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Late Jurassic Gold Mineralization in the Western Belt of the North China Craton: Insights from S-Pb-H-O Isotopic and Apatite U-Pb Geochronology Studies at the Luyuangou Gold Deposit

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The North China Craton (NCC) hosts abundant gold deposits clustered within two NNE-trending metallogenic belts: the western and eastern belts. While the eastern belt is characterized by short-lived Early Cretaceous gold mineralization, the western belt predominantly records Late Jurassic mineralization [1]. Notably, Late Jurassic gold deposits are unevenly distributed, with most occurrences concentrated in the northern segment of the western belt and significantly fewer in the southern Xiaoqinling-Xiong'ershan region [2]. This spatial disparity has resulted in limited research and ongoing controversy regarding the existence of Late Jurassic mineralization in the southern segment. The Luyuangou gold deposit, a representative deposit in the Xiong'ershan gold district (XESGD), has conventionally been interpreted as an Early Cretaceous product due to chronological limitations of previous dating methods, impeding a comprehensive understanding of its genesis and hindering exploration efforts. This study presents new hydrothermal apatite U-Pb geochronology and integrated S–Pb–H–O isotopic analyses from the Luyuangou deposit. U-Pb dating of gold-bearing pyrite-associated hydrothermal apatite constrains the mineralization age to 157.1 ± 6.6 Ma, firmly establishing its formation during the Late Jurassic metallogenic event. Isotopic systematics reveal dual crustal and mantle contributions to ore-forming materials, with magmatic fluids mixed with meteoric water forming the hydrothermal system. Our findings collectively demonstrate that the Luyuangou deposit formed in a Jurassic extensional tectonic regime associated with magmatic activity, providing new insights for future prospecting and exploration strategies in the XESGD.

References

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