Relationship between tectonic activities and sandstone-hosted uranium mineralization in China

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Résumé

Uranium enrichment has been notably observed in the Mesozoic-Cenozoic terrestrial basins of Northern China. Sandstone-hosted uranium deposits are very susceptible to tectonic uplift events due to their hydrological mobility, dynamic nature and vulnerability to dispersal and concentration. These events have significant influence on the redistribution and enrichment of uranium, with their impact being markedly pronounced within the Cenozoic tectonic regime. Our investigation centers on the spatiotemporal dynamics of the Eurasian, Indian, and Pacific Plates during the Cenozoic and their association with the regional uranium mineralization. The favorable uranium-bearing structures are generally shown as a basin-margin slope or transition belt of uplifts with the development of faults, which are conducive to a fluid circulation system. The regional tectonic events would motivate the circulation of sedimentary materials and fluid for the uranium mineralization in the basin. They would further construct the provenance, explain the deposition of sand bodies, identify the uranium sources, establish the fluid circulation system, release of deep reducing agents, locations of metallogenic sites, and metallogenic ages. In China, the Hercynian, Indosinian, and Yanshanian movements produced uranium-rich granites, which were exposed to the surface as the significant uranium sources by the tectonic movements since the Cretaceous, especially the Cenozoic. The chronology of uranium mineralization across these basins, spanning both Mesozoic and Cenozoic, predominantly aligns with the Oligocene-Miocene, with a notable surge noted in the post Miocene period ($<$ 25 Ma). This chronology correlates with the significant uplift events that follow the collision between the Eurasian and Indian Plates and the subduction of the Pacific plate, thereby laying the foundational conditions for the observed uranium enrichment. As a result, the regional tectonic movements motivate the migration of ore-forming fluids of sandstone-hosted uranium deposits, especially the Himalayan movement.

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