A fluid-rock reaction experiment in semi-open flowing system at 500-300 ℃ and 50-20 Mpa: implications for the formation of potassic zone and coexisting mineralization in porphyry copper deposits

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Potassic alteration zone, usually as the major contributor of ore body, generally locates at center in porphyry copper systems which are source of huge amounts of metals, such as copper, molybdenum and gold, etc. In our study, we employed experimental method, a semi-open and flowing hydrothermal system at 500-300 ℃ and 50-20 Mpa which can be regarded as a simplified environment of porphyry ore formation, to simulate the interaction between ore-forming fluid and country rocks, and to determine the mechanisms and controlling factors that govern high-intermediate temperature alteration, mineralization and their coexisting at center of relatively shallow emplaced magmatic-hydrothermal systems.

The results indicate that relative high temperature condition (T≥ 400 ℃) is crucial to potassic alteration, and the process of fluid immiscibility facilitated by pressure dropping can furtherly enhance potassic alteration.The experimental results also imply that the temperature is a key factor which controls formation rate of reduced sulfur and mineralization and subsequently affect metals zonation, such as Cu, Mo at proximal and Zn at distal zones in porphyry systems. Significant Cu can be dissolved in sulfur-alkaline-bearing vapor, but Cu complexes in vapor is more unstable during interaction of immiscibility fluid with country rocks, which is enhanced by temperature and pressure increasing, implying that extensive fluid immiscibility at relative high temperature is beneficial to high-grade enrichment of metals in limited space. A main conclusion derived from this study is that both high temperature and fluid immiscibility process, esp. vapor-rock interaction, are crucial for formation of potassic alteration and metals deposition (zonation), and they are also important mechanisms to cause coexisting of potassic zone and main ore-body in porphyry copper systems.