Shortening in the southern Lhasa block during India-Asia collision

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Recently, it has been suggested that shortening deformation in the Lhasa block during the India-Asia collision, starting ~45Ma ago, has been minimal (Murphy et al. 1997). Our mapping in the area between Lhasa and Yangbajian in the southern Lhasa block shows that, to the contrary, there is significant shortening of the Paleocene-Eocene Linzizong volcanics. Horizontal shortening due to folding and south-directed thrusts in these volcanics amounts to 20-45%, from a detailed 15km-long section along the Drolling Chu valley through the well-known locality at Maqu, where the unconformity that these volcanics cover is spectacularly exposed, above significantly more strongly folded strata of the late Cretaceous Takena Formation. It is important to emphasise that the Linzizong volcanics are well-folded and are locally vertical in the section; it is simply not true that they are all [nearly] flat-lying as seen at the Maqu unconformity locality. In some reports, it has been suggested that the underlying Takena Formation contains volcanics; we are of the opinion based on our detailed observations that this is also not the case, and that Linzizong volcanics have been included in the Takena sequence only because they are significantly dipping.

Agreement on the time of shortening come from the youngest dated volcanics, about 50Ma (Pan, 1993; Coulon et al. 1986), and the time of opening of the Yangbajang graben and related normal faults that truncate the folds in the Linzizong volcanics, suggested to be about 13Ma (Harrison et al., 1997). Median Moescue volcanics near Majiang dated as 14-15Ma (Pan, 1993; Coulon et al. 1986) are also tilted, but the amount and extent of significant shortening in these rocks is not yet clearly defined. It is perhaps possible that a significant part of the shortening in the southern Lhasa block occurred between 15-13Ma ago; other evidence, of significant and rapid Early Moescue unroofing of the southern Lhasa block associated with the Gangdese Thrust (Copeland et al., 1995; Yin et al. 1994; Pan et al. 1993; Copeland et al. 1987) suggests that the shortening may have been, at least in part, early Moescue (27-15Ma), but not older than this.

As first suggested by England and Sarale (1986), limited collisional shortening in the southern Lhasa block, within the area of the andean-type Gangdese batholith and related Linzizong volcanics, is consistent with the idea that this would have been the location of already thickened crust from subduction-related processes. However, the dating of exhumation of the southern Lhasa block (Copeland et al. 1987, 1995) shows that the simple model of thickening spreading north from the India-Zangbo suture cannot be correct since collision must have begun here by 40Ma, yet significant exhumation did not begin until about 25Ma ago.

What is still unresolved in most places is how much shortening of India-Asia collision age occurs in upper crustal strata north of this well-dated section near Lhasa. The occurrence of the 40-50% shortening in the 100km-long section through the Enagne-strata of the Fengoanian in southern Tibet (Chang et al. 1986; Coward et al. 1988) suggests that the minimal shortening reported by Murphy et al. (1997) may be an anomaly, rather than representative of the Tibetan Plateau.

References


