The role of amphiboles in the formation of Malanjkhand Porphyry Cu-deposit

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The mineralogy, petrology and geochemistry of the early Cretaceous Lower Yangtze River Belt (LYRB) granitoids, central-eastern China, that host porphyry Cu deposits are similar to the ~2.5 Ga Malanjkhand Cu mineralized granitoids. The LYRB porphyry Cu deposits belong to the Western circum-Pacific metallogenic belt of the Eurasian active continental margin. The relict amphibole chemistry of the ~2.5 Ga Malanjkhand granitoids hosting the large Cu deposit in central India reveals "porphyry mineralizing trend" and two distinct stages of formation/crystallization at relatively high and low pressures (P), respectively. High-P amphiboles represent extensive crystallization at T, log $f\ O_2$, and H_2O_{melt} (wt. %) at ~ 850ºC, NNO + 0.3 and ~ 6, respectively. In contrast, low-P amphiboles formed at T, log $f\ O_2$, and H_2O_{melt} (wt. %) at ~ 750ºC, NNO + 1.6 and ~ 4.5, respectively. Employing Greisen's mass balance equation for equilibrium crystallization of low-P amphibole results in exsolution of magmatic supercritical aqueous fluids enriched K and Cu from the Malanjkhand batholith that can give rise to the porphyry Cu mineralization and potassic alteration. Accordingly, exsolution of magmatic supercritical aqueous fluids enriched K and Cu during low-P amphibole formation may be an important mechanism for the formation of porphyry Cu deposits.