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Re-Os Isotopic Dating of Molybdenites in the Galale Skarn Cu-Au Deposit in Tibet and Its Geological Significance

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1 Introduction

The Galale gold-copper deposit is a very important skarn deposit which located in the west part of Bangong Co-Nujiang River suture zone. It is the typical mineralization event during the collision stage of the tectonic evolution of Bangong Co-Nujiang River suture zone (Tang et al., 2013; Zhang et al., 2013a, 2014). Tang et al. (2013) proposed that Galale and Gaerqiong deposit were the products of the same tectonic setting-magma-mineralization event which got the evidence of the study of the magma dating and lithogeochemical characteristics (Yao et al., 2013; Tang et al., 2013; Zhang et al., 2013b). But the mineralization age of the Galale deposit was still a serious problem that had not been resolved all the time, so this paper based on the summary of the geological characteristics of Galale deposit to determine the mineralization dating by using the Re-Os isotopic dating method, giving constraint for the source of minerals, investigating the mineralization dynamics background and regional prospecting significance.

2 Geological Setting

The Galale gold-copper deposit located in the Cuoqin-Shenzha magmatic arc of the Bangong Co-Nujiang River suture zone. The outcropped strata in the Galale district are mainly made up of the Cretaceous Langjiu Group (K_1l), Cretaceous Jiega Group (K_1jg) and the Quaternary (Q). The Jiega Group strata are mainly made up of dolomite, dolomitic marble and limestone. The geological conditions show that there exists genetic connection between the dolomite or dolomitic marble and the mineralization. The Langjiu Group strata are mainly made up of rhyolitic-

dacitic volcanoclastic rocks and trachyandesites.

There develops a set of intermediate-acidic intrusive rocks which are mainly made up of Diorite, granodiorite, quartz diorite and granite porphyry in the district. The granite porphyry is dikes while the other intrusive rocks are stocks, the emplacement activities of the granodiorite has close relationship with the mineralization. Zhang et al. (2014) determined the age of the granodiorite by using the laser ablation-inductively coupled plasma - mass spectrometry (LA-ICP-MS) zircon U-Pb dating method and got the result of diagenetic age with 88 ± 1 Ma (MSWD=0.56). It indicated that the mineralization occurred in late Yanshanian and the tectonic setting was the collision stage of the tectonic evolution of Bangong Co-Nujiang River suture zone.

There exists four faults and the boundary of all the faults has not been ascertained. The F1 fault (NE-SW) and F2 fault (NW-SE) were formed after the mineralization and gave damaging effects to the orebody while the F3 fault (NE-SW) and F4 fault (N-S) were still having the uncertain relationship with the mineralization.

Ten orebody had been found in the district and the main orebody were composed of KT2, KT3, KT4 and KT8. The gold resource has already reached large-scale. So far, the main orebody that had been found were all the skarn type orebody which were outputted the contact zone between the granodiorite and the dolomite or dolomitic marble with layered, layered, lenticular and irregular shape. Zhang et al. (2013b) conducted the research for the skarn mineral characteristics and indicated that the skarn minerals mainly included olivine, serpentine, pyroxene, phlogopite, tremolite, garnet, epidote and brucite, and the skarn mineral assemblage is a typical magmatic skarn associated with calcareous skarn mineral of andradite. The metallic minerals mainly included magnetite, natural gold,

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chalcopyrite, bornite, chalcocite, and molybdenite. The wall rock alteration of the deposit mainly appeared skarnized, silicified, propylitization, hornfels, sericitization, kaolinization, etc.

3 Samples and Analytical Methods

The samples of molybdenite were collected from the drilling of the Galale gold-copper deposit. Six samples were collected from the different depths of the ZK42 and two samples were collected from the different depths of the ZK21.

After crushing rock samples, the molybdenites were separated by gravitational and electromagnetic methods, the monominerals of molybdenite were selected to more than 99% purity under microscope to use for analyzing and testing. Re-Os isotope analyses were performed at the Re-Os Isotopic Laboratory, National Research Center of Geoanalysis of Chinese Academy of Geological Sciences in Beijing. The analytical instrument used in the test was inductively coupled plasma-mass spectrometer TJA X-series ICP-MS. Sample processing procedure and mass spectrometric techniques can see the related references (Du et al., 1994, 2001). The blank level is much less than Re and Os content of tested samples in whole process of this experiment, which will not affect the accurate determination of test results (Du et al., 2004).

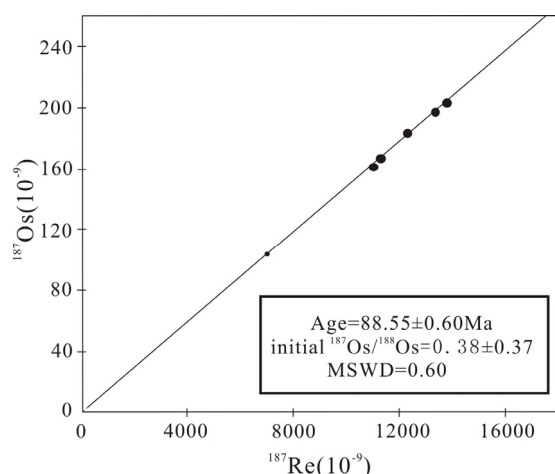


Fig 1. Re-Os isochron ages of molybdenites from Galale deposit

4 Analytic Results

The testing results of the Re-Os isotopic dating show that the ^{187}Re contents of molybdenites were 18.44-133.1ppm; there ^{187}Os contents of molybdenites were 27.7-203ppb. The model ages of molybdenites varied from 88.19Ma to 90.11Ma, and the weighted average age was

$89 \pm 0.48\text{Ma}$ (MSWD=0.80). The isochron ages of molybdenites were calculated by software Isoplot, the obtained results was $88.55 \pm 0.60\text{Ma}$ (MSWD=0.60), and the initial $^{187}\text{Os}/^{188}\text{Os}$ was 0.38 ± 0.37 (Fig 1).

5 Discussion

In this study, the Re contents of the 8 molybdenites were 29.33-218.6ppm and the average contents of these molybdenite is 143.77ppm, indicating that ore-forming materials of Galale gold-copper deposit mainly has the characteristics of mantle materials (Mao et al., 1999; Stein et al., 2001) and mixed with a small amount of crustal materials. The Re-Os testing results showed that the isochron ages of different molybdenites were $88.55 \pm 0.60\text{Ma}$, the result is consistent with the zircon U-Pb dating result of the granodiorite (Zhang et al., 2014), indicating that the deposit was formed in the late Cretaceous. The diagenetic age and the mineralization age is close to the Gaerqiong deposit and indicated that they were the products of the same tectonic setting-magma-mineralization event of the tectonic evolution of Bangong Co-Nujiang River suture zone. The comprehensive research showed that there existed 90Ma strong mineralization in southern edge of the Bangong Co-Nujiang River suture zone.

6 Conclusions

(1) The Re-Os testing results showed that the isochron ages of different molybdenites were $88.55 \pm 0.60\text{Ma}$, indicating that the deposit was formed in the late Cretaceous. The comprehensive research showed that Galale deposit and Gaerqiong deposit were the products of the same tectonic setting-magma-mineralization event, they were the typical mineralization event during the collision stage of the tectonic evolution of Bangong Co-Nujiang River suture zone.

(2) The Re contents of the molybdenite were 29.33-218.6ppm and the average contents of these molybdenite is 143.77ppm, indicating that ore-forming materials of the deposit mainly has the characteristics of mantle materials.

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