The distribution and formation of mine body in Tibet

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Abstract. The Gangdise metallogenic belt has been a popular mineral mine since it was discovered due to its various types of mineral elements, such as copper, iron, zinc, molybdenum, silver, gold, and bismuth, attracting millions of researchers. Moreover, the possible copper output that has been indicated here has already reached 3,000,000 tons. The deposit here is a typical skarn type ore rich in garnet. The article mainly introduces how the minerals in Gangdise metallogenic belt is distributed and investigates how the Gangdise metallogenic belt is formed. Some hypotheses in this article refer to previous investigations in the Gangdise metallogenic belt. This paper concludes that the reasons for the formation of the major ore deposit in Gangdise metallogenic can be regarded as the movement of the Eurasian Plate and India Plate, which can also be defined as the main collision phase, though other geologic changes altered the distribution of the ore body later.

Keywords: Gangdise Metallogenic Belt, Chengba Copper Mine, Geologic Feature, Skarn Type Deposit.

1. Introduction

The Gangdise metallogenic belt is located near the Himalayas in Tibet, which is a province in the southwest of China. And it has been becoming a popular ore body belt for geological prospecting due to the various mineral resources, such as copper, iron, zinc, molybdenum, silver, gold, and bismuth. Meanwhile, the countless geologic activities here also motivate many scientists to discover the mysteries behind this aged treasure. The main ore body is located between Nujiang River and the Yarlung Zangbo River, with 2000km from east to west, and 500km from south to north. More specifically, the Gangdise metallogenic belt can be divided into three parts due to the difference in geologic features: the north part, the middle part, and the south part. The formation of minerals in these three areas is all influenced by the geological change of the New Tethys Ocean, which is supposed to be an old ocean and the precursor of this area. This article is mainly going to talk about the northern part of the Gangdise metallogenic belt and the Chengba copper mine, which is located at the boundary of the northern and southern parts, introducing the mineral distribution characteristics of this part of the mining area and then explaining how geological movements shaped this mineral-rich area.

2. Distribution and formation

Tibet is located in the south-west corner of China, and it can be recognized as the steepest area within the territory of China. Many famous high-altitude landscapes, such as the Qinghai Tibet Plateau and part of the Himalaya Mountains, are located right here. So, it is not surprised that there was a rich mineral

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resource hidden under the surface of Gangdise. However, when the mysterious veil of Gangdise metallogenic belt was lifted, many doubts were following at the same time: what does it really look like and what made it? The article is going to carry on the detailed discussion on these two aspects.

The type of ore body in Chengba copper mine can be mainly described as a stratiform-like one, which means the whole ore body is generally layered, but the mineral aggregates in the middle are clumped together. In general, the main part of Chengba copper mine on the ground is located form north east to south west. As for the mineral compositions that comes out from Chengba copper mine, the output for the vertical layers of Chengba copper mine are surprisingly the similar. The types of useful ore minerals are impregnation structure and block texture. Copper is the main ingredient of these minerals.

Also, zinc and bismuth are other two common elements that can be discovered in Chengba copper mine. For the useless mineral deposits, known as the gangue mineral, the main component of it is skarn. But the elements consist in it is quite different from the useful ore minerals: the ore forming elements in the gangue mineral, the skarn, varied as the altitude changes: when the altitude is higher than 4500 metres, copper is the most common element that can be seen in the skarn, with only a small amount of molybdenum element. Below 4500 metres, the concentration of molybdenum increases. Some copper minerals even combine with molybdenum, and forming a type of symbiont. Below 4200 metres, some element called bismuth are discovered partially.

The outcrop mines in the diggings are in a northeast-southwest trend. The lithology is deep gray silty slate. The underground subterrane, with a thickness of nearly 1400 m, is covered by layers of sandstone. There are many interlayers in the upper sandstone, and in these interlayers, many ancient plant and animal fossils have been found. The magma in the mine lot is still active. Part of the granodiorite and small rock stubs are exposed to the air in some areas of the mine lot, according to Figure 1.

Figure 1. The Granodiorite.

The skarn ore bodies in the northern part of Gangdise metallogenic belt are obviously hosted by the formation which means these minerals are usually founded between two layers of stratum, and they are usually mixed with carbonates and clastic rocks. The skarn mine in this area has already shown outstanding output: the amount of copper in these ore bodies has already reached 5,000,000 tons, which is also a remarkable figure in the world [1].

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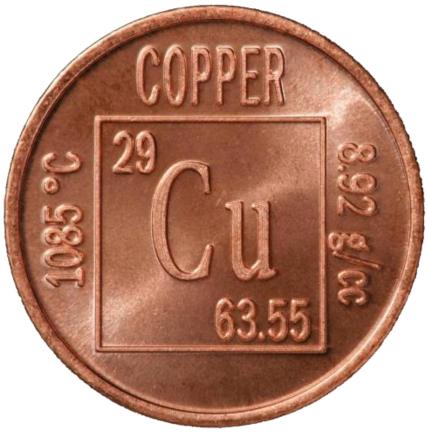

Figure 2. The Copper Element.

Therefore, what geologic activity moulded the Gangdise metallogenic belt in Tibet forming the shape we see right now? Actually, it was due to the movement between two plates, one is called the Indian Plate, and the other is called Eurasian Plate. Gangdise is coincidentally located in the plate boudaries of these two continents. These two continents are moving in opposite direction due to the thermal convection within the earth. Therefore, these two plates are unavoidable to collide together. And this did happen in Gangdise, Tibet, and formed the Gangdise metallogenic belt [2].

When India Plate converged with Eurasian Plate, these two continental shelves compressed each other. At the boundary of India Plate and Eurasian Plate, they stuck together, resulting in the stratum for each continental tangled together and formed the Nappe tectonic system. This geologic movement exerted stress on the stratum and caused the movement of different layers[3-6]. And due to the difference in the rock physical properties, such activity caused the relative slide, some layer went over anther, and some went under another, forming interlayer-gliding facture zone. This series of geological movements altered the original distribution of ore body for the boundary between India Plate and Eurasian Plate, and formed the main ore bearing site of skarn type deposit in Gangdise metallogenic belt right now, this process is also called the the main collision phase.

At the same time, some denser stratum which was pushed up by other layers started to fall down due to gravity. These heavier stratum put pressure on lower lighter stratum, which caused many lower layers are pressed and crashed, the rocks in these stratum were more broken and deformed [7, 8]. So the formation of the ore bodies in Gangdise metallogenic belt cannot be simply attributed to a single reason. However, one thing is needed to be mentioned, during the movement of different stratum in the main collision phase, some stratum in the continental lithosphere were split up due to the friction with other layers, and magma contentiously rose up through the gaps that formed in these broken stratum, after magma crystallized again and over again, they have also become a source of producing minerals here.

3. Conclusion

The discovery of a skarn-type ore body in the Gangdise metallogenic belt shows that the geological movement of two continents, the India Plate and the Eurasian Plate, known as the main collision phase here, can already form its own individual mineral deposit. It is also worth mentioning that some granodiorite has been found in the deep boreholes of some exploration lines, which means that there may be large-scale granodiorite in the deep part of the mine. However, as to whether this hypothesis is true, this paper did not carry out further investigation; there are still many subsequent experiments needed to prove my point of view.

Right now, the original ore body model (model of deposit association from deep to shallow) is no longer referable and too old to use. As more minerals and elements have been indicated and more research has been done, it is believed that the model of the ore body in the Gangdise metallogenic belt will be updated in the future.

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