Position of the Lhasa Terrane Prior to India-Asia Collision Derived from Paleomagnetic Inclinations of 53 Ma-Old Dykes of the Linzhou Basin: Constraints on the Age of Collision and Post-Collisional Shortening within the Tibetan Plateau

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The Lhasa terrane comprises the southern Eurasian margin since at least mid-Cretaceous. Therefore paleomagnetic data from the Lhasa terrane are crucial to reconstruct the pre-collisional southern margin of Eurasia. Previous paleomagnetic data from the Cretaceous Takena Formation provide a rough constraint on the pre-collisional paleolatitudinal position of the southern Eurasian margin. However, Paleogene paleomagnetic data from the Lhasa terrane, which can provide more direct constraints, are very limited. In addition, reliability of the existing data is ambiguous because of a possible later overprint. In our new study 17 sites were drilled from mafic dykes intruded in the T1 unit of the Linzizong Formation of the Linzhou Basin near Lhasa for paleomagnetic studies (Figure 1). The dykes were Ar^{40}/Ar^{39} dated to c. 53 Ma by Yue and Ding (2006). From ten sites a higher coercivity component demagnetized between 20 and 100 mT could be isolated. Detailed rock-magnetic analyses reveal Ti-rich titanomagnetite as the remanence carrier, which suggests that the rock is not much altered and the remanent magnetization is likely of primary origin. This is supported by a positive fold test. The occurrence of normal and reverse polarity directions within single sites, the subvolcanic character of the dykes, and the within-site scatter, as well as the scatter between site mean directions, indicate that paleosecular variation is recorded within sites. Tilt correction was performed using the bedding of overlying fluvial- lacustrine sediments and tilt angles of ignimbrite columns postdating the dyke emplacement.

Bedding-corrected directions give an overall mean direction of D/I = 12.3°/27.2° (α_{95} = 10.6°, k = 21.7, N = 10) corresponding to a paleolatitude of 13.2° ± 5.8°N at a reference location on the suture zone (20°N/90°E). Comparison with previous Cretaceous data mainly from the Takena Formation yields a stable position of the Lhasa terrane during Cretaceous and Early Eocene. This indicates that no large north-south crustal shortening occurred along the southern Eurasian margin between Late Cretaceous and Early Eocene. The difference between expected paleolatitudes determined from the APWP of Eurasia and observed paleolatitudes reveals relative northward movement of the Lhasa block of ca. 1847±763 km since Early Eocene. This is attributed to indentation of India into Asia and implies a considerable amount of north-south crustal shortening. Two models of “Greater India” were used to determine the extended northern margin of India: Ali and Aitchison (2005) proposed a Greater India based on bathymetric features in the Eastern Indian Ocean and Patzelt and others (1996) determined the paleolatitude of northern India using paleomagnetic investigations on Paleocene sediments of the Zongpu Formation at Gamba and Duela. Intersection of the pre-collisional southern Eurasian margin and the northern margin of India yields a collision age of the Indian and Eurasian continents of c. 53-49 Ma. An initial collision within this time range is in accordance with previous studies based on paleomagnetic or geologic data (e.g. Patriat and Achache 1984, Klootwijk and others, 1992, Guillot and others, 2003). A significantly later collision age at the Eocene/Oligocene boundary as proposed by Aitchison and others (2007) is not in agreement with our new and previous paleomagnetic data from the Lhasa Block.

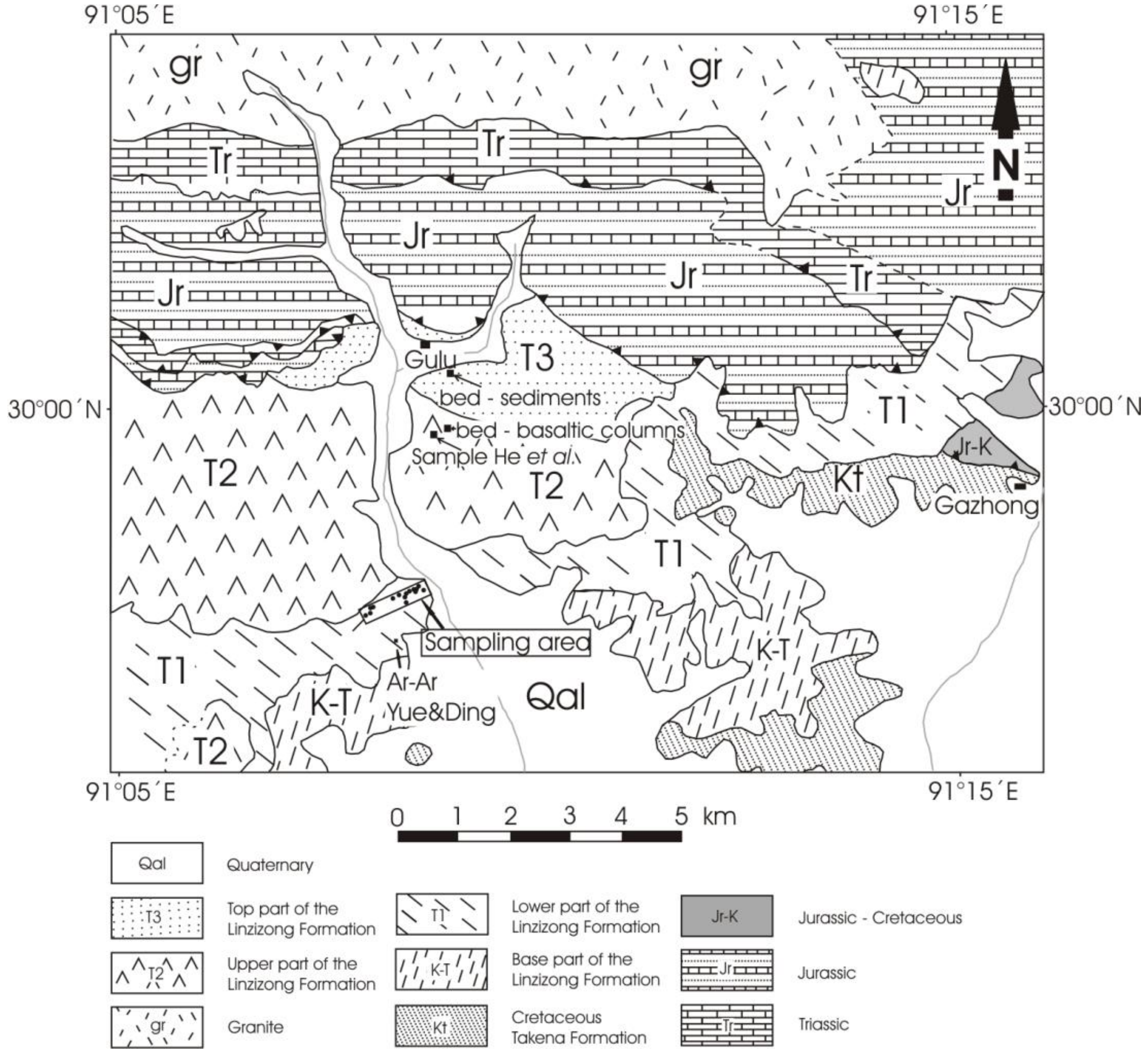

Figure 1. Geological map of the Linzhou area (modified after He and others, 2007) showing our site locations.

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