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Magnetite texture and trace-element geochemistry fingerprint of pulsed mineralization in the Xinqiao Cu-Fe-Au deposit, Eastern China

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Abstract

The origin of stratabound deposits in the Middle-Lower Yangtze River Valley Metallogenic Belt (MLYRB), Eastern China, is the subject of considerable debate. The Xinqiao Cu-Fe-Au deposit in the Tongling ore district is a typical stratabound ore body characterized by multi-stage magnetite. A total of six generations of magnetite have been identified. Mt1 is commonly replaced by porous Mt2, and both are commonly trapped in the core of Mt3, which is characterized by both core-rim textures and oscillatory zoning. Porous Mt4 commonly truncates the oscillatory zoning of Mt3, and Mt5 is characterized by 120° triple junction texture. Mt1 to Mt5 are commonly replaced by pyrite that coexists with quartz, whereas Mt6, with a fine-grained foliated and needle-like texture, commonly cuts the early pyrite as veins and is replaced by pyrite that coexists with calcite. The geochemistry of the magnetite suggests that they are hydrothermal in origin. The microporosity of Mt2 and Mt4 magnetite, their sharp contacts with Mt1 and Mt3, and lower trace-element contents (e.g., Si, Ca, Mg, and Ti) than Mt1 and Mt3 suggest that they formed via coupled dissolution and reprecipitation of the precursor Mt1 and Mt3 magnetite, respectively. This was likely caused by high-salinity fluids derived from intensive water-rock interaction between the magmatic-hydrothermal fluids associated with the Jitou stock and Late Permian metalliferous black shales. The 120° triple junction texture of Mt5 suggests it is the result of fluid-assisted recrystallization, whereas Mt6 formed by replacement of hematite as a result of fracturing. The geochemistry of the magnetite suggests that the temperature increased from Mt2 to Mt3 and implies that there were multiple pulses of fluids from a magmatic-hydrothermal system. Therefore, we propose that the Xinqiao stratiform mineralization was genetically associated with multiple influxes of magmatic hydrothermal fluids derived from the Early Cretaceous Jitou stock. This study demonstrates that detailed texture examination and in situ trace-elements analysis under robust geological and petrographic frameworks can effectively constrain the mineralization processes and ore genesis.

Keywords: Magnetite, stratabound mineralization, Xinqiao Cu-Fe-Au deposit, Middle-Lower Yangtze River Valley Metallogenic Belt