Magmatic Oxidation State of the Baogutu Porphyry Copper Deposit, Xinjiang, China: Implications for Porphyry Copper Mineralization

ShaoNi Wei*

College of Geology and Environment, Xi'an University of Science and Technology, Xi'an, Shanxi, China, *e-mail, weishaoni03@163.com

West Junggar, located in the eastern part of the Balkash-Junggar metallogenic province in Xinjiang, NW China, is an important constituent of the central Asian metallogenic domain. The Baogutu porphyry copper deposit, located to the southern side of Darbut fault system, is a newly discovered medium size porphyry copper deposit in West Junggar. Several mineralized intrusions (I to V) are exposed in the mining area. The petrology of these intrusive bodies is mainly granodiorite, quartz diorite, and diorite, with equigranular or porphyritic texture. Previous studies have investigated the geology, alteration, mineralization, geochronology, and fluid inclusion measurements of the deposit. In this study, the oxidation state of the Baogutu mineralized intrusions has been investigated using various mineralogical and geochemical parameters.

Zircons from these intrusions have low Ce^{4+}/Ce^{3+} ratios (average 67.0±39.5, *n*=54) and Eu/Eu* ratios (average 0.40±0.09, *n*=54), plotting in the lower section of the range for typical porphyry copper deposits worldwide. Magnetite-ilmenite mineral pairs, intergrowths with straight boundaries and without exsolution textures, record an average ΔFMQ of 2.72±0.70 (*n*=16). Fresh samples show intermediate whole-rock Fe^{3+}/Fe^{2+} ratios (average 0.71±0.40, *n*=12), plotting near the boundary of magnetite series and ilmenite series. The corresponding oxidation state is mainly "moderately oxidized." Amphiboles from the Baogutu intrusions yield ΔFMQ of 2.5±0.5 (*n*=58), which is in agreement with the magnetite-ilmenite mineral pair and estimated whole-rock Fe^{3+}/Fe^{2+} ratios. Considering all of these mineralogical and geochemical parameters, the ore-forming magma of the Baogutu porphyry copper deposit is oxidized, with ΔFMQ＞2. Fluids exsolved from these magmas are crucial to the formation of porphyry copper deposits.