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Restriction of Vertical Variation of Stratigraphic Lithology on Mineralization of Sandstone-type Uranium Deposits: An Example from the Yili Basin, NW China

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Introduction

The Yili Basin, located in Xinjiang Province, is one of the most important Mesozoic and Cenozoic continental basins for prospecting and mining of in-situ leachable sandstone-type uranium deposits in China. Ore-bearing stratigraphic unit is mainly coal-bearing formation of Shuixigou Group of Middle-Lower Jurassic. A total of 12 coal seams are developed in Shuixigou Group, which can be further divided into three formations from bottom to top. Namely Badaowan Formation (J_1b), Sangonghe Formation (J_1s) and Xishanyao Formation (J_2x), or alternatively divided into eight sedimentary cycles (Ⅰ-Ⅷ) (Song et al., 2019). From the thickest conglomerate to the finest mudstone is common in each formation, and the vertical upward assemblage is complex and changeable, Uranium deposits occur in different forms in these variable sand bodies. With the continuous research work, scholars have gradually paid attention to the stratabound characteristics of sandstone-type uranium deposits, and pointed out that the favorable position of uranium mineralization is the change of sand body configuration. The best metallogenic area of uranium mineralization is often located at the frequent bifurcation of sand body or the sudden location of barrier layer (Liu et al., 2003). It can be seen that lithologic mutation has a certain restrictive effect on the mineralization of sandstone-type uranium deposits

Results and Discussion

The biggest lithologic mutation characteristic of ore-bearing strata in Yili Basin is that mudstone or coal seam is often used as a stable water-proof layer formed by uranium deposits, and a lithologic mutation interface is formed between the mudstone or coal seam and the ore-bearing sand body. Uranium orebodies are commonly long-headed tongue-shaped, short-headed coil-shaped, Tabular and lenticular orebodies, which have spatial coupling relationship with lithologic mutation interface. Uranium mineralization is characteristic by the following aspects: Long-tongued orebodies are generally developed in sand body which has good connectivity, and near the water-proof layer of mudstone or seam; Short-headed coil orebodies is generally developed in the part where the muddy interlayer increases or becomes thinner in the transverse direction of the sand body, and the two wing orebodies are also developed at the junction of the waterproof layer and the sand body. Tabular and lenticular orebodies are associate with the upper or lower boundaries of muddy intercalation, and it also occur at the interface of coarse to fine sandstone.

This phenomenon can be attributed to following reason. (1) Sandstone bodies have high porosity, so that form diffuse fracture system, whereas the mudstone and other rock that compose of fine-grained low-permeability mud, played a physical barrier. (2) The site of lithologic variation is the site where the original organic matter and clay content are increased, the mudstone or coal seam with high organic matter content forms a double reduction interface with the reducing material of the sand body. (3) Lithologic mutation interface superimposed the physical and chemical action of the two kinds of lithology that to form a dual control interface.

Conclusions

Through a lot of research, it is found that (1) orebody is obviously controlled by lithologic mutation, especially those with rolling and tongue wings, as well as tabular orebodies, lenticular orebodies are formed almost along the interface of lithologic abrupt changes. but Uranium orebodies are not developed in every lithologic mutation site. (2) The main function of lithologic mutation interface is physical interface and chemical interface, in which the physical interface is that the cemented dense rock plays the role of water insulation, and the high porosity rock plays the role of ore-bearing. In addition, the chemical interface is manifested in the increase of the content of reductive substances and adsorbents at the interface. the reductive substances contained in mudstone or coal seam are superimposed with the reductive substances in the sand body to form an interface with higher reduction intensity. (3) It is significant to study the stratabound characteristics of sandstone-type uranium deposits.

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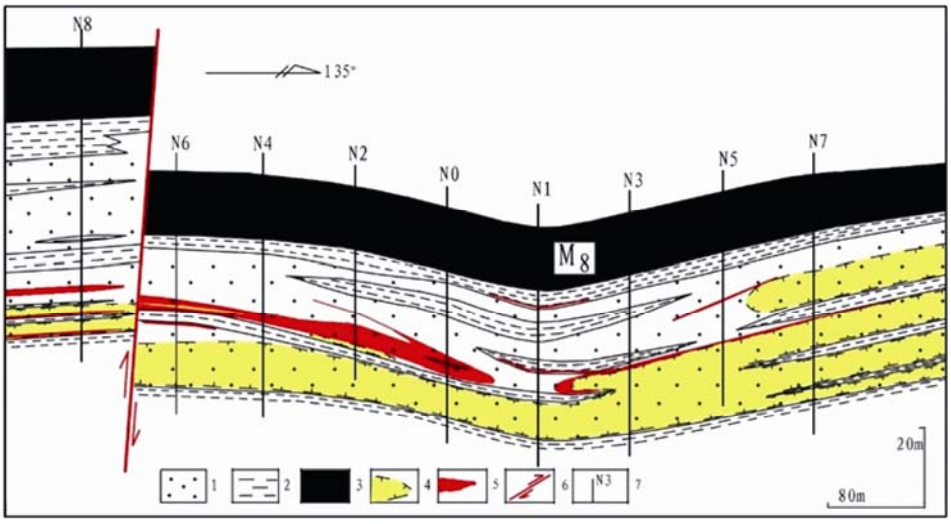

Fig. 1. Cross-section of a typical sandstone-hosted uranium deposit in the Yili Basin (According to Geologic Party No. 216, 2007, unpublished data)
1, sandstone; 2, mudstone; 3, coal; 4, oxidation; 5, Uranium orebodies; 6, fault.7, drill

Key words: Yili Basin, sandstone-type uranium deposits, lithologic mutation interface

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