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Re-Os and U-Pb Ages of the Sifangdianzi Molybdenite Deposit in Central Jilin Province, NE China

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1 Introduction

Central Jilin Province is located on the continental margin of NE China, along the eastern edge of the Xing–Meng orogenic belt. In recent years, at least 10 Mo deposits of various size have been discovered in the area; this makes it the second-richest concentration of molybdenum resources in China, a fact that has attracted a large amount of research interest in the mineralization of the area. Deposit geological characteristics and metallogenic chronology has previously been researched. As a deposit studies the important problem, metallogenic age is to solve the important approach of ore genesis, also conduce to discuss temporal and spatial distribution rule and evolution characteristics of deposits in the area.

The Sifangdianzi Mo deposit is located in central Jilin province, NE China, which is the first quartz-vein type molybdenite deposit discovered in recent years in the Jilin province. The medium-sized sacle reserves, can be studied as a typical quartz vein type molybdenum deposit. Strengthening this Mo deposit research is not only beneficial to enhance the understanding of the quartz vein type Mo deposits, but also play an important guiding significance in the further prospecting. The scientific researches of the deposit are relatively poorer and little is known of the ages of the mineralization events. Therefore, we have carried out zircon U–Pb dating and molybdenite Re–Os dating from Sifangdianzi Mo deposit, with the aim to obtain the mineralization age and provide scientific basis to constraint on the metallogenesis.

2 Geological Characteristics of the Deposits

The geology of the Sifangdianzi Mo deposit district is dominated by tuff of the Nanloushan Formation and Quaternary sediments, which were intruded by batholiths or stocks of monzogranite and quartz diorite. The Sifangdianzi major orebodies are associated spatially with the monzogranite. The Mo mineralization mainly occured in the fractures of the monzogranite stocks. The orebodies are mainly veins in form, part of which are branching, composite and uncontinuous along the strike. So far, seven Mo orebodies have been discovered in the mineralized zone. The individual orebodies have a length of 180–3100 m, and a thickness of 0.1–8 m. The Mo grade of the deposit ranges from 0.04% to 0.71%. 90% of the reserves of the deposit are contained in the I orebody. The I orebody is the largest orebody in the mineralized zone and have a length of about 3500 m and a thickness of 0.1 m to 8 m, with average Mo content of 0.59%. The ore structures are mainly vein, and the main metal minerals in the ores are molybdenite, magnetite and pyrite. The gangue minerals are quartz, feldspar and biotite. Wall-rock alteration is well developed in the mining area, including silicification, kaolinization, chloritization and carbonatation. Mineralization can be divided into three stages: quartz-vein stage, quartz–molybdenite–pyrite stage and quartz–carbonatation stage.

3 Results

3.1 Zircon LA–ICPMS U–Pb age data

These zircons contain U and Th concentrations of 158.06 to 1539.31 ppm, and 83.58 to 732.71 ppm, respectively, Their Th/U ratios (0.41 to 0.75) are typical of magmatic genetic origin. Zircon grains concordant U–Pb ages can divide into 2 group. 16 analyses have $^{206}Pb/^{238}U$ ages of 177–181 Ma, weighted mean age of 179.63 ± 0.98Ma (N = 16, MSWD=0.36), 1 analyses have $^{206}Pb/^{238}U$ ages of 211 Ma (N = 1).

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3.2 Molybdenite Re–Os dating

Five molybdenite samples yield model ages ranging from 175 – 176 Ma, with a well–defined ^{187}Re–^{187}Os isochron age of 176.6 ± 4.2 Ma (MSWD=0.5) and a weighted mean model age of 176.1 ± 1.1 Ma, with an initial ^{187}Os of -0.02 ± 0.19 ppb. The nearly identical model and isochron ages suggest that the analytical results are reliable.

4 Discussion

4.1Magmatism and metallogenesis

The zircons from monzogranite of the Sifangdianzi Mo deposit have two group concordant U–Pb ages (179.63 ± 0.98 Ma and 211 Ma). These data indicate that many magmatic episodes occurred in this area. These frequent magmatic activities provide rich sources of elements for the formation of mineral deposits, and lead to the unique mineralization event in this area. The LA-ICP-MS zircon age of 179.63 ± 0.98 Ma for the monzogranite shows that the granite emplaced during the Early Jurassic. There may be a small interval (approximately 3 million years) between the emplacement age of intrusions (179.63 ± 0.98 Ma) and the Mo mineralization ages (176.6 ± 4.2 Ma). These age data suggest that the Mo mineralization in the Sifangdianzi Mo deposit may be associated with the monzogranite magmatic intrusion.

4.2 Two stages of mineralization in Jilin Province

The zircon U–Pb ages and Re–Os isochron ages of the quartz vein from Sifangdianzi Mo deposit is not only the age of the deposit, but also indicate that the Mesozoic is an important age of metallogenesis in Jilin Province. The Mesozoic Mo deposits are widely distributed in Jilin Province, the geochronology data of which demonstrate that Early Jurassic (196.9-186Ma) and Middle Jurassic （176.6-166.9 Ma）represent a peak in the large-scale Magmatism and metallogenesis. The Middle Jurassic is the strongest mineralization stage.

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