American Mineralogist, Volume 106, pages 1809–1817, 2021

Upper temperature limits of orogenic gold deposit formation: Constraints from TiO_2 polymorphs in the Dongyuan Au deposit, Jiangnan Orogen, China

Shenghua Wu[1,2,*], Jingwen Mao[1], Hong Yu[1], Daorong Tan[3], and Xinxia Geng[1]

[1]MNR Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing 100037, China
[2]Laboratory for Marine Mineral Resources, Pilot National Laboratory for Marine Science and Technology (Qingdao), Qingdao 266237, China
[3]Jiangxi Geological and Mineral Development Co. Ltd., Nanchang 330078, China

Abstract

Gold (Au) deposits have formed in orogenic belts throughout Earth's history. However, the upper temperature limits of orogenic Au vein formation are difficult to constrain because measurements made on fluid inclusions focus on intermediate to late-stage minerals (e.g., quartz and calcite) or are based on *P-T* estimates for the metamorphic mineral assemblages of the host rocks. We conducted a study of TiO_2 polymorphs that are among the earliest minerals that grew in Au-bearing veins of the Dongyuan deposit, Jiangnan orogenic Au belt, South China. Based on Raman analyzes, we identified TiO_2 polymorphs of anatase (with Raman peaks at 396, 515, and 638 cm^{-1}), rutile (with Raman peaks at 235, 447, and 613 cm^{-1}), and anatase–rutile intergrowths. Transmission electron microscope (TEM) confirmed the polymorphs identifying the $[1\bar{1}\,\bar{1}]$ zone axis of anatase, $[1\bar{1}0]$ zone axis of rutile, and $[1\bar{1}\,\bar{1}]$ and $[11\bar{1}]$ zone axes of rutile–anatase intergrowths. The TiO_2 polymorphs in the Dongyuan Au veins constrain a temperature range for early mineral precipitation in the veins of 450–550 °C. The results show that ore-forming fluids for this orogenic Au deposit emplaced in the shallow crust originated from deeper and hotter crustal levels (e.g., high-grade metamorphic rocks in the middle to lower crust).

Keywords: Temperature, rutile, anatase, Raman, TEM, orogenic gold deposit