Geomorphic evolution and sediment partitioning in the Tista Fan and Barind Tract areas, NW Bangladesh, during the Late Quaternary

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Characterizing surface dynamics at the input of deltas is key for understanding the behavior of rivers as well as the large scale partitioning of their sediments which has implications on stratigraphic architectures and delta-surface evolution. Indeed, the ability of a river system to either efficiently migrate laterally or to persist at a single location through time has repercussions downstream. At the front of mountain ranges, underlying surface deformation and transverse sediment delivery from large alluvial fans (megafans) can steer rivers thus affecting their behavior. In this study, we are interested in the area of NW Bangladesh that is bounded by the Brahmaputra and Ganges rivers (Barind Tract and Tista Fan). We use field reconnaissance as well as a survey of 70 boreholes to characterize surface geomorphology and subsurface deposits. Bulk sediment Sr measurements have enabled us to identify provenance and map the evolution of the Tista Fan boundaries through the Holocene. We find that these boundaries are overall stable despite some changes through time to the east. The distribution of soils and paleosols shows distinctive patterns between the Tista Fan area and the Barind Tract: while the former shows the alternations of soils with various degrees of weathering and fine to coarse sand bodies, the latter forms a more consistently weathered sand accumulation capped by outcropping paleosols. Borehole samples show different types of paleosols between the East Barind Tract and the West Barind Tract, which forms a relative topographic high incised by both the Ganges and Tista rivers. We then analyze both sediment partitioning and geomorphic evolution with emphasis on the geometry of deep-structures. We combine gravity analysis and 2D flexural models that account for differential loading associated to both the tectonics (of the Himalaya Front mainly) and the sedimentation (of the Tista Fan and the Brahmaputra valley). We show that the Barind Tract is underloaded relatively to its surrounding which suggests that the region is being isostically uplifted. Hence the Tista Fan and Barind Tract surface dynamics have been propitious to keep both the Ganges and Brahmaputra rivers away from NW Bangladesh through the Holocene, affecting the Bengal basin evolution.