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Uranium Mineralization Conditions and Elements in Tengchong Area

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1 Overview

Located at the west of Boxoilaling-Gaoligongshan fold belt, Tengchong Area has more than 10 basins. At present, 8 phreatic-interlayer-oxidation type sandstone-hosted (Sun Zexuan, 2007; Cai Yuqi et al., 2002) uranium deposits which are subject to various minerogenetic conditions have already been found in Tengchong Area.

2 Analysis of Uranium Minerogenetic Conditions

2.1 Ore-controlling tectonic conditions

The north-south-oriented Longchuanjiang and Dayingjiang fracture tectonic belts are both important basin-controlling fractures. Within the basin, curvilinear fractures and the east-west fractures control its material sources and the underground water so as to provide a channel for underground heat sources; besides, the volcanic activities under the control of these fractures are mainly fissure eruptions and the crater spreads from south to north. In a word, the fracture tectonics is closely related to uranium mineralization.

2.2 Horizon conditions

The primary depositional horizons of uranium-producing basins in Tengchong Area are quaternary and upper-tertiary; furthermore, due to influences of volcanic eruptions, they mostly distribute at the edge of a basin incompletely, irregularly and in disorder. Moreover, U mineralization is mostly formed within the quaternary sediments and the fan-shaped medium-pebbly sandstones deposited in braided stream channels.

2.3 Conditions of intrusive rocks

As controlled by arc structures, Tengchong Area which

has strong magmatic activities is predominated by Yanshanian neutral-acid-granites. For example, the main lithology of complex uranium-rich rock masses in Menglian is biotite-granite and the rather large outcrop areas of these rock masses are basements of Longchuanjiang basin and Lianghe basin.

2.4 Conditions of volcanic rocks

Volcanic activities are strong in Tengchong Area, especially at Longchuanjiang Basin where the strongest ones can take place. Within this basin, it is fissure or central eruption with the crater being incomplete semi-annular or circular. As the heat generated during such activities can activate the uranium in rocks and migrate it into the underground water; moreover, the underground water runoff and discharge processes are able to further promote the enrichment of uranium. Hence, there is no doubt that those volcanic activities provide abundant heat sources for the late reformation of uranium mineralization. Moreover, the primary uranium mineralization within this basin is all distributed near the craters.

2.5 Basin conditions

The basins are mostly asymmetric half-graben fault depression basins whose formations and evolutions are controlled by curvilinear fracture tectonics. On the side which is close to main fault zone, the gradient of basement is very abrupt and the fault depression is very deep because of multiple faulting; while for the side which is far from the main fault zone, as such a gradient is very smooth and the fault depression is very shallow, a stable slope zone of graben basin tectonics is formed. With regards to most basements of basins, they simultaneously have two kinds of lithology (the granite and the metamorphic series of Gaoligong Mountains) with high U abundance which is beneficial to the formation and enrichment of uranium ore deposits. In addition, the basin has quaternary and upper-tertiary caprocks.

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3 Uranium Mineralization Model and Elements

Formation of uranium ore deposits is achieved by an integrated organic combination of "source-migration-storage".

3.1 Uranium source

The uranium source is mainly derived from U-rich granites at the basement of basin. As these granites are located at uplift denudation zones over a long period of time, thick weathered crusts and peneplains take shape; therefore, the uranium can be activated and migrated so as to provide plentiful uranium sources for U mineralization.

3.2 Favorable ore-bearing strata series

Primarily speaking, uranium mineralization occurs in the Upper Tertiary Mangbang Group and Nanlin Group pebbly sandstones which are rich in reduction absorption media such as granites, organic matters, carbon, phytodetritus, pyrite, etc.. These sandstones with low degree of consolidation, good permeability and poor separation are proximal deposits and favorable aquifers; hence, they have provided an enabling environment for uranium migration, settlement and absorption under water.

3.3 Hydrogeochemical environment

In Longchuanjiang fault zone, a discharge area of development has been formed for groundwater circulations; and the discharge source forms a redox transitional zone which plays a role in activating U to facilitate the further enrichment of ore bodies. Besides, in favorable horizons, the oxidization zone and the heterolithic rock unconformity surface oxidation zone on basement are both beneficial to the control of ore shoots and ore deposits.

3.4 Heat sources

Multiple volcanic activities in Tengchong Area provide a regional warming effect which is in favor of uranium mineralization. In addition, the ground temperature of uranium mineralization zone is 1-2 times higher than that of general areas and this is extremely helpful in uranium migration and enrichment. CO₂, H₂S and CH₄ given rise to by those volcanic activities result in clayization, opalization, carbonatation and pyritization, etc. of the stratum; and to be specific, not only can a compact industrial mineralization come into being at a section where clayization and pyritization are developed, but the settlement of U can be promoted as both H₂S and CH₄ are good reductants. The better the hot water erosion develops, the more the beneficiation of mineralization will be.

3.5 Lithofacies paleogeography

Distribution and scale of uranium mineralization are both under the strict control of sedimentary facies which is derived from sand bodies in a wandering river before the diluvial fan of the basin as well as the gritty watercourses and flood depressions extending from a wandering river to a low sinuosity river; for interlayer oxidation zones easily formed by the overlying shallow lake facies, the closer they are to the edge of basin, the more favorable it is for U mineralization. In space, uranium mineralization which is jointly controlled by the palaeotopography of basin basement and the structure of basin cover is formed at each end of trench-like depressions in basement and within the secondary hollow zone in basement highland.

3.6 Fault structure

The distribution section of ring structures and the intersection area of north-south-oriented (arc-shaped) and east-west-oriented fractures are favorable places for U mineralization.

3.7 Basins

The known mineralization in Tengchong Area is all distributed in Upper Tertiary basins controlled by arcuate tectonic belts; however, due to different basin reformations (uplift or descending) after basin formation, the degree of mineralization thus varies.

4 Analysis of Mineralization Favorable Areas

Mineralization elements in Tengchong Area are analyzed comprehensively. As Longchuanjiang Basin, Lianghe Basin and Tengchong Basin are not only equipped with all favorable elements for mineralization, but also already have large area and preferable known mineralization, they are classified as first-grade favorable areas for mineralization. Therein, special attentions should be paid to Mangbang-Dabingnong, Waizhai-Damengliu and Tuantian-Houku in Longchuan River Basin, Zhenyiguan-Liangying-Pujiazhai and Huangguaqing-Tianbaojie-Dayutang in Lianghe River Basin, and Qiluo-Shuiyingsi in Tengchong Basin, etc.

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