Fluid geochemistry of the Na-metasomatism U mineralization in Longshoushan, NW China: Implication on ore genesis

J. ZHONG[1*], S. Y. WANG[1] AND D. Z. GU[1]

[1]Beijing Research Institute of Uranium Geology, CNNC, Beijing, 100029, China (*correspondance: crickzhj@163.com)

The Longshoushan belt in Northwest China is an important uranium metallogenic belt, hosting several Na-metasomatism-type U deposits and occurrances as represented by the Jiling and Xinshuijing deposits. The uranium orebodies in Jiling and Xinshuijing are mostly in veins, pods, lens and sometimes irregular shapes and completely hosted within the albitites. Three mineralization stages are recognized: pre-ore Na-metasomatism alteration stage, syn-ore U mineralization stage and post-ore barran stage, with dignostic mineral assemblage of albite-hematite±chlorite, U minerals (mostly pitchblende) + albite ± pyrite ± chlorite ± calcite ± apatite, and calcite±quartz, respectively.

The major and trace elements in less-altered granite, albitite and ore in Longshoushan were systematically analyzed, and the element transportation were further discussed using the isocon diagram proposed by Grant (1986). During the Na-metasomatism stage, Na, Ca, Sc, V, Cr, Co, Ni, U, Th and volatile components (e.g. CO_2, H_2O) were enriched, while LILEs and some LREEs were depleted. The ore-forming fluids of the U-Th mineralization stage were rich in heavy rare earth elements, U, Th, PO_4^{3-}, with CO_2 abundantly escaped. Fluid inclusions are dominated by the aqueous liquid-rich ones, with average homogenization temperatures and salinities in the main U mineralization and post-mineralization stages of 156 ± 20 °C, 2.1 ± 1.1 wt.% NaCl eqv and 141 ± 25 °C, 2.23 ± 0.02 wt.% NaCl eqv, respectively. The $\delta^{13}C_{VPDB}$ ann $\delta^{18}O_{VSMOW}$ values of the ore-forming fluids in equilibrium with host calcite in the syn-ore and post-ore stages are calculated to be −7.6‰ to −2.9‰, −7.0‰ to −0.6‰ and −4.6‰ to −3.5‰, −4.3‰ to −0.7‰, which are interpreted to be dominantly of meteroric water, with minor input of magmatic components. Fluid-rock interaction and subsequent physicochemical changes (oxygen fugacity decrease, fluid composition changes) are the main U mineralization mechanism, with the formation of the most widespread stockwork/vein type mineralization. Fluid immicibility is also locally recognized, which is in response to the formation of the breccia-type ores.