

Multi-stage uplift of the Qilian Shan, northeast Tibetan Plateau

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Qilian Shan, as the deformation frontier of the Tibetan Plateau (TP), is the key area to understand the deformation mechanism of the TP. Previous studies on the deformation time of the Qilian Shan revealed that both the northern and southern Qilian Shan region grew outward synchronously in opposite directions during the Neogene [1]. However, few knowledge relative to the tectonic history of the central Qilian Shan has hindered a complete understanding of the Cenozoic deformation pattern of the entire Qilian Shan. To study the uplift history of the central Qilian Shan, 10 apatite fission track (AFT) data have been obtained from the Qilian County section. AFT thermal history shows two stage rapid cooling episode occurred at ~100-80Ma and ~8-7Ma. Combined with the previous studies (middle Miocene rapid cooling of central Qilian Shan caused by the Haiyuan fault) [2], our findings suggest that the central Qilian Shan built during the middle-late Cretaceous. Since then, it experienced a long quiet period until middle Miocene and followed by two-stage rapid cooling events at 17-15 Ma and 8-7Ma, respectively.

Our new data show that during Cenozoic, 1) there is no deformation at the Qilian Shan until 17-15 Ma; 2) combined with initial deformation of Himalaya at ~55Ma and deformation of Kunlun Shan at 26 Ma, our findings support that the TP grew stepwise rise toward northeast; 3) at Neogene, two stages deformation events may occurred among the whole Qilian Shan, not only the outward expansion along the margin, but also the rapid cooling of the central range.

[1] Pang Jz et al., (2019) Neogene Expansion of the Qilian Shan, North Tibet: Implications for the Dynamic Evolution of the Tibetan Plateau. *Tectonics*, doi.org/10.1029/2018TC005258

[2] Yu Jx et al., (2019) Mid-Miocene uplift of the northern Qilian Shan as a result of the northward growth of the northern Tibetan Plateau, *Geosphere*, 15(2)