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Paleomagnetic constraints on the Mesozoic drift of the Lhasa terrane (Tibet) from Gondwana to Eurasia

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The Mesozoic plate tectonic history of Gondwana-derived crustal blocks of the Tibetan Plateau is hotly debated, but so far, paleomagnetic constraints quantifying their paleolatitudinal drift history remain sparse. Here, we compile existing data published mainly in Chinese literature and provide a new, high-quality, well-dated paleomagnetic pole from the ∼180 Ma Sangri Group volcanics of the Lhasa terrane. Our Sangri Group pole is calculated from pre-folding characteristic remanent magnetizations carried by thermoremanent magnetizations in low-Ti titanomagnetite and titanohematite in basalts and basaltic andesites that we have dated using zircon U-Pb geochronology. Forty-two lava sites (68%) meet our quality criteria and provide an average direction of D±ΔD = 341.9±3.4°, I±ΔI = -13.3±6.5°, A95 = 3.4, K = 42.9, n=42, corresponding to a paleolatitude of ∼6°S. The A_{95} value falls within the n-dependent confidence envelope of Deenen et al. (2011) (A_{95min}=2.7; A_{95max}=7.8), indicating that the data scatter can be straightforwardly explained by paleosecular variation of the paleomagnetic field alone. In addition, positive fold tests are consistent with a pre-folding remanence acquisition. Our new pole confirms a trend in existing data of variable quality that suggests the Lhasa terrane rifted from Gondwana in Late Triassic rather than Permian time, as widely perceived. A total northward drift of ∼ 4500 km between ∼220 and ∼130 Ma yields a reasonable average paleolatitudinal plate motion rate of 5 cm/yr. Our results are consistent with both an Indian or an Australian original position of the Lhasa terrane and cannot directly discriminate between these two interpretations. Nonetheless, we show that paleomagnetic data can provide a strong constraint on Mesozoic plate kinematics of the Tethyan realm. Our study also underscores the need for new, high-quality and well-dated paleomagnetic poles from the Paleozoic and Mesozoic of the Tibetan terranes.