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Quaternary Geomorphology and evolutionary history of Jia Bhareli Basin, North Brahmaputra Plain, India

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Abstract

The north Brahmaputra plain forms a part of the Himalayan foreland basin characterized by a thick pile of Quaternary sediments bearing imprints of aggradation history, tectonism and climate changes. A number of river systems viz., Subansiri, Dikrai, Bhareli etc. having large hinterland catchments transverse through the sub Himalayan orogen and flows into the Brahmaputra taking orthogonal courses across the Alluvium. The present study deals with the Jia Bhareli catchment (~11800 km^2 , $92^0$00'-$93^0$25'E : $26^0$39'-$28^0$00'N) which has almost 3/4^{th} of its area within the hinterland. The precursor trunk channel, known as the Kameng, flows orthogonal to the Himalayan thrust pattern and found to have responded to deformation by deflecting along the Tipi Thrust in north and foothills fault (HFF) in the south respectively, before debouching into the foreland at Bhalukpung through a structural re-entrant. Further downstream it is known as Bhareli with its catchment localized within Brahmaputra alluvium.

Geomorphic mapping of the alluvial catchment reveals the presence of a paired high level aggradation terrace buttressing an extensive, gently rolling plain on either side of the active channel belt of Jia Bhareli ('Jia' meaning alive) that have an average gradient of about 1 in 650. A large flood plain of a meandering river system (sinuosity index. ~1.9) can be identified adjacent to the present channel as a distinct geomorphic entity towards west. It is dotted with numerous meander scars, remnant channels, misfit streams, inactive floodplains and arcuate natural levee. The course of this palaeo river system known as Mara Bhareli ('Mara' meaning dead), is well discernible in the ground and in satellite images. A reconstruction of the basin history suggests basin wide uplift during Quaternary that was compensated through incision by an order of 12-15m by the river system. Presence of wood stump at the base of terrace sections indicates that the event is geologically a very recent one. Subsequently, the erstwhile Mara Bhareli attained a graded condition with respect to the local base level (Brahmaputra river at Tezpur, $92^0$53'53"E: $26^0$39'15"N) and developed a wide meander belt. The alluvial catchment again experienced accelerated aggradations from a heavy influx of coarse bed load brought down from the Himalayan hinterland (present average sediment load ~1782 ha m and mean annual discharge ~ 27574 MCM). The river responded to the latest phase of active tectonism and sediment influx through change in channel pattern - from highly meandering to a typically braided one with widespread bank migration. Within the alluvial reach, width of the active multithread channel varies from ~1Km to more than 5km at places. The earlier river course is now occupied by a small misfit stream known as Jorasar, having substantially less stream power than the Mara Bhareli. A regional look at the fluvial regime adjacent to the study area indicates that the phases of basin rejuvenation in response to active tectonism was not confined to this area alone. The perplexity of this problem can however, be fully disentangled after reliable chronological data on Quaternary stratigraphic, geomorphological and structural events are generated and the tectonic and/or climatic forcing on them are established.