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Gold-bearing dolomite veins reveal multiple events as the cause of giant Au deposits

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Giant ore deposit formation has commonly been considered to result from a single tectonic-hydrothermal event. A major weakness of this hypothesis is that such a large concentration of metals requires a huge flux over a long period, which is not common in geological processes. Here, we present dolomite U-Pb age data for multiple stages of formation and refinement in the production of the giant Zaozigou orogenic Au-Sb deposit in China. Disseminated (invisible) Au mineralization formed at 211 Ma during collision between the South China and North China blocks. Vein-style (native) Au-Sb ores formed at ca. 137 Ma, closely timed with reactivated compression between the South China and North China blocks. Refinement of gold occurred at ca. 89 Ma, coincident with orogenic collapse. Using this evidence, we propose a multi-stage model for Zaozigou. Multiple transient orogenic mineralization events can evolve throughout an entire collisional regime. Earlier orogenic mineralization at Zaozigou provided a favorable physical and chemical setting for later orogenic mineralization. Subsequent orogenic collapse triggers the pressure dissolution of the dolomite and quartz in auriferous veins, liberating metals from gangue minerals, reprecipitating metal, and upgrading ores. This model is consistent with geologic observations and does not require a huge flux and a single continuous tectonic-hydrothermal event as proposed by previous studies.

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