



The Greater India Basin Hypothesis: Closing the Gap between India-Asia Crustal Shortening and Lithospheric Convergence Records

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Cenozoic convergence between the Indian and Asian plates produced the archetypical continental collision zone comprising the Himalaya and Tibetan Plateau. How and where India-Asia convergence was accommodated after initial collision around 50 million years ago (Ma) remains a long-standing controversy. Since 50 Ma, the two plates have converged up to ~ 3150 km, yet the upper crustal shortening documented from the geological record of Asia and the Himalaya is up to 1900 km less. Here we show that the discrepancy between convergence and shortening can be explained by subduction of highly extended continental and oceanic Indian lithosphere within the Himalaya between ~ 50 and ~ 25 Ma. Paleomagnetic data show that this extended continental and oceanic "Greater India" promontory resulted from $\sim 2675 \pm 700$ km of N-S extension between 120 and 70 Ma, accommodated between the Tibetan Himalaya and cratonic India. We suggest that the ~ 50 Ma 'India'-Asia collision was a collision of a Tibetan Himalayan microcontinent with Asia. This was followed by subduction of the largely oceanic Greater India promontory along a subduction zone at the location of the Greater Himalaya. The "hard" India-Asia collision with thicker and contiguous Indian continental lithosphere occurred around 25-20 Ma. Hard collision is coincident with far-field deformation in central Asia, extrusion of the Greater Himalaya crystalline rocks, and may be linked to intensification of the Asian monsoon system. This two-stage collision between India and Eurasia is also reflected in the deep mantle remnants of subduction imaged with seismic tomography.