Acta Geologica Sinica (English Edition), 2019, 93(supp.2): 130–131

The Relationship between Alteration Characteristics and Uranium Mineralization in Zhiluo Formation, North-Eastern Ordos Basin

YI Chao[1, 2, *], WANG Gui[3], LI Ping[1, 2], ZHANG Yan[1, 2] and LUO Xiaoneng[1, 2]

[1] *Beijing Research Institute of Uranium Geology, China National Nuclear Corporation (CNNC), Beijing 100029, China*
[2] *Key Laboratory of Uranium Resource Exploration and Evaluation Technology,China National Nuclear Corporation (CNNC) ,Beijing100029, China*
[3] *No.208.Geologic Party, China National Nuclear Corporation (CNNC), Baotou014010, Inner Mongolia, China*

Citation: Yi et al., 2019. The Relationship between Alteration Characteristics and Uranium Mineralization in Zhiluo Formation, North-Eastern Ordos Basin. *Acta Geologica Sinica* (English Edition), 93(supp.2): 130–131.

Abstract: The sandstone in Zhiluo Formation experienced the early oxidation at first and oxidized to brick red and purplish red sandstone when after the sediment. Then it also experienced the secondary reduction of oil and gas, changing the color of sandstone to green (Qi et al., 2007). The direct evidence was that the green sandstone wrapped the brick red and purplish red sandstone, and the residue of oxidized sandstone still could be seen in the core. The green alteration sandstone is the product of strong reducing environment forming by the secondary reduction of ancient oxidized sandstone (Wu et al., 2006). After the previous research by the author on the geochemistry characteristic of sandstone in this region, results showed that the residual oxidized purplish red and brick red sandstone had features of low content of U, S and TOC and high content of Ca and Fe^{3+}/Fe^{2+}; the secondary reducing green sandstone had features of low content of U, S, TOC, Ca and Fe^{3+}/Fe^{2+} (Yi et al., 2015). The content of S and TOC in both two sandstones was low indicating the oxidized feature. Because the residual ancient oxidized sandstone remained the oxidation characteristic, the sandstone had the high content of Fe^{3+}/Fe^{2+}. The secondary reducing sandstone was influenced by the late secondary reduction of gas and oil, so the content of Fe^{3+}/Fe^{2+} was low. The ore-forming process of Zhiluo Formation in this region experienced the early acidic oxidation and the late alkaline reduction process (Fan et al., 2007). In the process of the acidic oxidation, the water- rock reaction occurred between the oxygenated water in the provenance and the formation, resulting in the feldspar dissolution. The feldspar alteration released Ca^{2+} for kaolinite and activated U in the formation at the same time, altogether entering into the oxygenated water and migrating with water. As the increment of migration distance, the mental sulfides in the formation was oxidized to the sulfuric acid by the oxygen in water with the participation of aerobic bacterium, which decreased the oxygen content in water. When migrating to the redox zone, the oxygen in water ran out and the formation was in an anaerobic environment. With the participation of the sulfate- reducing bacteria, SO^{2-}_4 in the formation was reduced to H_2S gas and CO^{2-}_3. CO^{2-}_3 and Ca^{2+} in water reacted, formed $CaCO_3$ and precipitated down. Meanwhile, U in water was reduced by H_2S, leading to the precipitation and concentration and forming the phenomenon of the concurrent precipitation of the uranium minerals and calcite. The phenomenon of the coffinite occurrence around the calcite observed under a microscope and the high content of CaO in the ore- bearing sandstone in this region both proved points mentioned above (Yi et al., 2015). Besides, the result of the C-O isotope data showed that the carbobate cement was correlated with the precipitated organic matters, and a part of CO^{2-}_3 was formed by the decarboxylation of the precipitated organic matters. The basalt eruption happened at the period of the Lower Cretaceous in the research zone leads to the transformation effect of the thermal fluid in the Zhiluo Formation, forming the thermal genetic minerals and promoting the process of the uranium metallogenesis in this period. In summary, after the Zhiluo Formation in the target zone in this region precipitated, it experienced a bunch of alteration processes which were the early acidic oxidation alteration, mid- life hydrothermal fluid alteration and late secondary reduction alteration. The alteration had a wide range and high strength, and plenty alterations had a close connection with the uranium metallogenesis.

Key words: uranium mineralization, alteration characteristics, Ordos Basin

Acknowledgments: This work is granted byGeological Research Projects of Uranium of Nuclear Industry Geological Bureau “Mineralization and Breakthroughs in New Areas of Sandstone-type Uranium Deposits in Northwest Ordos Basin” (Grant No.Geo-D1911) and Concentrated Research and Develop Projects of CNNC “Identify Key Factors and Select Target of Sandstone Type Uranium Deposits in Northern Ordos Basin”(Grant No.Geo-LTD1601-2).

References

Fan, A.P., Liu, Y.Q., Yang, R.C., Feng, Q., Zhang, F.X., Han, Z.Z., 2007. Study on diagenesis of sandstone-type uranium deposits in Dongsheng Area, Ordos Basin. *Science in China* (Series D:Earth Science), 37(S1):166–175(in Chinese with English abstract).

Qi, F.C., Qin, M.K., Liu, W.S., Xiao, S.Q., Wang, Z.M., Zou, S.G., Huang, J.B., 2007. Time-space configuration of uranium mineralization ,sedimentary facies and oil & gas- induced alteration zone in Zhiluo formation ,Ordos basin. *Uranium*

* Corresponding author. E-mail: 40625688@qq.com

Geology, 23(2):65–70(in Chinese with English abstract).
Wu, B.L., Liu, C.Y., Zhang, F.X., Fang, X.H., Liu, X., 2006. Geochemical Characteristics of Epigenetic Alteration in Dongsheng Sandstone-type Uranium Deposit and its Metallogenic Signification. *Acta Geologica Sinica*, 80(5):740–747(in Chinese with English abstract).
Yi, C., Gao, H.W., Li, X.D., Zhang, K., Chen, X.L., Li, J.X., 2015. Study on indicative significance of major elements for sandstone-type uranium deposit in Zhiluo formation in northeastern Ordos Basin. *Mineral Deposits*, 34(4):801–813 (in Chinese with English abstract).

About the first and corresponding author

YI Chao, male, born in 1985 in Beijing City; master; graduated from Chengdu University of Technology; senior engineer of Beijing Research Institute of Uranium Geology. He is now interested in the study on metallogenic mechanism of sandstone type uranium deposit. Email: 40625688@qq.com; phone: 010-64965244, 18911412730.