Geochemistry and fluid evolution of the Liyuan gold deposit, northern Shanxi Province, central North China Craton

YING MA[1], HUA-LIANG LI[1,2], SHAO-YONG JIANG[1,3]

[1]State Key Laboratory of Geological Processes and Mineral Resources, Collaborative Innovation Center for Exploration of Strategic Mineral Resources, Faculty of Earth Resources, China University of Geosciences, Wuhan 430074, China. Email: maying9607@gmail.com

[2]School of Earth Sciences, East China University of Technology, Nanchang 330013, PR China. Email: 469026120@qq.com

[3]State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210093, China. Email: shyjiang@nju.edu.cn

The Liyuan gold deposit is hosted within Archean basement metamorphic rocks in the Taihang Mountain, central North China Craton. The orebodies was controlled mainly by the NNE-trending faults. The mineralization occurs as disseminated, quartz vein and veinlet/stockworks. Deatiled field geology and petrographic observation revealed a three-stage ore-forming process, i.e., the early quartz stage, middle quartz-polymetallic sulfide stage, and late quartz-carbonate stage, respectively. Three types of primary fluid inclusions (pure carbonic, carbonic-aqueous and aqueous inclusions) are identified in quartz and calcite from different ore stages. The early stage shows a temperature of 318-408°C and salinity of 2.1-8.9 wt.% NaCl equivalent, and the middle stage (the main gold mineralization stage) displays lower temperature (201-329 °C) but silimar salinity (0.5-12.4 wt.% NaCl equivalent), and the late stage has the lowest temperature (136-229 °C) and salinity (0.4-6.3 wt.% NaCl equivalent). During the main gold mineralization, large scale fluid immiscibility occurred at pressures of 39-189 MPa, which lead to rapid precipitation of gold. Ar-Ar dating on hydrothermal sericite associated with gold mineralization yielded an isotope plateau age of 133.3 ± 1.2 Ma, which is consistent with zircon U-Pb age (134.1 ± 1.1 Ma) of the quartz porphyry dikes in the mining district, indicating a close temporal and possibly genetic relationship between gold mineralization and granitic magmatism in the region during early Cretaceous. H-O-C-S-Pb isotopic compositions suggest that the initial ore-forming fluids were magmatic water, and mixed with meteoric water at later stages. We suggest that the Liyuan deposit belongs to orogenic gold deposit.