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Lithofacies analysis of river terrace and fan deposits at Rangpo Khola and Ben Khola confluences in the Teesta Valley, Sikkim Himalaya: implication on climate change and active tectonic

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Abstract

Quaternary alluvial sediments occur in the form of distinct terrace deposits and fan lobes at the confluences of Ben Khola and Rangpo Khola with Teesta River. This region falls between the Main Central Thrust and the Main Boundary Thrust in the Sikkim Himalaya. These sequences are characterized by lithofacies belonging to braided river systems, debris flows, hyperconcentrated flows, and channel flows. The channel flow deposits in the study area are relatively well sorted, well imbricated and clast-supported gravels with coarse to medium grained sandy matrix. Mostly matrix supported, poorly sorted, weakly imbricated, disorganized pebbly to bouldery gravel with silty sand represent the debris flow deposits in the study area. Hyperconcentrated flows represent an intermediate sedimentation state between debris flows and fluid flows. Such deposits in the studied terrace and fan sequences include clast-supported, poorly sorted, polymodal gravel facies with poorly imbricated fabric. These deposits generally occupy the lower parts of the terrace and fan sequences.

The base of the oldest terrace deposit (T3) in the region lies about 30 m above the present day Teesta river channel. It consists of two distinct units – the lower sandy unit and the upper gravel unit. Fine to coarse sands with several thin ferruginous layers define the lower unit and the upper unit is composed of well-rounded, well-sorted, well-imbricated gravels. Terrace T2 is paired and is widely exposed in this stretch of the Teesta valley. The upper surface of this terrace lies at an elevation of 14 m above the modern flood plain of the Teesta river. A younger terrace deposit T1 is located along the eastern bank of the Teesta river. Its upper surface lies at an elevation of 5 m above the flood plain of Teesta river and is partly covered by talus cones. Fan deposits of the Rangpo Khola and Ben Khola streams are exposed at their confluences with the Teesta river. The F2 fan lobes in both the systems are more incised (2-8m) compared to the F1 fan lobes (0.5-4m).

The dominant deposits of the T3 and T1 terraces are channel flow deposits whereas hyperconcentrated flow deposit is dominate in the T2 terrace. Deposits of hyperconcentrated flows dominate the lower unit of F2 lobes of Rangpo Khola and Ben Khola fans whereas deposits of channel flows dominate the upper unit and younger F1 lobes.

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