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Rock magnetic and paleomagnetic investigation of Cenozoic sediments from the northern and southern flank of the Tianshan mountains: implications for inclination shallowing in Central Asia

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Paleomagnetism is a powerful tool to constrain the paleogeography of continents and has been widely used to understand the timing and deformation associated with the India-Asia collision. However, paleomagnetic data from the Tertiary sediments of Central Asia show significant shallowing (15˚ to 20˚) with respect to the synthetic Eurasian apparent polar wander path (APWP). Such amounts of intercontinental shortening, more than 1500 km between Central Asia and Siberia, are incompatible with geologic constraints. Several hypotheses have been proposed to explain this dilemma; however, the majority of recent studies conclude that syn-sedimentary and/or compaction induced inclination shallowing best explains the discrepancy.

In order to better constrain the recording process of the Earth's magnetic field in Central Asian sediments, we carried out magnetostratigraphic studies at three Neogene sections located on both sides of the Tianshan Mountains. All together, 727, 1069 and 759 orientated cores were collected at the Yaha section on the southern flank of the Tianshan, and the Kuitun and Jingou He sections on the northern flank. 18, 16, and 22 polarity chrons were identified at the Yaha, Kuitun and Jingou He sections, respectively. Correlation with the reference polarity time scale reveals the ages of the sections to span from 5.2 to 12.6 Ma, 3.1 to 10.5 Ma, and 8.5 Ma to 22 Ma, respectively.

The Yaha section on the south side of the Tianshan has a shallow inclination of 43˚, whereas the mean inclinations from the Kuitun and Jinguo He sections are coherent

with the expected inclination of 64˚. If the paleolatitude difference between the northern and southern flanks was interpreted in a classical tectonic sense, then the Tianshan would have accommodated 2000 km of shortening in the past 5 million years, which is clearly impossible. On the other hand, if one understands why the difference exists between the northern and southern flanks, one can better understand the mechanism resulting in the inclination differences. For this reason, we employed a suite of rock magnetic experiments. The major difference seems to be that the dominant carrier of the magnetic remanence at Yaha is hematite while that in the northern sections is magnetite. We are currently determining whether the intrinsic shape between the two minerals facilitates shallowing or whether the shallowing is due to the magnetic force couple, which is about 250 times greater in magnetite than in hematite.