The Budunhua copper deposit, a medium-sized (0.2 to 0.5 Mt) deposit, is located in the northeastern Tianshan-Tuquan copper-polymetallic metallogenic belt of the southern Great Xing’an Range. The deposit consists of the Kongqueshan ore block in the north and in the Jinjiling ore block in the south, with the Budunhua composite stock occurring at the boundary between the blocks. Several previous geological and geochemical studies have attempted to characterize the mineralization in this deposit, most of which were published in Chinese (e.g., Jin and Pang, 1983; Shen and Fu, 1999; Liu, 2001; Xiao, 2008; Feng, 2010; Wu et al., 2012). Some of the previous studies suggest that this deposit might be related to late Mesozoic magmatic-hydrothermal activity (Jin and Pang, 1983; Wu et al., 2012), although detailed deposit characterization and evaluation of mineralization style, especially for the Jinjiling ore block (e.g., Jin and Pang, 1983; Shen and Fu, 1999), have not yet been well constrained. For example, Jin and Pang (1983) suggested that Budunhua is a hydrothermal vein-type deposit, whereas Shen and Fu (1999) and Liu (2001) proposed that the mineralization in the Jinjiling ore block is of porphyry-type. The appropriate classification of this deposit might be related to late Mesozoic magmatic-hydrothermal activity (Jin and Pang, 1983; Wu et al., 2012), although detailed deposit characterization and evaluation of mineralization style, especially for the Jinjiling ore block (e.g., Jin and Pang, 1983; Shen and Fu, 1999), have not yet been well constrained. For example, Jin and Pang (1983) suggested that Budunhua is a hydrothermal vein-type deposit, whereas Shen and Fu (1999) and Liu (2001) proposed that the mineralization in the Jinjiling ore block is of porphyry-type. The appropriate classification of this deposit is critical to the prospecting and evaluation of the Budunhua area, as well as for the northeastern Tianshan-Tuquan copper-polymetallic metallogenic belt.

This paper draws on new detailed field investigations, geochronology and fluid inclusions from the Budunhua deposit to address the following aspects: 1) the genesis and mineralization processes that formed the Budunhua deposit, and 2) the genetic link between the Budunhua copper deposit and other copper deposits in the northeastern Tianshan-Tuquan copper-polymetallic metallogenic belt, such as the Naoniushan, Chentaitun and Lianhuashan deposits. The results from our study sheds light on the division of the metallogenic systems in the northeastern Tianshan-Tuquan copper belt and offer guidelines for expanding the size of pre-existing deposits or future prospecting of new mineral deposits in this area.

The Budunhua copper deposit is located in the southern Great Xing’an Range where the stockwork ore bodies are mainly hosted in the Lower Permian Dashizhai Formation. The mineralization occurs in two blocks - the Jinjiling and Kongqueshan – and both are characterized by four main stages: arsenopyrite - pyrite - (molybdenite)- quartz, chalcopyrite - pyrrhotite - quartz, galena - sphalerite - chalcopyrite - quartz and calcite - fluorite - quartz. Wall-rock alteration, which is related to mineralization, is dominated by silicification, sericitization, and chloritization. Fluid inclusion studies show that the ore fluids from Cu stages in both the blocks are broadly identical with trapping temperatures of 280 to 400°C for the Kongqueshan, and 300 to 420°C for the Jinjiling. Estimated trapping pressures for the Kongqueshan is 15.0 to 26.6 MPa and for the Jinjiling is 14.9 to 29.4 MPa, corresponding to entrapment depth of 1.5 to 2.7 km and 1.5 to 2.9 km below the paleowater table, respectively. Zircon grains from the tonalite porphyry in the deposit yielded a weighted $^{206}\text{Pb}/^{238}\text{U}$ mean age of 152 ± 0.7 Ma.
which is consistent with a molybdenite Re–Os model age of $150 \pm 2.2$ Ma, indicating that both the porphyry intrusion and the copper deposit are of Late Jurassic age. Our data suggest that the Budunhua deposit is an atypical porphyry deposit related to a Late Jurassic magmatic-hydrothermal vein ore system.

Acknowledgements

This research was jointly supported by the Scientific Research Fund of the China Central Non-Commercial Institute (K1414 and K1314), the National Natural Science Foundation of China (41302061) and the Project of the China Geological Survey (1212011085260 and 12120113093600).

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