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Foreland out-of Sequence thrusting and rapid Pleistocene exhumation of Higher Himalayan crustal rocks in the Western Arunachal Himalaya

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The Siwaliks foreland in the western part of Arunachal Himalaya reveal that the Himalayan Frontal Thrust (HFT) related uplift in the foreland resulted in abandonment of the Kameng River initially, and it later migrated parallel to the uplift. The HFT related uplift commenced from west and slowly propagated towards east during Late Pleistocene to Mid Holocene. For the first time, evidences of out-of-sequence thrusts (OOSTs) have been observed from the NE Himalaya that falls outside the Higher Himalaya. The OOST is argued as a result of precipitation related pronounced focused erosion of the Siwaliks, leading the wedge to a sub-critical state. This resulted in the initiation of the frontal wedge to grow its topography by means of the OOSTs to attain a critical state. Apatite Fission Track (AFT) investigation of the metamorphic crustal rocks from the Higher Himalaya reveal two phases of rapid exhumation. The first phase indicates an exhumation rate of 0.44 mm/yr, while the second rapid phase shows 3.62 mm/yr for the high grade gneisses and migmatites. The second phase samples have been collected from deeply incised 1.5 km valley. Four samples at 400m intervals along the vertical face of the valley show close AFT cooling ages of 1.0 ± 0.2 Ma. The cooling ages thus indicate rapid exhumation of the lower $\sim$ 1.5 km crustal rocks in this valley region. We envisage that the wide spread glaciation during Pleistocene acted as an efficient eroding agent to remove cover rocks. Land sliding and efficient removal of the eroded materials by the river in the valley and incision further aided the mass removal from the region. The deep river incision and removal of material by rapid erosion have driven the hot lower-mid crustal ductile material towards the weak valley zone. Focused and effective erosion steepens the local geothermal gradient concentrating the hot material flow towards the weak zone, and as thus a positive feedback mechanism of rapid exhumation of topography occurred in this region, but probably on a local scale.