural alteration zone are mainly pyrite mineralization, chalcopyrite mineralization, malachite mineralization, limonite mineralization, silicification, sericitization and carbonation. Pyrite is mainly produced in granular form and a small part is in aggregates, mainly produced in quartz veins, with a subhedral crystal structure. The particle size of pyrite is generally 0.2-0.5mm. The chalcopyrite mineralization is produced in the form of agglomerates, mainly produced in the fracture surface of the quartz vein, and the size of the agglomerate is 1-3mm.

6. Ore Quality and Wall Rock Alteration

6.1 Ore Characteristics

(1) Ores and minerals

The ore minerals are mainly pyrite, followed by limonite, chalcopyrite, azurite, pyrrhotite, etc., which are distributed in the form of star points, sparse dissemination, block mass and network veins. Gangue minerals are mainly quartz, followed by feldspar, sericite, calcite, chlorite, amphibole,
pyroxene, and so on. Ore minerals account for about 5-10% of the total, and gangue minerals account for about 90-95% of the total. There is a positive correlation between gold mineralization and the content of metallic minerals.

(2) Ore texture and structure
The ore texture includes granular metamorphic texture, fragmented texture, breccia texture, heterogrannular texture, and so on.

The ore structures mainly consist of massive, veinlet-network and band-like structures, with honeycomb and spot-like structures locally.

(3) Characteristics of ore alteration
The mineralization is mainly pyrite mineralization, chalcopyrite mineralization, limonite mineralization and malachite mineralization.

Alterations are mainly silicification, sericitization, chloritization, kaolinization and carbonation.

6.2 Wall Rocks of Ore (Mineralized) Body and Alteration
The wall rocks of the ore body mainly include granodiorite, plagioclase granite and biotite plagioclase gneiss. The wall rocks near the ore body are mainly altered granodiorite and altered plagiogranite, and the rocks are generally fragmented—schistositized. Wall rock alteration mainly includes silicification, limonite mineralization, kaolinization, chloritization, sericitization, etc. The wall rock near the ore body is altered strongly, and the boundary between the wall rock and the ore body is obvious. The alteration phenomenon gradually weakens from the alteration zone to both sides in space, presenting a gradual transition.

7. Genesis and Prospecting Criteria

7.1 Genesis of the Deposit
The distribution of gold and silver ore bodies in the area is strictly controlled by tectonic alteration zones. The gold ore bodies found are produced in the structural alteration zones inside the Variscan granodiorite and plagiogranite bodies. The structural alteration zone generally presents silicification, pyrite mineralization, chalcopyrite mineralization, chloritization, and kaolinization. The occurrence of gold ore bodies is basically the same as that of the structural alteration zone. In the gold-silver-rich areas in the area, the rocks are broken, the alteration is strong, and the metal is enriched. The overall manifestation is the following two aspects:

The gold deposits (mineralized) discovered in the area are mainly produced in the NNE-NEE-trending structural alteration zone, and silver mineralization is mostly produced in the NW-trending structural alteration zone. The confluence and expansion of the structural alteration zone are prone to form gold and silver ore bodies.

(2) Gold and silver ore bodies can be formed in areas with complex combinations of mineralization and alteration in the structural alteration zone, and the area with single and strong silicification generally contains low or no gold and silver content.

7.2 Ore-Controlling Factors
(1) The relationship between strata and mineralization. In the early Proterozoic Jinshuikou (rock) group strata in the area, the contents of Au, Ag, Ba and other mineralizing elements are all greater than the average value of that in the crust. In particular, the content of Au in various rocks in this set of strata is 2-3 times higher than the average value of that in the crust. Its content is (5.02~10.00)×10^-9, with an average of 6.99×10^-9. It is a high background stratum of Au in the area, and therefore, the Jinshuikou (rock) group strata may be an important initial source of gold mineralization.

(2) The relationship between magmatic activities and mineralization. Magmatism is very frequent in the area, and the Variscan granodiorite and plagiogranite constitute the main lithology in the area. Related data shows that the Au abundance value of granite in the area is relatively high: the granodiorite is (5-19)×10^-9 and the plagioclase granite is 8×10^-9, which are 2-5 times the
average value of those in the crust. They provide a source of fluid and some materials for mineralization.

(3) The gold ore bodies in the area are all produced in the NNE-NE and NWW trending structural alteration belts with multiple activities. The structure provides channels for the flow and penetration of ore-forming fluids and a favorable space for the ore body to be in place, and the tectonic heat of structural changes is also one of the heat sources of mineralization.

7.3 Genetic Type

The gold ore bodies in the area are produced inside the structural alteration zone. The shape, occurrence and distribution of ore bodies are controlled by structure, and the ore types are mainly structural altered rocks. From the analysis of the geological conditions, mineralization geological environment and ore body characteristics in this area, the genetic type of the deposit should be magmatic hydrothermal type.

References

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