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Magmatic degassing controlled the metal budget of the Axi epithermal gold deposit, China

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Abstract

From integrated textural and compositional studies of auriferous and barren pyrite/marcasite in the epithermal Axi gold deposit, China, we have identified a relationship between multiple gold mineralizing events, mafic magma recharge, and fluid-rock reactions. Three generations of pyrite (Py1–3) and four generations of marcasite (Mar1–4) record episodic gold mineralizing events, followed by silver-copper-lead-zinc-cadmium enrichment. The gold mineralizing events are recorded by high concentrations of subnanometer-sized gold in Py1, Py3, and Mar3 (max. = 147, 129, and 34 ppm, med. = 39, 34, and 12 ppm). Based on previous Re-Os age determinations of pyrite and U-Pb zircon ages of the andesitic wallrock, these gold events slightly postdate pulsed mafic magma recharge and represent the incursion of Au-As-S-rich magmatic volatiles into circulating meteoric water. Silver-Cu-Pb-Zn-Cd enrichment in Py2, Mar2, and Mar4 are consistent with quiescent degassing and gradual Ag-Cu-Pb-Zn-Cd enrichment in an evolved felsic magma. Barren Mar1 records the dominance of meteoric water and a limited magmatic fluid contribution. High-Co-Ni-V-Cr-Ti contents in porous cores of Py1 and Mar2 are attributed to wall rock alteration and dissolution-reprecipitation. The results provide convincing evidence that the metal budget (especially for Au, Ag, Cu, Pb, Zn, Sb) of the hydrothermal fluids and sulfides in epithermal systems are controlled by the influx of magmatic fluids and associated magma, whereas the enrichment of certain fluid-immobile elements, such as Co, Ni, V, Cr, and Ti, is caused in part by fluid-rock interaction.

Keywords: Mafic recharge, magma degassing, metal budget, fluid-rock interaction, epithermal deposit, Axi, Central Asian Orogenic Belt