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Fluid Evolution of the Zhunuo Porphyry Cu(-Mo-Au) System in Gangdese tract in Tibet,China: A Fluid Inclusion Investigation

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The Zhunuo porphyry Cu(-Mo-Au) deposit in the western south Gangdese porphyry copper belt (GPCB), Tibet, is a giant porphyry system. Cu(-Mo-Au) mineralization is mainly associated with a Miocene weak aluminous I-type granite porphyry pluton, formed in a extensional tectonic setting. Field observations and petrographic studies demonstrate that emplacement of the pluton took place in several intrusive pulses, each with associated hydrothermal activity. Early hydrothermal alteration produce a potassic assemblage, overprinted by later phyllic alteration. At least three main stages of mineralization have been identified, characterized by: (1) quartz+K-feldspar+minor sulfide, (2) quartz+chalcopyrite+minor molybdenite and quartz+molybdenite+sporadic sulfide, and (3) quartz+pyrite, respectively.

Three types of fluid inclusions(FIs) are distinguished in quartz in stages 1 and 2. i.e., aqueous (W-type), carbonic bearing-aqueous and solid bearing (S-type), and only aqueous FIs were observed in stage 3 minerals. S-type FIs contain variable daughter minerals including halite, chalcopyrite, calcite, anhydrite and an unidentified transparent crystal, but only halite can dissolve during heating. Halite-bearing S-type FIs are mainly homogenized by halite dissolution at 192–430°C, corresponding to salinities of 33.1–50.3 wt.% NaCl equiv.; and minor halite bearing S-type FIs are homogenized to liquid at 222–499°C via vapor disappearance, with salinities of 31.7-56.8 wt.% NaCl equiv. Other FIs in minerals of stages 1, 2 and 3 are homogenized at temperatures of 320–550 °C, 185–445°C, and 160–346°C, with salinities of 1.9–21.4, 1.7–21.8, 0.5-7.2 wt.% NaCl equiv., respectively. These data suggest that the ore fluids forming the Zhunuo deposit changed from high-temperature, high-salinity, CO_2-rich magmatic to low-temperature, low-salinity and CO_2-poor meteoritic fluids. The boiling and cooling were the important factors to cause the precipitation of abundance of chalcopyrite and molybdenite in stage 2 veins. This hydrothermal ore-forming system is not resembling those of other magmatic-hydrothermal systems in GPCB, but same with the porphyry systems generated in a post-collisional tectonic setting, which were initially CO2-rich, indicated by abundant CO_2-bearing and calcite bearing S-type fluid inclusions.