

Geochronology of the Carlin-type gold deposits in SW China

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Carlin-type gold deposit (CTGD) is one of the most important types of hydrothermal gold deposits in the world. The Youjiang basin in SW China is the world's second largest Carlin-type gold province after Nevada, USA. In Nevada, the timing of gold mineralization had been well constrained by precise Rb-Sr and Ar-Ar dates on hydrothermal galkhaite and adularia that are associated with gold formation. However, these minerals have not been reported in the Youjiang basin. The lack of precise age determinations on gold deposits in this basin has hindered the understanding of their genesis and relation to geodynamic settings.

The CTGD in this basin are primarily hosted in carbonate-bearing sedimentary rocks and are characterized by carbonate dissolution, silicification, sulfidation, and argillic alteration, and secondly hosted in basalts with ages of ~260Ma. "Invisible" gold occurs as nanoparticles or in the lattice of arsenian pyrite, or as minor micron-sized native gold. Au is associated with anomalous concentrations of As, Sb, Hg and Tl. Fortunately, micron-sized hydrothermal rutile, monzonite, zircon and apatite crystals have been recognized in gold ores of the CTGD recently. These minerals are closely associated with hydrothermal ankerite, sericite and gold-bearing pyrite, contain primary two-phase fluid inclusions, and are overgrown by late ore-stage realgar and stibnite, which shows that they formed simultaneously with gold mineralization. The minerals contain variable lattice-bound U and Th, and thus is suitable to date the ages of gold mineralization using U-Th-Pb method. In situ secondary ion mass spectrometry (SIMS) U-Th-Pb dating on these hydrothermal mineral grains from representative gold deposits in the Youjiang basin yields two episodes of precise and reproducible ages of ~150 Ma, and ~210 Ma respectively, which is consistent with the Ar-Ar age of hydrothermal sericites separated from the mineralized basalts in the region. These new ages, therefore, suggest that the CTGD in the Youjiang Basin formed in the Triassic and Jurassic, driven by Triassic intra-continental orogeny triggered by collision of the Paleo-Tethys plates, and Jurassic lithospheric extension due to asthenosphere upwelling related to rollback of the Paleo-Pacific subducted slab.