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Tectonics of the Himalayan Mountain Front, Darjiling Himalayas, India

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The Himalayan Mountain front in the Darjiling Himalayas exhibits a pronounced frontal recess near Gorubathan. The Gorubathan recess exhibits an amplitude of ~ 15 km and the Siwalik section is not exposed within the recess. Investigations into the cause of the recess has led to the discovery of a new transverse structure at high angles to the trend of the Himalayan belt that continues into the Yadong-Gulu cross structure on the Tibetan Plateau. The Gish river flows along this transverse zone near the mountain front; the Gish transverse zone is expressed as an abrupt discontinuity between low Siwalik hills to the west and plain land to the east. The mountain front to the west of the Gish zone is defined by a thrust that puts Siwalik rocks on Quaternary deposits whereas the mountain front to the east of it is defined by a thrust that puts Proterozoic Daling Formation rocks on Gondwanas. There is evidence of blind imbrication continuing farther south of the mountain front both east and west of the Gish zone; these blind imbricates form E-W trending fault scarps. The Siwalik section is repeated and exposed by several imbricate thrusts west of the Gish zone. These faults are missing east of the Gish fault or blind leading to the absence of Siwalik rocks east of the Gish zone. The mountain front east of the Gish zone is characterized by asymmetric river terraces that have been raised by ~ 400 m relative to the present level of the Chel river. Such terraces are missing west of the Gish zone. The contrasting styles of geological and neotectonic deformation kinematics, reflected also in the topography along the Darjiling Himalayan mountain front, on either side of the Gish zone points to segmentation of the Himalayan deformation along its length. Also, there is no Siwalik-on-Quaternary thrust exposed east of the Gish zone. Therefore, the Main Frontal Thrust cannot be traced unambiguously across the Gish zone; this makes the definition of the Main Frontal Thrust in the Darjiling Himalayas non-unique. The Gish transverse zone exhibits an early quasi-plastic deformation phase characterized by steep, east-dipping discrete cleavage. This is overprinted by elastico-frictional, left-lateral, strike-slip deformation in the Gish zone characterized by widespread cataclasis.