Supplement for manuscript titled

‘Structural variations in basal decollement and internal deformation of the Lesser Himalayan Duplex trigger landscape morphology in NW Himalayan interiors’

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Declaration: All photographs provided in the supplement is ether taken by Saptarshi Dey or Rasmus Thiede in the year of 2019 and 2020.

Part 1

This part is a collection of additional maps and figures for the manuscript.

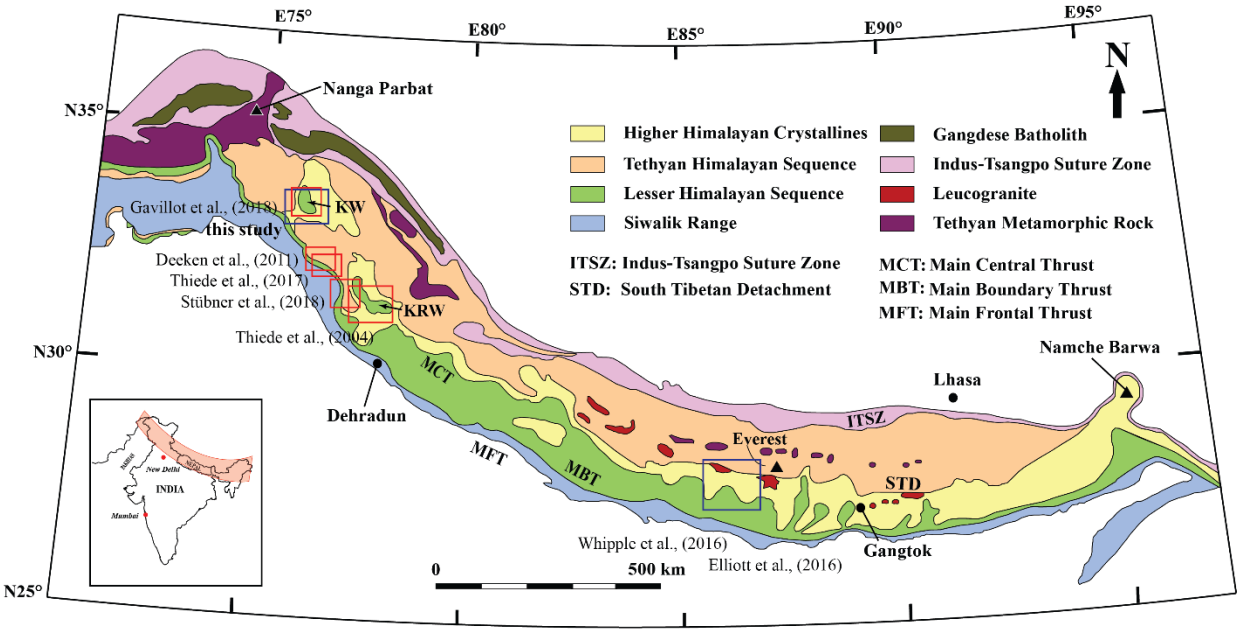

Fig. S1: A generalized geological map of the Himalayan orogen (modified after Yin and Harrison, 2000; DiPietro and Pogue, 2004) showing spatial distribution of major morphotectonic sectors. Locations of important low-T thermochronology studies in the NW Himalaya are shown (Thiede et al., 2004; Deeken et al., 2011; Thiede et al., 2017; Stuebner et al., 2018; Gavillot et al., 2018).

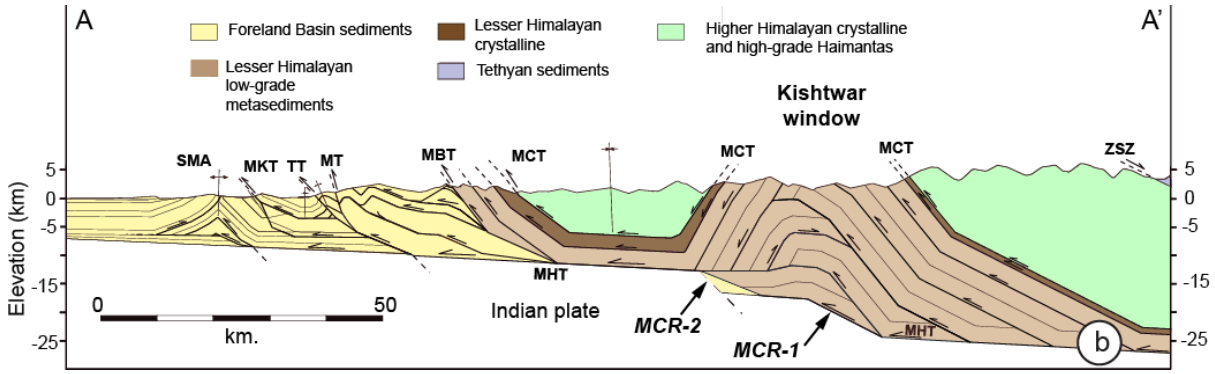

Fig. S2: Balanced cross-section across the Jammu-Kishtwar sector of the NW Himalaya (modified after Gavillot et al., 2018) showing model-predicted structural variations of the Himalayan orogenic wedge. Important to note the two small mid-crustal ramps (MCR-1 and MCR-2) emerging from the MHT, lying beneath the Lesser Himalayan duplex. They propose a higher exhumation rate of the LH duplex (3.2-3.6 mm/a) since Quaternary.

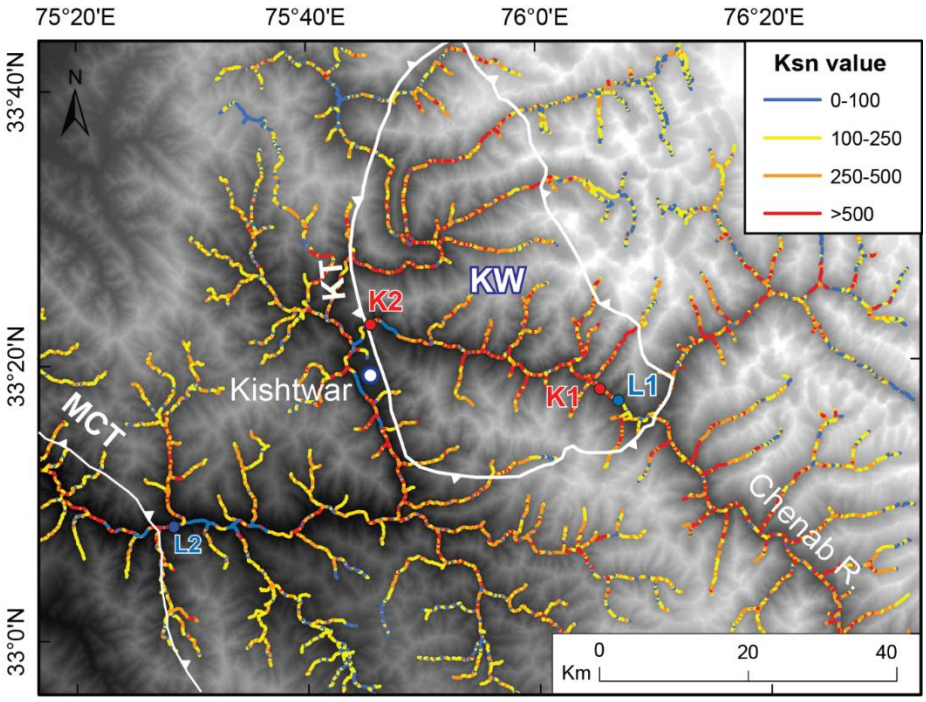

Fig. S3: Stream-specific normalized steepness indices map of the study area with major knickpoints on the trunk stream of Chenab watershed. The average ksn values within the KW and the N-S traverse of Chenab is > 300 (matching well with basinwide averaged ksn values suggested by Nennewitz et al., (2019).

Part 2

This is a collection of field photos taken during field campaigns in the year of 2019 and 2020. It portrays the morphological and structural variations seen in the study area.

Fig. S4: Photo of the Padder valley situated near the eastern margin of the KW, where the fluvioglacial sediments are still being incised by the Chenab river. Note that 'U-shaped' valley profile suggesting glacial occupancy during past glacial advancements below 2000m above msl.

Fig. S5: View of the Chenab river at the core of the KW showing steep valley walls and a narrow channel manifested by a sequence of rapids. The steep segment suggests an existence of a ramp within the LH duplex.

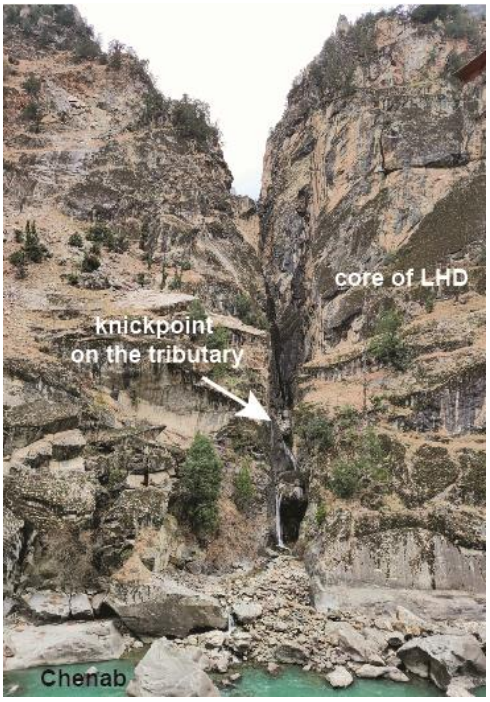

Fig. S6: A tributary of the trunk stream within the ramp of the LH duplex. Note the significant vertical incision caused by the small tributary and the sharp knickpoint near the confluence. This morphological attribute is typical for a fast-uplifting landscape.

Fig. S7: View of the low-slope segment of the Chenab river, upstream from the knickpoint K2, lying above the flat segment between two crustal ramps. The valley is wider despite harder bedrock lithology, indicating subdued uplift.

Fig. S8: View of the N-S orogen-parallel traverse of the Chenab river showing narrow channel width despite low-strength Higher Himalayan bedrock. The river forms a sequence of small rapids throughout the traverse instead of a single large knickpoint.

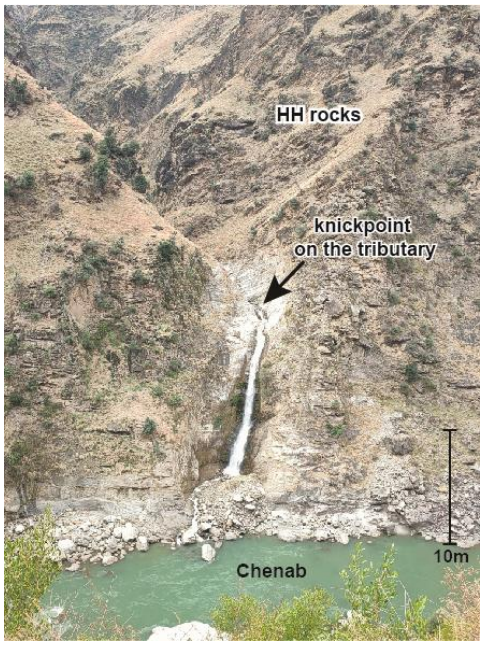

Fig. S9: Tributaries along the N-S traverse of the trunk stream also form salient knickpoints at the confluence suggesting a stronger incision of the trunk stream than the tributaries.

Fig. S10: Steeply dipping and highly-deformed Higher Himalayan gneisses exposed along the N-S traverse of the Chenab river.

Fig. S11: Highly-deformed Higher Himalayan gneisses at the base of the Kishtwar Thrust exposed near the north of the town of Kishtwar.

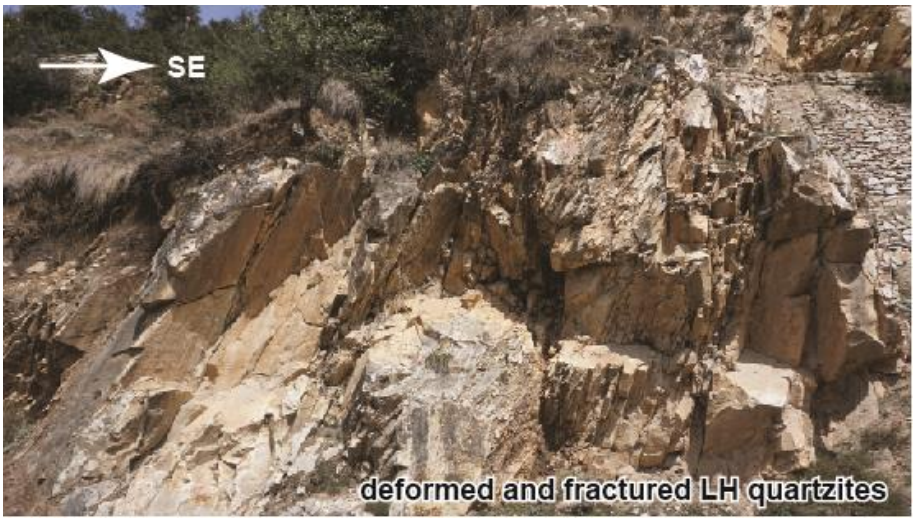

Fig. S12: Sub-vertical slabs of Lesser Himalayan quartzites exposed within the frontal horses of the LH duplex showing significant deformation and fracturing. Multiple generations of quartz veins have intruded the quartzites.

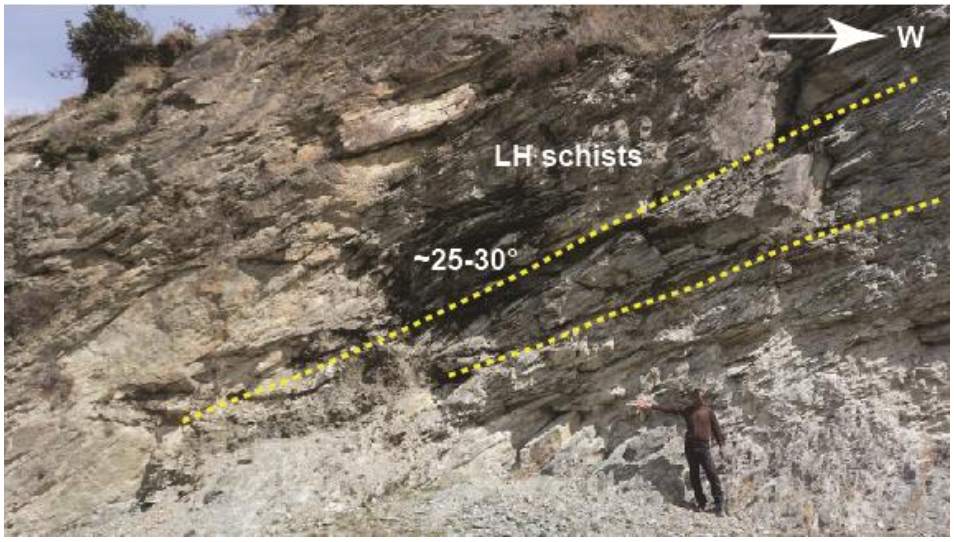

Fig. S13: Gently-dipping LH schists exposed ~5km upstream from K2 knickpoint.

Fig. S14: Highly-deformed and fractured LH rocks exposed near the base of the ramp segment at the core of the duplex showing higher degree of deformation than the rest of the Lesser Himalaya.

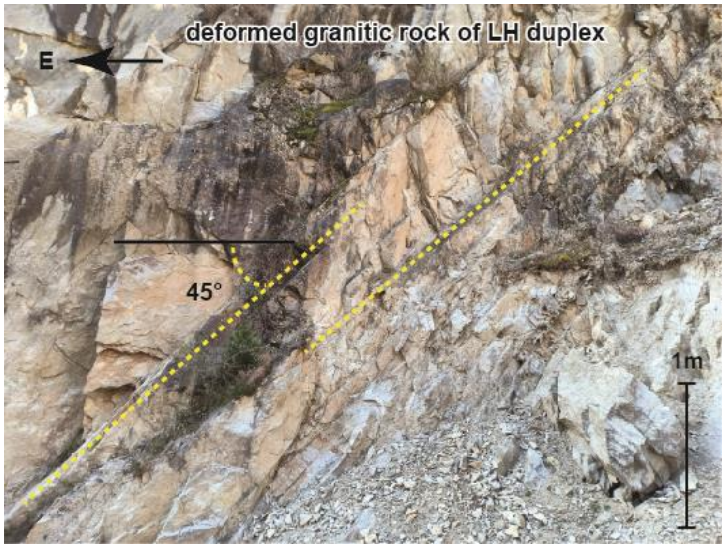

Fig. S15: Foliated granites dipping steeply towards east. Photo taken near the core of the duplex over the crustal ramp segment. The Chenab channel nearby has very steep gradient and multiple rapids.

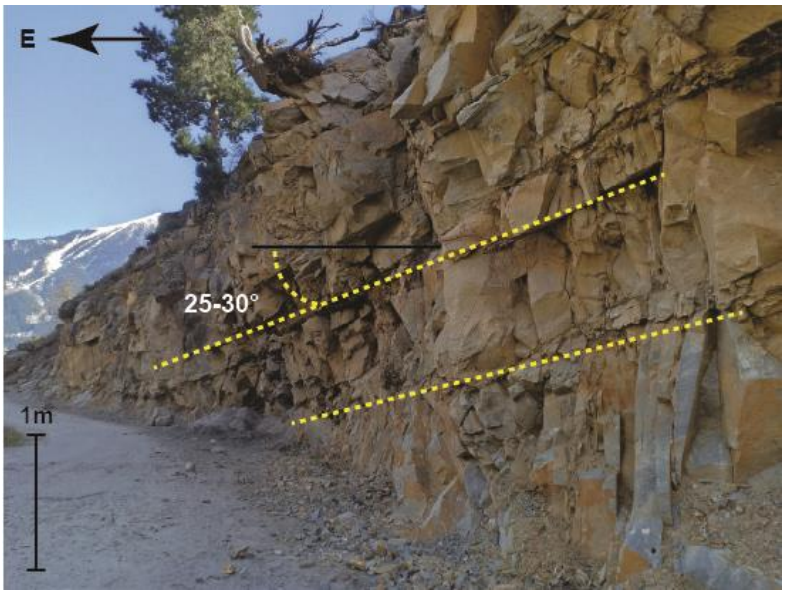

Fig. S16: Gently-dipping LH rocks situated over the flat segment of the LH duplex.

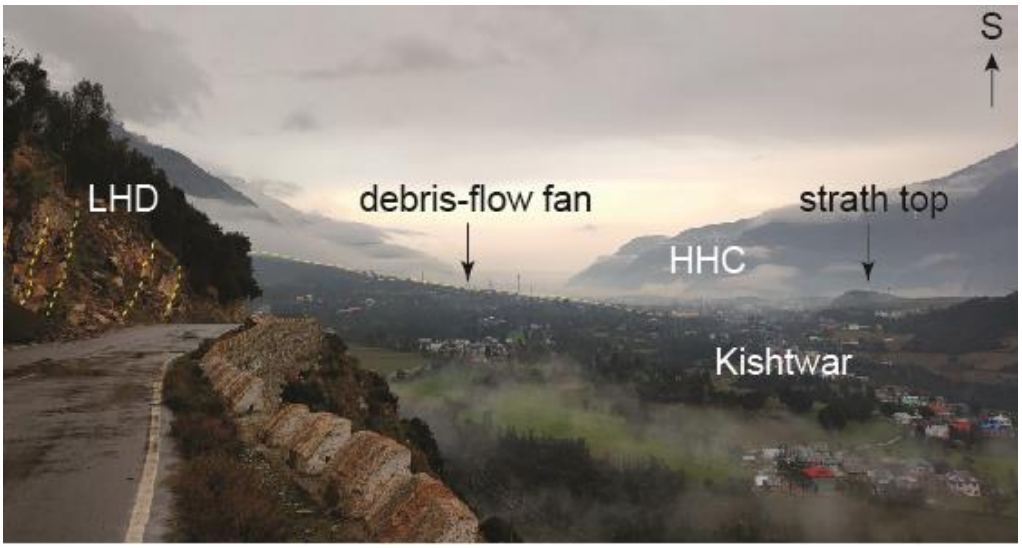

Fig. S17: A view of the Kishtwar town from the western margin of the KT shows the town has been sitting on a large-scale mass movement deposit. The sediment characteristics suggest that to be a debris-flow fan.

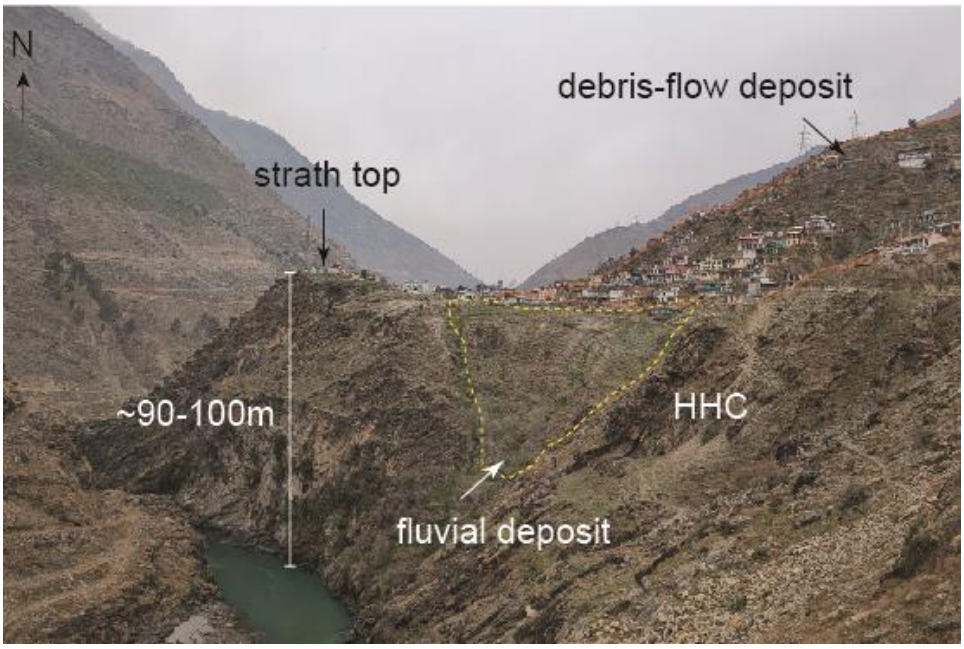

Fig. S18: A field photo along the N-S traverse of the Chenab river taken at the village of Drabshalla depicting a presence of an epigenetic gorge. The older channel (filled with fluvial deposits) have been buried by debris flow from the LH duplex. The river has incised a new path towards west of

the paleo-channel, leaving behind a ~100m high strath. This hints rapid fluvial incision along this transect, as the fluvial deposits are most-likely late Pleistocene.