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Development of the Himalayan frontal thrust zone: Salt Range, Pakistan

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The Salt Range is the active frontal thrust zone of the Himalaya in Pakistan. Seismic reflection data show that a 1 km offset of the basement acted as a buttress that caused the central Salt Range-Potwar Plateau thrust sheet to ramp to the surface, exposing Mesozoic and Paleozoic strata. The frontal part of the thrust sheet was folded passively as it overrode the subthrust surface on a ductile layer of Eocambrian salt. Lack of internal deformation of the rear part of the thrust sheet is due to decoupling of sediments from the basement along this salt layer. Early to middle Pliocene (~4.5 Ma) conglomerate deposition in the southern Potwar Plateau, previously interpreted in terms of compressional deformation, may instead document uplift related to basement normal faulting. Stratigraphic evidence, paleomagnetic dating of unconformities, and sediment-accumulation rates suggest that the thrust sheet began to override the basement offset from 2.1 to 1.6 Ma. Cross-section balancing demonstrates at least 20 to 23 km of shortening across the ramp. The rate of Himalayan convergence that can be attributed to underthrusting of Indian basement beneath sediments in the Pakistan foreland is therefore at least 9-14 mm/yr, about 20%-35% of the total plate convergence rate.

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