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Mg Isotopes of Carbonate from the Shuiyindong Carlin-Type Gold Deposits of the Youjiang Basin (Southwest China) Provide Insights into Gold Genesis

Jialong Liu[1], Xiaoye Jin[1], Xiaodong Deng[2], Jianwei Li[1, 2]
1. School of Earth Resources, China University of Geosciences, Wuhan, China, 2. State Key Laboratory of Geological Processes and Mineral Resources& School of Earth Resources, China University of Geosciences, Wuhan, China

The Youjiang basin in SW China hosts the world's second largest Carlin-type gold province after Nevada in USA. Gold deposits in the Youjiang basin are mostly stratabound and hosted in the Permian marine limestone and intercalations of volcaniclastic sedimentary sequences, with minor ores in Triassic carbonates and clastic rocks. The localization and distribution of the orebodies are structurally controlled by gentle folds and associated brittle faults. Gold mineralization is closely associated with hydrothermal alteration, including decarbonatization, silicification, sulfidation, dolomitization, and argillization. Despite extensive research for decades, genesis of most gold deposits in the Youjiang basin remains elusive.

Shuiyindong, the largest Carlin-type gold deposits with over 300 tonnes of proven gold reserves in Youjiang basin, is characterized by abundant hydrothermal dolomite associated with gold mineralization. Here we present Mg isotopes of hydrothermal dolomite and its precursor in the ore-hosting rocks, combined with mineralogical and geochemical data, to provide better understanding in the genesis and process of gold mineralization. The ore-related dolomite tends to decrease from the main ore zone to the ore-hosting rocks. There is no systematic difference in CaO and MgO between the ores and wall rocks, but dolomite in the ores has much higher δ^{26}Mg values (-1.52‰ to -0.77‰) compared to the wall rocks (-2.37‰ to -2.01‰). Furthermore, a positive correlation between δ^{26}Mg values and gold contents, with δ^{26}Mg values increasing progressively from wall rocks (δ^{26}Mg = -2.21±0.05‰, 2SD) through the weakly altered rocks periphery (δ^{26}Mg = -1.52±0.08‰, 2SD) to the gold ores center (δ^{26}Mg = -0.77±0.08‰, 2SD), suggests a fractionation of Mg isotopes between dolomite and ore fluid. This correlation indicates that Mg isotopes are not only an indicaor for fluid-rock interactions but also serve as a novel tracer for gold mineralization process. Our finding has implications for ore-forming mechanisms of Carlin-type gold deposits.