

**ASYNCHRONOUS FORMATION OF
ADJACENT EPITHERMAL AU–CU AND
PORPHYRY CU–MO DEPOSITS IN THE
ZIJINSHAN OREFIELD, SOUTHEAST
CHINA**

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Adjacent high-sulfidation epithermal (HSE) and porphyry deposits often have similar Cu–Au metal associations, suggesting they are cogenetic and formed contemporaneously. The Zijinshan orefield (ZOF) is the largest Au producer in China and contains the largest HSE Au–Cu deposit and porphyry Cu–Mo deposit of southeast China. This pair of HSE Au–Cu and porphyry Cu–Mo deposits is different from the majority of adjacent and cogenetic HSE and porphyry deposits that have similar Au–Cu associations.

We present new (1) muscovite ⁴⁰Ar–³⁹Ar ages for the HSE deposits in this area, (2) new zircon laser ablation–inductively coupled plasma–mass spectrometry (LA–ICP–MS) U–Pb ages for felsic igneous rocks associated with the epithermal and porphyry mineralization, and (3) new zircon Lu–Hf isotopic data for these intrusions, all of which provide insights into the relationship between this pair of deposits, and why these adjacent epithermal Au–Cu and porphyry Cu–Mo deposits have different metal associations.

The age data indicate that the alunite–dickite alteration related to the HSE Au–Cu mineralization formed before ca. 110 Ma and the main HSE Au–Cu mineralizing event occurred at ca. 113 Ma. In comparison, the adjacent porphyry Cu–Mo mineralization formed at ca. 104 Ma, ca. 9 Myr after the HSE event. The volcanic rocks associated with the HSE Au–Cu mineralization yield zircon $\epsilon_{\text{Hf}}(t)$ values from –4.1 to 0.3, whereas the Cu–Mo mineralized porphyritic intrusion has lower zircon $\epsilon_{\text{Hf}}(t)$ values (–4.5 to –1.2), suggesting that the magmas that formed the latter intrusion were derived from a source containing more crustal material than the magmas associated with the HSE mineralization. The differences in the timing of mineralization and the sources of the magmas indicate that the adjacent HSE and porphyry deposits in the ZOF formed from different magmatic–hydrothermal systems that controlled the different metal associations of the mineralizing systems. This means that future mineral exploration within the ZOF should target porphyry Au–Cu deposits at depths that are genetically related to the HSE Au–Cu deposits. The results also show that not all adjacent porphyry and epithermal deposits, especially those with different metal associations, are cogenetic.