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Morpho-sedimentary records of active tectonics at the Kameng river exit, NE Himalaya

Pradeep Srivastava *, Dileep K. Misra

Wadia Institute of Himalayan Geology, 33 GMS Road, Dehradun 248001, India

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Abstract

The Kameng River in the NE India cuts through the rising Siwaliks, the frontal ranges of the Himalaya and forms four levels of alluvial terraces. The geomorphic configuration and overlying alluvial cover of each terrace has been studied to decipher the uplift history of the Himalayan front and varying sedimentation pattern of the river. The ratio (SA ratio) of the thicknesses of alluvial cover and bedrock strath is used as a measure of geomorphic instability (GI) and a GI-Index has been calculated for each incision and aggradation phase. It is suggested that the area was geomorphologically most unstable when the Kameng River was incising from terrace T_2 to T_1. The Luminescence chronology constrained this phase to be at ~7 ka B.P. The older incision phases namely T_4–T_3 and T_3–T_2 occurred ~14 and ~10 ka B.P. respectively. The alluvial cover of the terraces is composed of four major lithofacies *viz.* (1) Matrix-supported pebble, (2) Clast-supported pebble, (3) Parallel laminated medium sand, and (4) Bioturbated fine sand. The vertical variation of the lithofacies indicates that the river was flowing under a braided pattern.

The study suggested that Kameng river incised 95 m from terrace T_4 to T_2 in the span of ~8 ka between 14–6 ka BP, suggested the uplift rate of 11.9 mm/year. However, the total uplift in the Siwaliks, as indicated by the height difference of terraces T_4–T_0 in the area is 105 m which occurred during the last 14 ka at the rate of 7.5 mm/year, indicating a varying rate of Siwalik uplift in the Holocene. The studies corroborate with published incision rates from the central Himalaya in Nepal.

Keywords: Fluvial terraces; Geomorphic instability; Kameng River; NE Himalayan front

1. Introduction

Geomorphic development of the Himalayan mountain chain is a consequence of interplay between climate and tectonics. This interaction through the last 55 Ma has resulted in the formation of various southward-younging thrusts, namely the Main Central Thrust MCT), contact between Higher Himalayan Crystallines (HHC) and Lesser Himalaya (LH); the Main Boundary Thrust (MBT), contact between Lesser Himalayan rocks and the Siwaliks; and the Himalayan Frontal Thrust (HFT) that brings the Siwaliks over Ganga plain alluvium. The neotectonic deformation in the HHC and LH zones occurs along the splays of the MCT and MBT, and due to formation of out-of-sequence thrusts it is said to be the result of high precipitation and erosion leading to isostatic adjustments (Bookhagen et al., 2005; Bookhagen, 2004; Hodges et al., 2004; Thiede et al., 2004; Wobus et al., 2005). The mountain front along the HFT is suggested to be tectonically active because of southward progression of deformation of the Himalayan orogen (Lave and Avouac, 2001). In the NW and the Central Himalayan sectors the rates of uplift of the

* Corresponding author.
E-mail address: Pradeep@wihg.res.in (P. Srivastava).

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Siwalik mountains along the HFT have been computed to be of the order of 10–15 mm/year. A suggestion is also made that in this sector at a timescale of 103–104 years, a greater percentage of crustal shortening between Indian and Asian plates is being accommodated along the HFT (Lave and Avouac, 2001). These studies

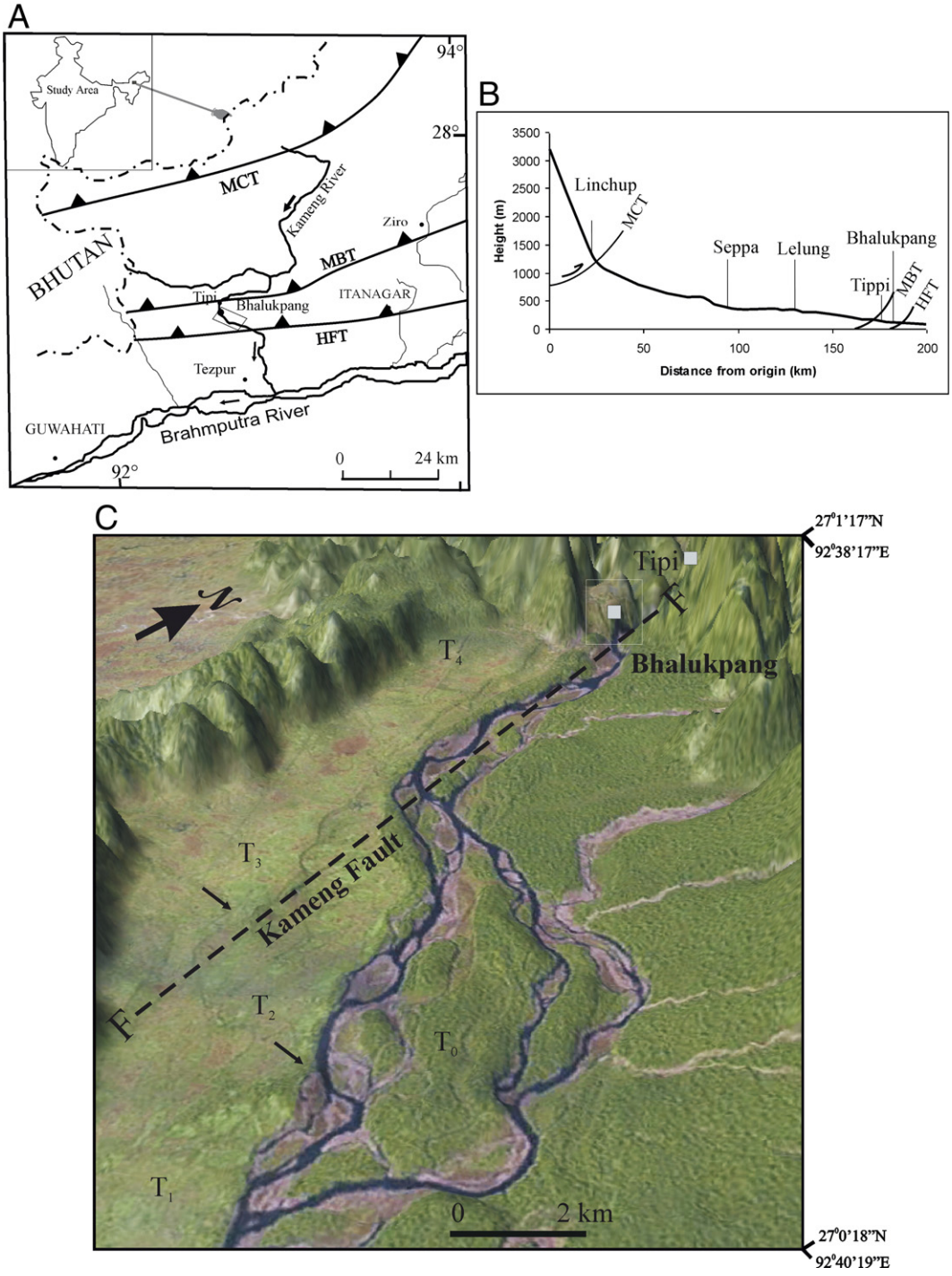

Fig. 1. (A) Location and general geology of the Kameng catchment. (B) Longitudinal profile of the river showing major topographic breaks and tectonic features. (C) Satellite picture of the Bhalukpong area showing the N–S-trending Kameng fault, the eastward-shifting Kameng river channel and alluvial terraces. Note the braided character of the river.