New Insights into the Indosinian Mineralization in the Nanling Range: Evidence from the Gaoling Tungsten Deposit

ZHANG Di, ZHANg Wenlan, WANG Rucheng, HUA Renmin and CHEN Wendi

State Key Laboratory for Mineral Deposits Research, School of Earth Sciences and Engineering, Nanjing University, Nanjing 210023, PR China.

Most W-Sn-(Mo) deposits in South China are closely associated with the Jura-Cretaceous granitic intrusions. However, recent studies have identified the Triassic tungsten mineralization in the Western Nanling Range (Li et al., 2012; Wu et al., 2012; Yang et al., 2013).

The Miao’ershan–Yuechengling intrusive complex is the largest granitic batholith in the Western Nanling Range with an exposure area of more than 3000 km². Available geochronological data indicates that this complex formed by repeated intrusive activities in the Silurian-Devonian (435-382 Ma) and late Triassic (ca. 220 Ma). There are more than 100 tungsten, tin and rare metal deposits and occurrences in the periphery of this batholith. Among them, the Youmaling tungsten deposit is located in the southeastern margin of the Miao’ershan pluton. This deposit consists of four mineralization styles (Fig. 1): quartz-vein (type 1), mineralized skarn (type 2), fracture-infillings (type 3) and W-bearing-greisen (type 4) (Yang et al., 2013).

The Gaoling tungsten deposit occurs in the northern part of the Youmaling mine and is dominated by vein type mineralization. The quartz veins are about 0.1 to 1.2 m wide and 300 m long. They strike NNE and dip 75°- 80° to southeast. The mineralization is hosted in medium- and fine-grained two-mica granite that consists of quartz (30%~35%), K-feldspar (25%~30%), plagioclase (25%~30%), muscovite (8%) and biotite (5%). The accessory minerals are mainly apatite, zircon, monazite, xenotime, allanite and uraninite.

The ore minerals are mainly wolframite and scheelite, with subordinate columbite, pyrite, chalcopyrite and molybdenite. The gangue minerals are mostly chlorite, quartz and calcite. The ore-related alteration mainly includes greisenization, chloritization and pyritization. Tungsten mineralization took place in two stages: high-temperature wolframite formation and low-temperature scheelite formation.

The wolframite \[(Fe_{0.84}Mn_{0.21})_{1.05}(Nb_{0.01}W_{0.98})_{0.99}O_4\] is brownish black, lath shaped, and has high Fe/Mn ratios indicating its formation at a high temperature condition. The scheelite is pale yellow and paragenetically associated with pyrite, chalcopyrite and molybdenite. It occurs as dissemination and is commonly present as interstitial grains between the wolframite crystals (Fig. 2).

* Corresponding author. E-mail: zhangdi900418@126.com
Twenty-three zircon grains from the host rocks were analyzed to constrain the emplacement age of the granite. Uranium concentrations of the zircon are highly variable, ranging from 1193 to 10338 ppm. Thorium contents range from 718 to 2615 ppm, and the Th/U ratios vary between 0.24 and 0.95. The U-Pb isotopic analyses give a single and concordant group with a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 220.2 ± 1.6 Ma (MSWD = 0.72), which is interpreted as the emplacement age of the host rocks.

Six scheelite samples were collected from the Gaoling tungsten deposit for Sm-Nd isotope analysis and provide constraints on the age of the deposit. The Sm and Nd contents of scheelite separates range from 11.6 to 94.2 ppm and 23 to 204 ppm, respectively. They yield a Sm-Nd isochron age of 212 ± 20 Ma (MSWD = 0.52). This age is broadly consistent with molybdenite Re-Os model ages of 215.3 to 227.3 Ma (Li et al., 2012), indicating that the Gaoling tungsten deposit formed in the late Triassic.

The scheelite Sm-Nd age, despite the large errors, is within the analytical uncertainties consistent with the emplacement age of the granite, indicating that the mineralization is directly related with the granite. Results from this study demonstrated the Triassic tungsten mineralization in the Western Nanling Range and thus provide a better understanding in the timing of W-Sn mineralization in the region.

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References

