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New luminescence dates from Tista megafan, eastern Himalaya and its implications for evolution of the foreland basin-fill

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We report here for the first time, the OSL age from the sub-Himalayan Tista megafan (TMF) deposits and discuss its implications on the evolution of the Quaternary foreland basin-fill. Ten OSL dates reported here are from the megafan and associated deposits. Four major geomorphic elements identified in the Tista valley are proximal high-gradient alluvial fans (AF), megafans (MF), major channel belts (CB) and interfluve or intermegafan plains (IP). Sedimentology of each of these geomorphic units was examined in the riverbank sections. Sediments collected from shallow depth (2- 4 m) below the megafan surface yield dates ranging from 4 - 6 ka. The sample collected from a depth of 28 m yields a date of about 30 ka. Other samples of the TMF collected from a depth of 4-15 m from the surface, yield luminescence dates varying between 4 - 8.5 ka. The adjacent old gravelly alluvial deposits (CB geomorphic element) sampled from a depth of 2 to 2.5 m yield dates ranging between 2- 4.5 ka. Sand or silt bed interlayered with fan gravels (AF geomorphic element) and occurring at a depth of 2 m, has been dated as $\sim$ 8.6 ka old. Two samples collected from a single vertical profile and separated by 18 m of uninterrupted sandy megafan deposits, yield a sedimentation rate of 0.74 mm/yr averaged over $\sim$20 k.

Comparison with more than fifty published OSL or C14 dates from west, south and central part of the Ganga Plain shows that the Tista valley deposits are significantly younger. In the western Ganga Plain sediments 2-4 m below surface, yield an age varying between 5.5 and 25 ka whereas those occurring at a depth of 25-30 m are mostly $\sim$60 to 100 ka old. Since there are no evidences of enhanced thickness of the basin-fill or repeated break in sedimentation in the studied sections, the near surface sediments of the Tista valley is inferred to represent a younger depositional event within the Ganga-Brahmaputra foreland basin.

Increasing precipitation and higher rate of crustal shortening is reported from west to east in the Ganga foreland basin. It has been postulated that these result in a net aggradational setting in the eastern part of the foreland, and that in turn has prompted the formation of a number of megafans in the eastern part of the Ganga Plain. However, the geomorphic features of Tista megafan, particularly deep river incision, narrow,highly sinuous and underfit nature of the modern channels indicate net degradational setting. Although present day precipitation may be higher in Tista Valley compared to western Ganga Plain, this fact explains neither the present-day incision of the megafan nor the formation of megafans only in the eastern part during late Pleistocene. Other workers have related the formation of the megafans to the hinterland drainage basin reorganization (development of 'gridiron pattern') due to progressive growth of the Siwalik folds several million years ago. As proposed this hypothesis of tectonically driven drainage basin reorganization fails to succeed as the prime reason for the formation of the megafans because of age incompatibility between the time of growth of the Siwalik folds and the time of sedimentation in the Tista megafan.

The megafans must be related to mighty sediment routing systems draining the orogenic belt. Periodic reorganization of the drainage networks may reposition the locales of the megafans or cause its abandonment and incision. The initial age data from the Tista megafan demonstrates that the time frame and causal mechanism of such drainage basin reorganization, and consequent development of megafans in the foreland basin is far from clear. The age data further indicate nearly simultaneous sedimentation in all the geomorphic elements (AF, MF, CB etc) implying differential response of the localized sediment dispersal systems over a strike length of about 100 km of the foreland basin.