

Hematite (U-Th)/He thermochronometry unveils unique exhumation history: An example from the Dexing porphyry copper deposit, Southern China

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ABSTRACT

Hematite, commonly found in endogenetic deposits, plays a crucial role in monitoring temperature variations during cooling history and can be used for (U-Th)/He dating. Hematite thermochronometry, when combined with apatite and zircon (U-Th)/He dating, also provides the clearest guide to the timing of the latest thermal evolution path. In this study, we established a new method of hematite (U-Th)/He thermochronometry based on an optimized analytical protocol to reveal the evolution of the latest uplift and cooling history of the Dexing porphyry copper deposit (DPCD) in South China. Two hematite samples from the Tongchang and Fujiawu mines in the DPCD yielded age distributions of 92–11.2 and 112–24 Ma, respectively, and gave closure temperatures between 180 and 215 °C based on their relations to hematite particle sizes (88–199 μm). Combined with the published (U-Th)/He thermochronological data on zircon and apatite, we propose that the DPCD may have experienced a prolonged thermal history characterized by a temperature decrease. The initial exhumation and uplift happened at 112 Ma, and then a rapid uplift occurred from 11.2 to 8.0 Ma. This study demonstrates that hematite (U-Th)/He dating can be effectively applied to reveal the uplift and preservation history of porphyry copper deposits.

Keywords: Hematite (U-Th)/He dating, ⁴He extraction, analytical protocol, Dexing porphyry copper deposit, Mineral Informatics: Revolutionizing Mineralogy, Petrology, and Geochemistry