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Sluggish Rise of the Western Gangdese Mountains after India-Eurasia Collision

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With the most prominent topography on Earth, the Tibetan Plateau has profound influences on the hydrologic cycle and climate dynamics in Asia. However, the regional uplift history of the Tibetan Plateau remains highly uncertain. Here, we use Eu anomaly in detrital zircon from modern rivers to constrain the crustal thickness evolution along the Gangdese mountain belt in southern Tibet. Our results reveal contrasting crustal thickening histories of the eastern (east of 88°E) and western (west of 88°E) parts of the Gangdese. In the Late Cretaceous, prior to the India-Eurasia collision (~60-55 Ma), the crust of the eastern Gangdese thickened continuously from ~40 km to nearly 60 km, while the western Gangdese maintained a mildly thickened crust of ~50 km. Although both the eastern and western Gangdese underwent substantial crustal thinning (to 40-45 km) immediately before the India-Eurasia collision, the eastern Gangdese rethickened rapidly after the continental collision, whereas in the western Gangdese, post-collisional thickening was delayed until 20 Myr later. On the other hand, the LREE/HREE ratio of detrital zircon and the whole-rock La/Yb ratio over time show similar trends to that of our Eu/Eu* in zircon, supporting our results to a first order. We propose the contrasting post-collisional thickening patterns may reflect the distinct nature between the western and eastern Gangdese lithosphere prior to the India-Eurasia collision. The delayed thickening of the vast western Gangdese may have resulted in a mild elevation of < 2 km for most areas of southern Tibet until the late Oligocene. The low western Gangdese mountains, as suggested by our results, may be important in sustaining the humid subtropical climate in the Central Tibetan Valley during the Late Eocene and the intensification of the South Asian Monsoon near the Oligocene-Miocene boundary.