Goldschmidt 2024 Abstract
https://doi.org/10.46427/gold2024.22827

New calcite U-Pb dating study in Carlin-type gold mineralization (Youjiang basin): insights into the timing between hydrocarbon accumulation and gold deposits

YUN-LONG ZHU[1], XIAO-YE JIN[2], SI-YU HU[3], KATY EVANS[4] AND JIAN-WEI LI[2]

[1]China University of Geosciences, Wuhan, China & Curtin University, Australia
[2]China University of Geosciences, Wuhan, China
[3]CSIRO Mineral Resources
[4]Curtin University, Australia

Presenting Author: ylzhu096@163.com

Relationships between hydrocarbon accumulation and Carlin-type gold mineralization has drawn interest because of their widely recognized spatial correlation [1], but whether there is genetic link between them is still controversial. Resolution of this question requires constraints on the formation age and hydrothermal history of paleo-oil reservoirs. Previous studies have yielded variable isotopic ages with large uncertainties and is difficult to link datable minerals unequivocally to hydrothermal events. Recently, in-situ calcite U-Pb dating has been developed. This technique provides a promising approach to constrain the ages of hydrothermal processes, including hydrocarbon accumulation [2] and gold mineralization [3]. Here, we present a case study of the paleo-oil reservoir from Youjiang basin (China) and demonstrate that this approach can be useful to clarify the timing of hydrocarbon accumulation and Carlin-type gold mineralization in the area.

Field and petrographic observations indicate that three generations of calcite (Cal-1, Cal-2, and Cal-3) formed within the paleo-oil reservoir. Cal-1 forms anhedral cements filling fossils, and was formed during burial diagenesis. Cal-2 forms white fillings coexisting with unaltered bitumen, and precipitated during hydrocarbon accumulation. Cal-3 occurs in white veinlets that crosscuts bitumen, suggesting a later hydrothermal event. LA-ICP-MS calcite U-Pb isotope analysis yields well-defined age constraints of 250 ± 7 Ma, 228 ± 2 Ma, and 138 ± 4 Ma for Cal-1, Cal-2, and Cal-3, respectively. These new ages show that sedimentary diagenesis of host bioclastic limestone occurred in the Late Permian (~250Ma), followed by hydrocarbon accumulation in the late Triassic (~228Ma). The late hydrothermal activity that overprinted paleo-oil reservoirs is in the early Cretaceous (~138Ma), which is consistent with ages reported for regional gold deposits (~140 Ma) [4], indicating ore-forming activity. Integration of the regional geology and new ages indicates hydrocarbon accumulation and Carlin-type gold mineralization are likely to be distinct hydrothermal events within Youjiang basin. The close spatial correlation between them could be caused and controlled by common fluid pathways and accumulating structures.

[1] Hulen & Collister (1999), EG 94(7), 1029-1049. [2] Drake et al (2019), NC 10(1), 4736. [3] Jin et al (2021), EG 116(6), 1253-1265. [4] Gao et al (2024), MD 59(1), 109-131.