1 Introduction

Globally, skarn Fe deposits are the most important type of skarn mineralization (Meinert et al., 2005). The relationship between skarn deposits and intrusions is an important subject for the petrogenesis of skarn deposits and mineral exploration. However, whether skarn Fe deposit is associated with granitic or diorite magmatism is still controversial (e.g., Xie et al., 2006). The Chengchao deposit located within the Edong ore district, is the largest skarn Fe deposit in the Middle–Lower Yangtze River Valley Metallogenic belt (hereafter referred to as the MLYRB; Shu et al., 1992), and provides a good sample for studying the relationship between Fe mineralization and magmatism.

2 Regional and Ore Geology

The MLYRB is located within the northern margin of the Yangtze Craton, to the southeast of the North China Craton and the Qinling–Dabie orogenic belt. The Edong ore district is located within the westernmost part of the MLYRB. Cambrian–Middle Triassic marine carbonates, clastic rocks, and flysch-type sedimentary successions are widespread in this area. Locally exposed Late Triassic–Middle Jurassic clastic sedimentary rocks, and the Early Cretaceous volcano-sedimentary rocks also present in the study area (Shu et al., 1992). The Edong ore district contains the Echeng, Tieshan, Jinshandian, Lingxiang, Yangxin, and Yinzu plutons. The Echeng pluton associated with the Chengchao Fe deposit, is located in the northernmost part of the area and contains granite, monzonite, and minor quartz diorite. Fe-bearing skarn deposits in the Edong ore district are mainly located along contacts between Early Triassic carbonates and late Mesozoic granitoids at intersections of faults and folds that trend NW–SE to NWW–SEE.

The Chengchao Fe deposit is located along contacts between Early Triassic carbonates of the Daye Formation, and porphyritic quartz monzonite and granite intrusions (e.g., Zhai et al., 1992), with minor orebodies being located along contacts between granite, porphyritic quartz monzonite, and diorite intrusions. NWW–SEE-trending folds and faults within the deposit control the distribution of individual magnetite orebodies within the deposit.

3 Relationship between Fe Mineralization and Granitic Rocks

The geological, geochronological, geochemical and mineralogical evidences indicate that the porphyritic quartz monzonite and granite intrusions in the Chengchao Fe deposit are spatially, temporally, and genetically associated with Fe mineralization.

Firstly, Compositional zoned skarns are generally
developed along contacts between porphyritic quartz monzonite and granite intrusions, and carbonate units within the Chengchao deposit. This indicates that the formation of the Chengchao skarns was associated with the porphyritic quartz monzonite and granite intrusions.

Secondly, significant volumes of brecciated porphyritic quartz monzonite and granite are observed within the orebodies, and a porphyritic diabase dike cross-cuts the orebody, indicating that Fe mineralization occurred during the interval between the porphyritic diabase, and the porphyritic quartz monzonite and granite. The LA–ICP–MS zircon U–Pb data indicate that the ages of Chengchao porphyritic quartz monzonite, granite and porphyritic diabase are 129 ± 1, 128 ± 1 and 126 ± 1 Ma, respectively, suggesting that Fe mineralization may have occurred between 129 ± 2 and 126 ± 1 Ma. This is consistent (within error) with the age of the Chengchao Fe mineralization (132.6 ± 1.4 Ma; Xie et al., 2012), indicating that the intrusions and mineralization are temporally related.

Thirdly, the LA–ICP–MS zircon U–Pb ages of Chengchao porphyritic quartz monzonite and granite are consistent (within errors) with ages (127–133 Ma) of diorites, quartz diorites, and granites associated with skarn Fe deposits (133–132 Ma) in the Edong ore district (Xie et al., 2012).

Fourthly, the andradite end-member composition of early-formed garnets (Yao et al., 2012), and Al₂O₃ and SiO₂ concentrations of early-formed magnetite in skarns and ores decrease from the granite to the hornfels zone, indicating a genetic relationship between the porphyritic quartz monzonite and granite, and Fe mineralization.

Fifthly, REE geochemical features of Chengchao granite and porphyritic quartz monzonite are similar to those of garnets, epidote and magnetite ores (Xia et al., 2009), indicating that granitic rocks are associated with Fe mineralization.

4 Conclusions

On the basis of zircon U-Pb ages, mineralogical, geochemical and geological evidence, we proposed that the Chengchao porphyritic quartz monzonite and granite, and Fe mineralization are spatially, temporally, and genetically related.

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References


