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The Coupling Relationship Research between Sandstone Type Uranium Mineralization and Yili Basin Sedimentary-tectonic Evolution

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1 Research Status

The formation of the Tianshan tectonic belt is generally interpreted as a consequence of intra-plate compression and uplifting of a Paleozoic orogen belt induced by the remote effect of the Euro-Asian and Indian Plates during the Cenozoic Era (Shu et al. 2003;Yin et al. 1998). Several geological evidences , such as unconformities, have been used to establish the uprising history of the Tianshan tectonic belt, which divided the tectonic evolution into one uprising period and two erosion periods, i.e. the Trassic-Jurassic and the Late Cretaceous erosion and the Late Jurassic-Early Cretaceous uprising period (Zhang et al. 1985;Ma et al. 1993). The AFT studies reveal that the southwestern Tianshan experienced two rapid uprising periods at Early Cretaceous (134-109 Ma) and Miocene (17-25 Ma) (Yang et al. 1995; Yang et al. 2003; Wang et al. 2001). The uprising of the modern Tianshan began as early as 24 Ma ago (Hendrix et al., 1994; Sobel et al.,1997； Trevor, et al., 2001). Sedimentary analysis suggests a rapid uprising event of the Tianshan during the Late Pliocene and the Early Quaternary (Wang et al. 2000). The sedimentary sequences in the fore-land basins also provide some important clues of the tectonic evolution of the Tianshan tectonic belt（Yin et al., 1998; Yang et al.，1995；Jia et al.，2003；Li et al.，2003；Hendrix et al., 1992）.

2 The Dating Age of the Apatite Fission Track

The results of the AFT dating reveal five age periods: ~24Ma，45-47Ma，85-89Ma，106-122Ma，and 156-158Ma, suggesting that the study area experienced multiple uprising-erosion events. The ages show a younging trend from south to north, which indicates that Tianshan upraised from south to north gradually. The ages of 79-114Ma of the apatites from the basin are much younger than the sediments, which imply those ages are cooling age. However some apatites of each sample show ages closed to the sediment ages, suggesting incomplete reforming of the AFT i.e. the temperature after the apatite crystallization was not higher than lower limit of the healing temperature. Additionally, as most ages of apatite are younger than those of the sediments, all samples might experience thermal event, whose temperature is higher than the upper limit of the AFT.

3 The Temperature - Time Inverse Modeling of the Apatite

According to the AFT modelling, all samples experienced two thermal histories, and annealing processes, which indicates a complicated the uprising-erosion history. According to the results, the early uprising of the western Tianshan range occurred at 200-185 Ma, 160-145 Ma, 115-90 Ma, while the late uprising happened after 24 Ma.

4 Yili Basin Sedimentary-tectonic Evolution

The sedimentary sequences and unconformities in the Yili basin suggest a intensive extension during the Carboniferous and Permian, a shrinking period during The Triassic, a relatively weak extension during the Jurassic, a weak extension to weak compression period during the Cretaceous to Paleogene, and an intensive compression at Late Paleogene. Initially, the strata folded intensively, then turned into weak extension after Neogene.

The tectonic setting of the Yili basin transferred from

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intensive extension to weak extension during the Late Triassic leading to the absence of the Upper Jurassic sediments, and the unconformities between the Cretaceous the underlay strata. The timing the of these extensions are in agreement with the uprising-erosions events of the western Tianshan range during the Early Jurassic to Middle Cretaceous. The samples from the drilling hole in the basin also suggests the whole uplift of the basin occurred during the Cretaceous (115-90Ma)

The Cretaceous （115-90Ma）uplifting event suggests regional significants. This event was well preserved at the Kuche and Duku Road and tectono-sedementary record of the Kuche foreland Basin in southern middle segment of Tianshan. We infer that this event is probably the produce of the far field effection of collision between Kohistan－Dran Arc and Lasa Block.

In the Tianshan orogenic belt, the sedimentary record show a Paleogene stratigraphic gap, super-thick Neogene sidementation and pre-Mesozoic uncomformity. In the Yili Basin, the Neogene unconformity covered the Jurassic and Cretaceous folds. Additionally, the previous study documented that the Tian Shan mountain initiated upllifting at Miocene. Thus, we infer that the West Tian Shan uplifted extensively and experienced a fast cooling after Miocene.

5 The Coupling Relationship between Sandstone Type Uranium Mineralization and Yili Basin Sedimentary-tectonic Evolution

According to previous and our dating results, some metallogenic events occurred at the Yili basin. The initial enrichment of the uranium took place during the Jurassic. The first mineralization occurred during the Middle Cretaceous. The second and third the mineralizations occurred during 25-8 Ma and 7 Ma, respectively. The main mineralization happened at 7Ma. The Uranium Mineralization and the Yili Basin Sedimentary-tectonic evolution show a good coupling relationship.

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