CORRECTION

Cenozoic vertical-axis rotation of the Altyn Tagh fault system

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An error was found in the calculation of vertical-axis rotation of the Altyn Tagh fault system by Rumelhart et al. (1999). The corrected results are shown in Table 1, which indicate that the Subei, Jianglisai, and Puska sites have undergone respectively $23.3\,^\circ \pm 7.6\,^\circ$, $10.6\,^\circ \pm 7.8\,^\circ$, and $10.7\,^\circ \pm 8.6\,^\circ$ of counterclockwise rotation relative to Eurasia, and the Aertashi site has undergone $7.4\,^\circ \pm 5.8\,^\circ$ of clockwise rotation. The revised rotation results are best understood in the context of the local structural setting of each site. In Subei, sampling was conducted between two strands of the Altyn Tagh fault system on the western limb of an orocline (Fig. 1a). Within the orocline, the strike of bedding changes ~30°, from N50-60°W in the east to nearly E-W in the west. This structural pattern is consistent with $23.3\,^\circ \pm 7.6\,^\circ$ counterclockwise rotation of the Tertiary strata as a result of simple shear deformation in the Altyn Tagh fault zone. In Jianglisai, the sampling site abuts the left-reverse-slip Jianglisai fault, which is a strand of the Cenozoic Altyn Tagh fault system (Cowgill et al., 2000; Fig. 1b). A broad orocline is present north of the fault, which exhibits a systematic change in the strike of bedding, from N45°E in the west, where samples were collected,
to N70°E in the east. This variation of bedding attitude is consistent with the sense of rotation determined by our paleomagnetic data, but the magnitude is slightly different (−5–15°). The Puska site is located in the foreland of the western Kunlun thrust belt. This locality occurs on the southern limb of a tight and slightly overturned anticline (Fig. 1c), the trace of which arches slightly northward on map view. The location of this site is on the west side of the arch, its measured counterclockwise rotation of 10.7° ± 8.6° can be explained by bending of an originally straight fold axis on map view. The Aertashi sampling site is about 4 km east of a major north-south trending right-slip fault (Fig. 1d). The slight clockwise rotation of 7.4° ± 5.8° could be related to simple-shear deformation in the right-slip fault zone. Pleistocene paleomagnetic results obtained from Pulu also suggest that the vertical-axis rotation is localized in the Altyn Tagh fault zone, as a result of simple shear deformation (Otofuji et al., 1995, Meng et al., 1998).

Because rotational data can simply be explained by the development of local structures, we suggest that both the Altyn Tagh fault and the western Kunlun foreland have not experienced significant rotation with respective to Eurasia since Oligocene time. In light of this new conclusion, Rumelhart et al.’s inference that the Altyn Tagh fault has undergone no significant rotation since the Oligocene should remain valid. However, Rumelhart et al.’s second inference that the Tertiary foreland strata of the western Kunlun thrust belt may have experienced up to 30° of regional clockwise rotation should be abandoned. Instead, we now conclude that the foreland region of the western Kunlun Shan has not been rotated significantly since the Oligocene. This is also consistent with the result of Chen et al. (1992) from Yingjisha. Thus, if the tectonic model of Rumelhart et al. is valid for the development of the western Kunlun Shan in the Cenozoic, it would require a significant relative rotation (20–40°) between the crystalline massif of the western Kunlun Shan in the hanging wall of the western Kunlun thrust belt and its Tertiary foreland basin. This possibility can be tested if paleomagnetic data are available from the interior of the western Kunlun Shan. Unfortunately, there has been only one paleomagnetic study carried out inside the western Kunlun Shan by Meng et al. (1998), who show that no significant rotation of Quaternary basalts at Kangxiwa (−4.2° ± 10.4°) and Dabongliutang (−8.7° ± 9.7°), which are 110–140 km south of
Puska. As the age of the rocks studied by Meng et al. (1998) are very young and the uncertainty is relatively high, it is still unclear whether the crystalline part of the western Kunlun Shan has been rotated in the past 50–40 Ma during the Cenozoic development of the Pamir. Thus, two possibilities remain open for the Cenozoic evolution of the Pamir: (1) the northward indentation of the Pamir was accommodated by the development of an orocline involving counterclockwise rotation in its western limb and clockwise rotation of its eastern limb (Burtman and Molnar, 1993; Rumelhart et al., 1999); or (2) the northward indentation of the Pamir was accommodated by counterclockwise rotation in the western Pamir and by eastward extrusion of the Karakorum block along the left-slip Karakax fault and the right-slip Karakorum fault without significant rotation of the western Kunlun Shan (Peltzer and Tapponnier, 1988). In any case, the paleomagnetic data from the interior of the western Kunlun Shan and from the Karakorum Mountains will be a key to differentiating the two models.

REFERENCES CITED


Figure 1. (a) Geologic map of the Subei site. Map units: N1 and N2, Tertiary strata; Qyal and Qoa1, Quaternary deposits; Pzv, Paleozoic volcanics. (b) Geologic map of the Jianglisai site. Map units: gn, Proterozoic gneiss; Jr, Jurassic strata; K, Cretaceous strata; Teg and Tss, Tertiary strata; Qal-1, Quaternary alluvial deposits. (c) Geologic map of the Puska site. Map units: gs, Proterozoic greenschist; Tb, Tc, and Td, Tertiary strata; Ql, Quaternary deposits. (d) Geologic map of the Aertashi site. Map units: Pz, Paleozoic strata; T, Tertiary strata, Qal, Quaternary deposits.