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Metallogenic Characteristics Discussion of Carbonaceous-Siliceous- Argillaceous Type Uranium Deposit

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According to statistical data (Uranium Geology of China, 2005; Research and Evaluation of Uranium Deposits in China, 2010), there are about 60 carbonaceous-siliceous-argillaceous (CSA) type uranium deposits in China, only 4 large ones, not more than 20 medium, and the left are small, as well as thousands of uranium occurrences, mineralized spots and anomalies of CSA type.

The genesis of CSA uranium deposit is various because many geological activities have been involved in ore-forming process. According to the definition of CSA uranium deposit and the ore-forming mechanism in CSA formation, four types of CSA uranium metallogenesis have been summarized, namely sedimentary diagenetic type, metamorphic type, hydrothermal type, and exogenous transformed type.

1 Forms of Uranium Migration

Uranium is electrovalence changeable. It is tetravalent in reducing environment, stably staying in uranium minerals or uranium-bearing minerals; while in oxidizing environment it is easily oxidized to be hexavalent, forming stable soluble uranyl carbonate complexes, which is easily migrating. According to Research and Evaluation of Uranium Deposits in China, 2010, there are mainly two forms of uranium migration, first, uranium minerals and uranium-bearing minerals are separated and migrate as fragments from cracked mother rocks; second, uranium is resolved out from primary minerals by aqueous solution or tectonic hydrothermal solution and migrates as ion or complexes.

2 Uranium Forms in Each Stage of Various Metallogenesis Types

Uranium metallogenesis could be generally divided into four stages, uranium activiating, uranium migrating, uranium depositing and concentrating, and uranium redistributing.

2.1 Sedimentary-diagenetic type

(1) Uranium activating. Uranium is resolved in surface or ground water as uranyl carbonate complexes.

(2) Uranium migrating. Active uranium migrates in forms of uranyl carbonate complexes, uranium minerals or uranium-bearing fragments along with surface or ground water.

(3) Uranium depositing and concentrating. Uranium mineral fragments physically deposit as heavy concentrate ore, while uranyl complexes form uranium anomalies or ore layers in sedimentations through biological or chemical activities when physical-chemical environment changes.

(4) Uranium redistributing. As long as crust descending, geochemical environment changes, and uranium migrates and redistributes, forming poor occurrences.

2.2 Hydrothermal type

(1) Uranium activating. When carbonate-chlorite gas hydrothermal solution rich in silica and alkali goes up through cataclastic zone in CSA strata, it activates uranium in cataclastic rocks easily.

(2) Uranium migrating. Deep hydrothermal goes up and keeps extracting uranium from wall rocks, mixed up with downward atmospheric water at shallow below surface.

(3) Uranium depositing and concentrating. When uranium-bearing hydrothermal fills in faults on surface, due to aqueous-litho reaction, degassing, decrease of Eh, P and T, etc., uranyl complexes become unstable and deposit, or are absorbed and enrich.

(4) Uranium redistributing. Later repeated hydrothermal metallogenesis reactivates uranium from early formed ore-bodies, so uranium migrates and deposits again in other reducing environment with organic materials.

2.3 Metamorphic type

(1) Uranium activating. Because of self purification

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associated with the recrystallization in metamorphism, uranium is eliminated and absorbed by argillaceous, siliceous and organic materials.

(2) Uranium migrating. As metamorphic temperature increasing, unbound water, constitutional water and crystal water (>450℃) are liberated step by step. These types of water has so high solubility as able to resolve uranium from rocks and migrate. At the same time, carbonate decarburization improves the uranium solubility and migration of aqueous solution.

(3) Uranium depositing and concentrating. Organics and uranium generally tend to migrate from unmetamorphized rocks to cataclastic zone, and locally enriched.

(4) Uranium redistributing. Under deep derived fluid, along with temperature and pressure increasing, rocks dehydrate, decarburize and recrystallize in different degrees, which increase certain uranium activation and migration, resulting to uranium redistribution. If the deep derived fluid is rich in uranium, uranium concentration could be superimposed.

2.4 Exogenous transformed type

(1) Uranium activating. Uranium-rich strata outcrop in fold-fault structures, and uranium is activated from rocks by weathering and eroding.

(2) Uranium migrating. Uranium is resolved in water in form of stable complexes, and migrates downwards along interlayered cataclastic zone and fracture zone.

(3) Uranium depositing and concentrating. Downward ranium-bearing ground water keeps reacting with wall rocks, and uranium is separated from solutions at geochemical barriers, and enriches as ore deposit.

(4) Uranium redistributing. As oxidation developing downward, the top of existing uranium ore-bodies will be oxidized again, uranium reactivated and migrating deeper, finally forming new ores.

3 Conclusions

The dominant factors in CSA uranium metallogenesis are hydrothermal superimposed transformation and exogenous infiltration, and then sedimentary diagenesis and metamorphism.

References

Zhang Jindai, Dai Minzhu, Jin Youzhong, et al, 2005. Uranium Geology of China. Beijing: Bureau of Geology, CNNC.

Zhang Jindai, Li Ziying, Zhao Fengmin, et al, 2010, Research and Evaluation of Uranium Deposits in China. Beijing: Bureau of Geology, CNNC.

Huang Shijie, Li Youliang, Ao Wenbo, et al, 2012, Essay Collection of Uranium-Gold of Huang Shijie. Beijing: Publishing House of Geology.