Geology, mineralization and calcite-rich potassic alteration at the Humpa Leu East (HLE) porphyry Cu-Au prospect, Hu'u district, Sumbawa Island, Indonesia

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Abstract	The Humpa Leu East (HLE) prospect is one of the newly discovered porphyry Cu-Au prospects in the Hu'u district, Sumbawa Island, Indonesia. The HLE prospect was formed by calc-alkaline magmatic activity in an active continental margin setting. The prospect is typical calc-alkaline porphyry Cu-Au mineralization related to multiphase diorite and quartz diorite porphyry intrusions, which are hosted by andesitic crystalline tuff, volcanic breccia, and andesite lava. Hydrothermal alteration recognized at the surface includes potassic, propylitic, advanced argillic, intermediate argillic, and argillic alteration. Two styles of Cu-Au mineralization were identified in the HLE prospect, that is, quartz-sulfide veins and sulfide dissemination, formed in the early, intermediate, and late stages. The early stage is associated with M (magnetite & PLUSMN; bornite & PLUSMN; chalcopyrite), A (quartz + magnetite), and AB (quartz + magnetite + chalcopyrite & PLUSMN; pyrite) veins. These veins were mainly formed in the potassic alteration zone. The intermediate stage is characterized by B (quartz + chalcopyrite + pyrite) and C (chalcopyrite & PLUSMN; pyrite) veins and mainly associated with the chlorite-sericite and sericite alteration zones. The late stage is mainly associated with D (calcite + gypsum + quartz + pyrite & PLUSMN; chalcopyrite & PLUSMN; sphalerite & PLUSMN; galena) veins with sericite-chlorite alteration halo. Petrography and electron microprobe analyses indicate that calcite mainly replaced Ca-rich plagioclase. Fluid inclusion petrography and Raman spectroscopy revealed that monophase vapor inclusions, as well as two-phase (V + L) and multiphase (V + S + L) fluid inclusions contain CO2 gas. The potassic alteration with significant amounts of calcite is indicative of CO2-rich fluids, which is uncommon in other porphyry Cu-Au deposits. On the basis of textural and fluid inclusion analyses, calcite formed by a reaction between Ca-rich plagioclase and CO2-rich hydrothermal fluids. The CO2 in the hydrothermal fluids of the HLE prospect was likely derived from the magma.
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