

Constraints on the collision and the pre-collision tectonic configuration between India and Asia from detrital geochronology, thermochronology, and geochemistry studies in the lower Indus basin, Pakistan

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The timing of India-Asia suturing in the Western Himalaya is complex, with the relative timings of collision between the Indian plate and Asian plate with the Kohistan Island arc and a proposed Tethyan Himalayan microcontinent, debated. Here we present an integrated provenance study of geochronology, thermochronology, and geochemistry on the late Cretaceous–Pleistocene sediments from the lower Indus basin on the Indian plate. The detrital zircon U–Pb and fission track data show a reversal in sediment source from a pure Indian signature to increasing inputs from the suture zone and the Asian plate between the middle Paleocene and early Oligocene. The Nd and Sr isotopes narrow down this change to 50 Ma by revealing input of Asian detritus and the establishment of a Nd & Sr isotopic pattern similar to that of the present-day Indus Fan by 50 Ma, with no significant variations up section, contrary to what might be expected if later major collisions had occurred. Our isotopic data indicate that since 50 Ma, Greater India was occupied by a fluvial-deltaic system, analogous to the present-day Indus and named as the Paleo-Indus, which has been transporting Asian detritus southward across the suture zone and Kohistan–Ladakh arc. This suggests that no other ocean basins were located between India and Asia after this time in this region. Our data require that in the west, the India–Asia collision was accomplished by ~50 Ma.