The Dongleiwan Cu–Mo–Au skarn deposit is located in the northwest of the Jiujiang–Ruichang ore concentration area. In this study, molybdenite Re-Os dating and zircon U-Pb dating are used to constrain the time of mineralization and ore-related magmatic activity in the Dongleiwan deposit. In combination with existing geochronological results, our new data provide important information on the spatial–temporal distribution of Cu–Mo–Au polymetallic deposits in the Jiujiang–Ruichang ore concentration area.

1 Deposit Geology

The deposit is tectonically located in the northern margin of the Yangtze Block. It lies within the Jiujiang–Ruichang ore field and is part of the Daye–Jiujiang metallogenic sub-belt of the middle–lower Yangtze River metallogenic belt. Strata exposed within the deposit area include Permian Changxing Formation, Triassic Daye Formation and Jialingjiang Formation, and Quaternary sediments. The northern part of the deposit is the Miaomushan Anticline and the central part is the Dongleiwan Syncline. There are seven large-size fracture zones within the area, where mineralization is widely developed. The Dongleiwan complex pluton is related to mineralization, comprising granodiorite in the center, coarse-grained granodiorite-porphyry in the transition and quartz–diorite–porphyry in the margin. Dykes are very common in the deposit area.

The deposit can be divided into two ore zones. The north ore zone is located in the north limb of the syncline with widely distributed chalcopyrite and pyrite mineralization; the south ore zone lies in the south limb. Disseminated pyrite and malachite are observed locally. Ore structures include massive and disseminated structures; ore textures are mainly hypidiomorphic-granular texture and metasomatic relict texture. Main metal minerals are chalcopyrite, pyrite, bornite, molybdenite and scheelite, with minor sphalerite and bismuthinite; gangue minerals include garnet, quartz, chlorite, diopside, calcite, and fluorite. Wall rock alterations consist of skarnization, chloritization, epidotization and carbonatation. The skarnization is the most commonly observed and closely related to mineralization. Ore-forming process of the deposit can be divided into four stages: (1) skarnization stage in which garnet, diopside and other anhydrous silicates were formed; (2) retrograde alteration stage in which phlogopite, epidote, chlorite and tremolite and magnetite were formed; (3) quartz sulfide stage which is the most important stage for mineralization of copper and molybdenum within this deposit; and (4) carbonate stage, which is dominated by calcite, pyrite and chlorite composition.

2 Results

Most of zircons from the granodiorite porphyry are colorless and transparent, mainly occurring as long– and short– columnar shapes and featuring typical oscillatory zonings. The long-columnar crystal form and oscillatory zoning indicate that the zircons are magmatic zircons. The Th/U ratio is 0.44–0.89, more than 0.4 which further proves that the zircons are magmatic zircons (Hoskin et al., 2003). In the U–Pb concordia plot, all the measured points are near to the concordant curves with over 95% concordant degree. The 206Pb/238U weighted average age of 17 zircons is...
142.24±0.52Ma, which represents the crystallization age. This indicates that the Dongleiwan pluton was formed in early Cretaceous.

The Re contents of six molybdenite samples fall within the range between 34084±339 and 57900±515 (×10⁻⁹) and the ¹⁸⁷Re contents between 21422×10⁻⁹ and 36391×10⁻⁹. The ¹⁸⁷Os content varies from 52.32×10⁻⁹ to 88.18×10⁻⁹. The model ages of these samples fall within the range from 144.8 to 147.1Ma, with a minor span of merely 2.3Ma. The isochron age is 143.3±5.2Ma (MSWD=0.35) while the weighted average age is 146.12±0.97Ma (MSWD=0.41). Initial ¹⁸⁷Os of the samples calculated by the intercept on the ¹⁸⁷Os axis is nearly zero with uncertainty, indicating that the model age measured with the contents of ¹⁸⁷Re and ¹⁸⁷Os in molybdenite is reliable. The weighted average age is in excellent agreement with the isochron age, which indicates the above mentioned ages are reliable. The molybdenite samples from the main mineralization stage can represent the mineralization age of the Dongleiwan deposit.

3 Discussions and Conclusions

The obtained weighted average age of zircons from Dongleiwan pluton is 142.24±0.52Ma, and the isochron age of the six molybdenite samples is 143.3±5.2Ma. These ages effectively constrain the rock– and ore–forming ages, indicating that the formation of the Dongleiwan pluton and the mineralization of this deposit occurred in early Cretaceous, and the mineralization was closely related to the Dongleiwan pluton. Previous researches have revealed that the zircon U-Pb age of typical ore-bearing magmatic rocks within the Jiujiang–Ruichang ore concentration area is between 138~146Ma. This rock-forming age is very close to the mineralization age (137~146Ma) for all other ore deposits in the area, which implies that ore deposits within this ore concentration area also have close genetic relationship with ore-bearing magmatic rocks.

The Dongleiwan deposit is closely related to granodiorite-porphyry in terms of time, space and genesis. The rock– and ore–forming processes should be formed in a same tectonic setting, which corresponds to the transition of the major stress field from NE to EW in East China (155~130Ma)(Ren et al., 1999; Niu et al., 2003). In addition to the Dongleiwan deposit, the late Jurassic and early Cretaceous metallogenic event in the middle and lower Yangtze River metallogenic belt seemed to be completely controlled by the ancient Pacific tectonic domain and was product of the complete intraplate activation of the extension mechanism after the tectonic regime transition which resulted in magmatic–metallogenic explosion (Xing et al., 2008).

References


