Ore Geology Reviews 95 (2018) 1161–1178

Contents lists available at ScienceDirect

Ore Geology Reviews

journal homepage: www.elsevier.com/locate/oregeorev

Multiple dating and tectonic setting of the Early Cretaceous Xianglushan W deposit, Jiangxi Province, South China

Pan Dai[a], Jingwen Mao[a], Shenghua Wu[a,b,*], Guiqing Xie[a], Xiaohong Luo[c]

[a] MLR Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing 100037, China
[b] Center of Deep Seep Research, Institute of Oceanology, Chinese Academy of Sciences, Qingdao 2666071, China
[c] Northwestern Geological Team, Jiangxi Bureau of Geology, Mineral Resources, Exploration and Development, Jiujiang 332000, China

ARTICLE INFO

Keywords:
Zircon U–Pb
Molybdenite Re–Os
Muscovite $^{40}Ar/^{39}Ar$
Hf isotopes
Xianglushan W deposit
Jiangnan porphyry–skarn W belt

ABSTRACT

The Xianglushan W deposit in northwestern Jiangxi Province, South China, is one of numerous large-size W deposits along the northern margin of the Jiangnan Massif. The deposit comprises lenticular and stratiform-like orebodies, mainly along the contact between argillaceous limestone of the Cambrian Yangliugang Formation and a biotite granite pluton. The mineralization is zoned from proximal W greisen within the cupolas of the biotite granite, through W skarn and sulfide-scheelite bands near the pluton, to distal quartz-sulfide ± scheelite veins. The granitic pluton and an aplitic dyke in the mining area contain zircon grains with U–Pb ages of 123.8 ± 0.8 Ma and 117.3 ± 1.7 Ma, respectively. Six molybdenite samples collected from skarn ores yielded a Re–Os weighted mean age of 125.5 ± 0.7 Ma, and muscovite separates from greisen ores yielded a $^{40}Ar/^{39}Ar$ plateau age of 122.8 ± 0.78 Ma. The molybdenite Re–Os and muscovite Ar–Ar ages are consistent with the zircon U–Pb age of the hosting granite. The Xianglushan deposit is formed by an Early Cretaceous W–dominated polymetallic ore-forming event in the Jiangnan porphyry–skarn W belt. Zircon from biotite granites in the Xianglushan deposit has negative $\varepsilon_{Hf}(t)$ values, generally from − 5.7 to − 3.1, with corresponding two-stage Hf model ages of 1363–1218 Ma, reflecting derivation of magmas from a crustal source. Molybdenite has Re contents from 12.12 to 22.77 ppm, indicative of a mixed crustal-mantle source, but with a dominantly crustal component. A compilation of precise ages for magmatism and mineralization in the Jiangnan porphyry–skarn W belt shows that there are two stages of mineralization at 150–135 Ma and 130–120 Ma, respectively. Integrated with published data, our results suggest that the Xianglushan W deposit formed in an extensional tectonic setting during the Early Cretaceous.

1. Introduction

South China is the world's most W-rich region, and many researchers have paid much attention to the large-scale metallogeny of the Nanling region, central part of South China (Mao et al., 2007; Hu and Zhou, 2012; Zhao et al., 2013, 2017b; Wu et al., 2017). In recent years, a new Yanshanian porphyry and skarn W belt, namely the Jiangnan porphyry–skarn W belt (JNB), has been recognized along the northern margin of the Jiangnan Massif. This new belt is to the south of the Middle-Lower Yangtze River porphyry–skarn Cu–Au–Mo–Fe ore belt and is hereinafter referred to as the YRB (Fig. 1a and b). The JNB extends from northern Jiangxi Province to southern Anhui Province, and hosts the Zhuxi W–Cu deposit (the world's largest W deposit; Pan et al., 2017), Dahutang W deposit (Mao et al., 2013b, 2015), Xianglushan W deposit (Wu et al., 2012), and Yangchuling W–Mo deposit (Mao et al., 2017) in northern Jiangxi Province; and the Dongyuan W–Mo deposit (Zhou et al., 2011), Xiaoyao W–Ag–Zn–Pb–Cu–Mo deposit (Tang et al., 2014), Baizhangyan W–Mo deposit (Li et al., 2015), and Zhuxiling W–Mo deposit (Chen et al., 2013) in southern Anhui Province (Fig. 1b). The importance of the belt promotes the necessary of the study of mineralization, magmatism, geological setting, and metallogenic systems of the belt. Although these deposits in the JNB have been recently investigated (Song et al., 2012a,b; Mao et al., 2013a,b, 2015), the ages and tectonic setting of mineralization are still not well-known, especially for those deposits comprising stratiform-like orebodies.

The Xianglushan skarn W deposit was discovered by the Geological Survey Team of the Jiangxi Bureau of Geology in 1958. Further work was done by the 706 Team of the Geophysical Exploration Brigade of the Jiangxi Bureau of Geology, and later by the No. 916 Geological Team during the period from 1977 to 1984. The deposit has been mined since 1993, and has measured reserves of ~220,000 tons of WO_3 with

* Corresponding author at: Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing 100037, China.
E-mail address: shenghuage@sina.com.cn (S. Wu).

https://doi.org/10.1016/j.oregeorev.2017.11.017
Received 8 September 2017; Received in revised form 19 November 2017; Accepted 19 November 2017
Available online 21 November 2017
0169-1368/

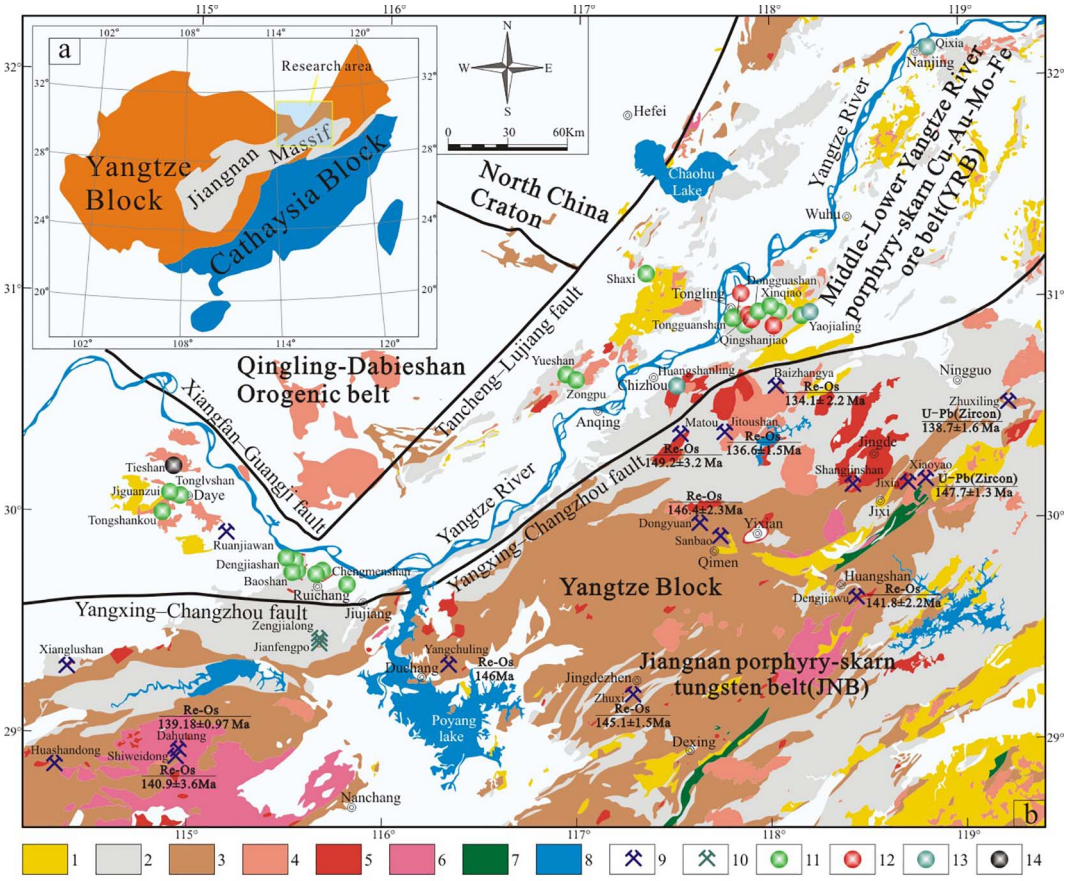

Fig. 1. Map showing the distribution of mineral deposits along the Middle-Lower Yangtze River porphyry–skarn Cu–Au–Mo–Fe ore belt (YRB) and Jiangnan porphyry–skarn W belt, modified after Mao et al. (2017).

an average grade of 0.641%. Although the deposit has been mined for a long time, very little research work has been done (Tian and Yuan, 2008; Zhang et al., 2008; Wu et al., 2014) and no precise ages for mineralization have been reported. Zhang et al. (2008) obtained Rb–Sr isochron ages of 128 ± 3 Ma and 126.2 ± 2.6 Ma for quartz and whole-rock biotite granite, respectively, and a Sm–Nd isochron age of 121 ± 11 Ma for scheelite. They suggested that the mineralization at Xianglushan formed at 130–120 Ma. However, the Rb–Sr isotopic system is easily disturbed by later thermal events, so it is still necessary to obtain precise ages for magmatism and mineralization. In this study, we describe the basic geology and mineralization of the deposit, and present LA–ICP–MS U–Pb ages and Hf isotopic compositions of zircon from felsic intrusions, and molybdenite Re–Os ages and muscovite $^{40}Ar/^{39}Ar$ ages from W ores. Our objectives are to constrain the ages of magmatism and mineralization, and the genesis of the deposit, and to discuss the geodynamic setting of the mineralization.

2. Geological background

2.1. Regional geology

The South China Block consists of the Yangtze Block in the northwest and the Cathaysia Block in the southeast (Fig. 1a), which were welded together along the Jiangnan Fold Belt, or the Jiangnan Massif, during Neoproterozoic time (Zhao et al., 2011; Luo et al., 2017; Faure et al., 2017). The YRB is located along the Middle-Lower Yangtze River Valley at the northern margin of the Yangtze Block (Fig. 1). The Xiangfan–Guangji and Tancheng–Lujiang faults mark the northern margins of the belt, separating it from the Qinling–Dabieshan orogenic belt and North China Craton, respectively. The southern margin of YRB is defined by the Yangxing–Changzhou fault. The Jiangnan Massif, south of the YRB and the Yangxing–Changzhou fault, is the southeastern part of the Yangtze Block. The massif is ENE trending and ~120 km wide by ~1500 km long (Faure et al., 2017; Wang et al., 2007).

There are two sedimentary successions separated by an unconformity in the region of Jiangnan Massif. The sedimentary successions below the unconformity comprise the Shuangqiaoshan Group in northern Jiangxi Province, and the coeval Shangxi Group in southern Anhui Province (Wang and Li, 2003). The Shuangqiaoshan Group is mainly a thick pile of flysch composed of pelite and sandstone, with volcaniclastic rock (Wang et al., 2008). Recent studies suggest that this Group is Neoproterozoic in age (Wang et al., 2008). The Neoproterozoic sedimentary strata above the unconformity, the Dengshan Group, in northeastern Jiangxi Province, are mainly composed of sandstone, slate, conglomerate, and pelite, and lesser carbonate, spilite, and volcaniclastic rock (Wang and Li, 2003; Wang et al., 2007). The sedimentary cover above the Neoproterozoic sedimentary strata in the area