Karst-Hosted MVT Pb–Zn Deposits in Fold-thrust Systems: a Case Study of the Changdong Deposit in the Sanjiang Belt, China

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Karst is the most common ore-controlling structure in Mississippi Valley-type (MVT) Pb–Zn deposits. Unfortunately, little is known about the formation process of karst caves containing MVT ores and their associated Pb–Zn mineralization in fold-thrust belts. The Changdong MVT deposit is hosted by karst caves located in the fold-thrust system of the Sanjiang metallogenic belt, Tibetan Plateau. It's a natural laboratory for studying the question above. The deposit is situated in the Late Permian limestones and hosted by a large-scale breccia belt in the hanging wall of a regional thrust fault. The breccia belt is composed of breccias and internal sediments. Breccias consist of limestone fragments within a clastic matrix. Internal sediments, consisting of K–Al silicate clays, quartz, and rock and calcite fragments, fill the voids between the breccias. According to geological observation, C-O isotope analysis, detrital zircon U-Pb dating, and palynological geochronology work, these breccias and internal sediments were the major karst factors in a meteoric paleo-karst system forming during the regional compassion. Pb-Zn sulfides precipitated in the deposit by replacing the carbonates or filling the voids in the internal sediments. They have $\delta^{34} S_{V\text{-}CDT}$ values from -16.9 ‰ to 15.8 ‰, indicating a preexisting H_2S reservoir resulting from bacterial sulfate reduction (BSR). A three-stage process for the Changdong deposit was proposed. Firstly, Permian limestone was uplifted to the near-surface by the regional thrusting during the India-Eurasia collision, and karst caves were formed by meteoric dissolution. Secondly, a reduced sulfur trap formed in the paleokarst caves by BSR during regional compression. Thirdly, metal-rich fluids migrated into the Changdong deposit through tensile faults formed during the transition from compressive stress to extensional strike-slip stress, and the sulfides precipitated. This study provides new data to establish a consistently geological framework for evaluating karst caves and associated MVT Pb–Zn mineralization in fold-thrust systems.