Carbon, Oxygen, and Sulfur Isotope Geochemistry and U-Pb Geochronology of the Changtuxili Mn-Ag-Pb-Zn Deposit in Inner Mongolia, NE China: Implications for the Nature and Timing of Mineralization

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Abstract: This study reports geochronological and isotopic (C, O, and S) data for the recently discovered Changtuxili Mn-Ag-Pb-Zn deposit by Tianjin Center on the western slopes of the southern Great Hinggan Range in NE China, to investigate the timing of mineralization and ore genesis. The mineralization is hosted by intermediate-acidic lavas and pyroclastic rocks of the Baiyingaolao Formation. Three stages of mineralization are identified: quartz-pyrite (Stage I), galena-sphalerite-tetrahedrite-rhodochrosite (Stage II), and quartz-pyrite (Stage III). The $\delta^{13}C$ and $\delta^{18}O$ values for carbonate from the ore vary from –8.51 ‰ to –4.96 ‰ and 3.97 ‰ to 15.90 ‰, respectively, which are indicative of a low-temperature alteration environment. The $\delta^{34}S_{CDT}$ values of sulfides range from –1.77 ‰ to 4.16 ‰ and show a trend of equilibrium fractionation ($\delta^{34}S_{Py} > \delta^{34}S_{Sp} > \delta^{34}S_{Gn}$). These features indicate that pyrite, galena, and sphalerite precipitated during the period of mineralization(Hoefs et al., 1987). The alteration mineral assemblage and isotope data indicate that the ore-forming fluid was derived largely from meteoric water and that the weakly acidic to weakly alkaline fluid and ore-forming elements C and S originated from magma (Hedenquist and Lowenstern, 1994). During the mineralization, a geochemical barrier was formed by changes in the pH of the ore-forming fluid leading to the precipitation of rhodochrosite. Based on the characteristics of the mineralization, new isotope data, and comparison with adjacent deposits, we propose that the Changtuxili Mn-Ag-Pb-Zn deposit is an intermediate- to low-sulfidation epithermal deposit that was controlled by fractures and varieties in the pH of the ore-forming fluid(Jin et al., 2017; Zeng et al., 2011). The surrounding volcanic rocks yield U-Pb zircon ages of 146−160 Ma (Late Jurassic), indicating that the mineralization is younger than 146 Ma.

Key words: Inner Mongolia, Changtuxili Mn-Ag-Pb-Zn deposit, C-O-S isotope geochemistry, zircon U-Pb age, intermediate- to low-sulfidation epithermal deposit

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