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# Magnetostratigraphy and rock magnetism of the Neogene Kuitun He section (northwest China): implications for Late Cenozoic uplift of the Tianshan mountains

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**Abstract**

In order to better constrain the tectonic evolution of central Asia under the influence of the India–Asia collision, we carried out a magnetostratigraphic study at the Kuitun He section, on the northern flank of the Tianshan range (northwest China). A total of 801 samples were collected from a 1559-m-thick section, which is composed mainly of fluvio-lacustrine sandstone and conglomerate. Stepwise thermal and alternating field demagnetization isolated a linear magnetization component that decays univectorally toward the origin and likely represents a primary magnetization principally carried by magnetite. From this component, 29 magnetic polarity intervals were identified. They correlate between ~3.1 and ~10.5 Ma with the reference magnetic polarity time scale, indicating a relatively constant sedimentation rate with an average of $0.21 \pm 0.01$ mm/year. We also performed a suite of rock magnetic experiments designed to track time-transgressive changes in the sedimentary record. From the rock magnetic parameters, together with the constant sedimentation rate, we conclude that the Tianshan mountains were actively uplifting by ~10.5 Ma.


*Keywords:* Tianshan; uplift; magnetostratigraphy; AMS

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## 1. Introduction

The vast region from India to central Asia contains the highest mountain ranges and is among the most rapidly deforming intracontinental areas on Earth today. Tectonic deformation driven by the India–Asia collision, which started some 50 Ma ago [1], has impacted global climate [2–4]. Thus, understanding how and when the topography was built has a wide range of implications for the Earth Sciences spanning from tectonics to climate change. Given the immensity of the region, it is natural that the timing and the way in which the topography formed remain poorly understood, with models ranging from a systematic south to north propagation of deformation [5,6] to a more sporadic evolution in time and place [7,8].

The Tianshan mountains lie some 2000 km north of the initial collision front. It is one of the largest mountain ranges in Asia (Fig. 1), with summits higher than 7000 m dominating the landscape over an E–W distance of 2500 km. They separate the Tarim basin to the south from the Junggar basin to the north. The geological structure of the range has resulted from a complex Paleozoic history of subduction-related processes [9,10], later reactivated in the Cenozoic. Modern tectonism is attested by high levels of seismicity and active faulting [7]; GPS measurements suggest shortening rates reach ~20 mm/year across the western Tianshan, where the range is widest [11], and about 6 mm/year across the central Tianshan [11,12]. While the present-day high topography is attributed to the Cenozoic India–Asia collision, the timing of the onset of the Cenozoic reactivation is poorly constrained. Most estimates fall within the Miocene, between 10 and 24 Ma [5,7,11,13–17].

Near Urumqi (Fig. 1), Windley et al. [10] described an angular unconformity at the base of the Oligocene followed by an increase in the rate and energy of sedimentation, which they interpreted as marking the onset of deformation induced by the India–Asia collision. Yang and Liu [16] proposed that uplift of the Tianshan started during or before Oligocene based on flexural modelling and sedimentological constraints of the Tarim basin. Fission track dating of detrital

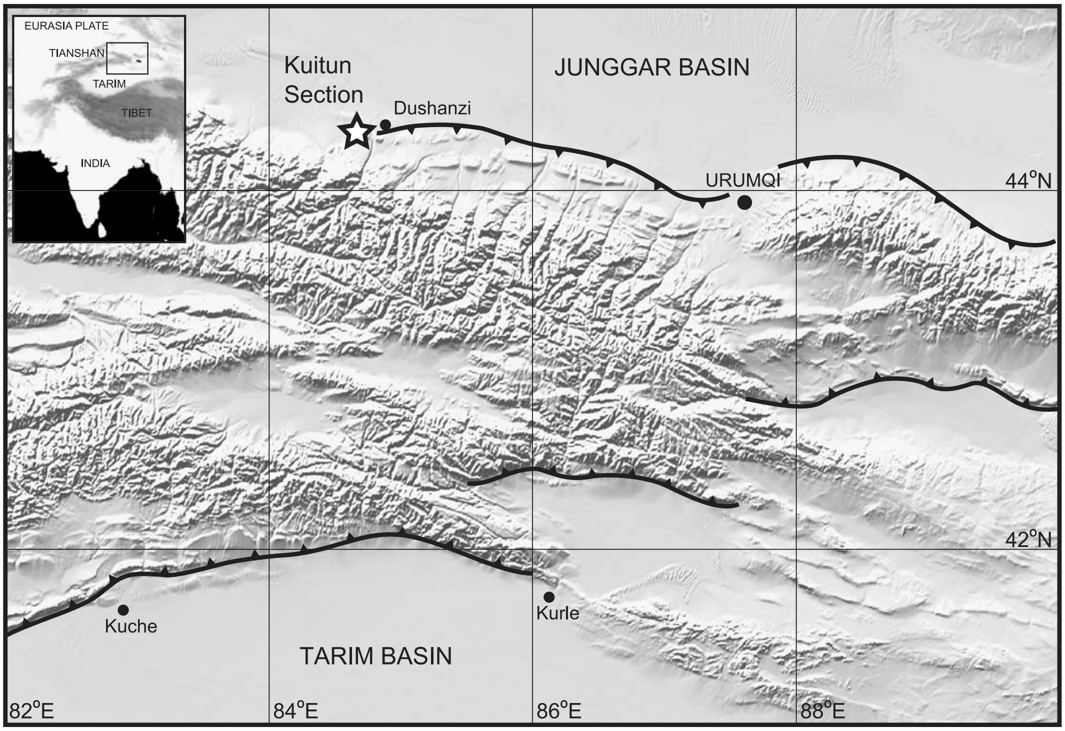


Fig. 1. Topographic map of central Asia.