

The influence of structural inheritance of the Indian plate on Himalayan foreland basin deposition, Nepal

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The Himalayan orogen has been subdivided from east to west into along-strike segments with differing rates of seismicity, deformation styles, thermal evolution, and thicknesses. Heterogeneities in the Indian plate, such as crustal scale basement faults and ridges are possible causes for this lateral segmentation. Our study examines the spatial correlation of these basement features on the foreland basin configuration in Nepal, and tests links between basement faults, and along-strike segmentation of deformation, depositional history, and geometry of the Ganga foreland basin.

The seismic stratigraphy within and below the foreland basin across the entirety of Nepal is imaged through 2D seismic reflection data. The data have been depth-converted to highlight structures and to produce isopach maps. Regional interpretations include: two horizons internal to the Cenozoic succession; an angular unconformity at the base of the Cenozoic succession, where older stratified units are truncated; the basement nonconformity that separates sedimentary strata from acoustic basement representing Archean granites and Proterozoic gneisses; and faults/deformation zones that cut the foreland basin strata.

Our seismic interpretation suggests basement depth fluctuates dramatically, ranging from > 12 km to < 3 km. These variations define two sets of depressions and ridges, and several large graben. The Cenozoic succession thins and thickens in step with the basement below. Thickness maps of formations within the Cenozoic succession reveal maxima above basement depressions, and minima above basement ridges, indicating that the basement features controlled accommodation in the foreland basin. Large tear faults in the Sub-Himalayan thrust system, interpreted to deform the foreland basin succession, are aligned with Indian basement ridges.

We interpret that basement-controlled differential subsidence has played (and likely continues to play) a significant role in the development of the Ganga foreland basin. Accommodation generation varied along strike during foreland basin fill, and was controlled by basement ridges or their bounding faults. Spatial localization of tear faults suggests that the ridges may influence lateral ramp and transfer zone distribution in the developing thrust belt.

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