Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16305

Constraints of in-situ S-isotopic compositions of pyrite on the genesis of the Bayinqinggeli sandstone-hosted uranium deposit, Ordos Basin, Northern China

YUAN LIU[1] AND JUN-HONG ZHAO[2]

[1]China University of Geosciences, Wuhan

[2]School of Earth Sciences, China University of Geosciences, Wuhan, P.R. China

Presenting Author: yuanliu@cug.edu.cn

Sandstone-hosted uranium deposits are formed by redox interactions between oxidized ore-forming fluids and sufficient reductants, such as sulfide and organic materials within hosting strata, or hydrocarbon-bearing fluids from deep reservoirs. Origin and role of reducing agents are very important for deciphering uranium mineralization processes to guide prospecting, but are hard to be addressed due to rare occurrences, small size, and complex microstructures of minerals at the mineralization stage. The Mesozoic Ordos Basin in the North China Carton is an intracontinental basin, in which many giant sandstone-hosted roll-front uranium deposits form an uranium metallogenic belt. Among these, the Bayinqinggeli uranium deposit has two orebodies that are hosted in sandstones of the Jurassic lower Zhiluo Formation. Adjacent to orebodies, sandstones are variably modified to form oxidized and reduced zones. Pyrite grains from the oxidized zone are replaced by iron oxides, but those from the orebodies and reduced zone are better preserved and widespread. These pyrite grains have three generations based on their morphologies and structures. The early two generations, framboidal Py1 and concentric Py2, occur in the reduced zone and orebodies and formed before the uranium mineralization. They have large variable $\delta^{34}S$ values ranging from -51.33‰ to +49.39‰ and -36.88‰ to +21.61‰, respectively. The pre-ore pyrite grains from the orebodies were partially dissolved by later oxidized ore-forming fluids and may act as a reducing agent during the uranium mineralization. The third generation of pyrite, subhedral to euhedral pyrite (Py3) or rims surrounding Py1 and Py2, coexists with uranium minerals, coffinite and pitchblende, and has dominantly negative $\delta^{34}S$ values (-51.63‰ to +2.44‰), ruling out the deep hydrocarbon-bearing (CH_4) hydrothermal fluids. Therefore, reduced hydrocarbon-bearing hydrothermal fluids outside ore-bearing zones were not necessary for the formation of the giant Bayinqinggeli uranium deposit. Instead, the deposit is more likely to have been formed by the continuous reduction of oxidized ore-forming fluids with the organic and inorganic reductants (e.g., carbonaceous debris and Fe^{2+}-bearing minerals) within the lower Zhiluo Formation.