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CORRECTION

Correction to: Chronological evolution of the channel functional units in association with palaeo-hydrogeomorphological environment in the ancient delta fan of Subarnarekha basin, India

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The original article has been published inadvertently with some errors in figures and their caption (Figs. 1, 2, 3, 5) and errors only in captions of figures (Figs. 4, 6, 7, 8, 9), also errors in tables and their caption (Tables 1, 5, 6, 7) and errors only in captions of tables (Tables 2, 3). All the corrected versions of figures and tables (with captions) are given below.

The original article can be found online at https://doi.org/10.1007/s12665-020-09093-1.

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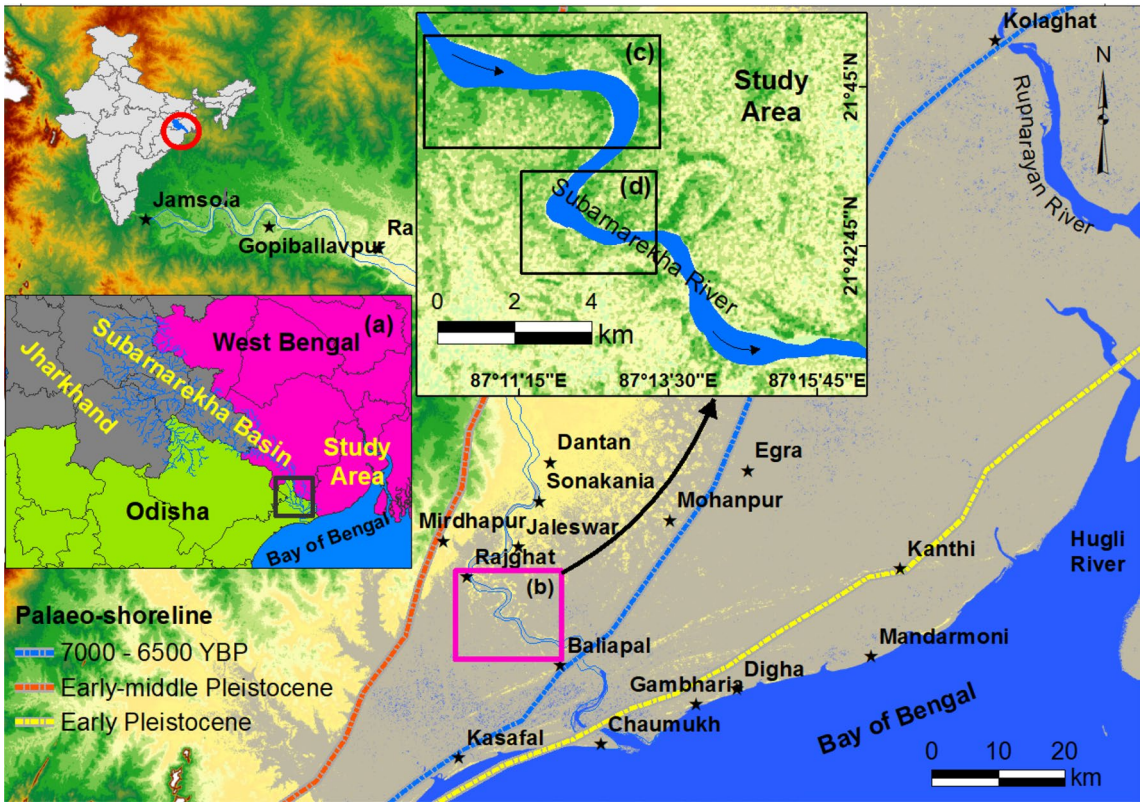

Fig. 1 Regional settings of the Subarnarekha deltaplain and position of palaeo-shorelines. Within the Subarnarekha river basin (*a*) the study area situated in the ancient delta fan region (*b*). The positions of river course in the downstream section of Rajghat (*c*) and in Asti section (*d*) have been considered for micro-morphological change analysis of the channel unit

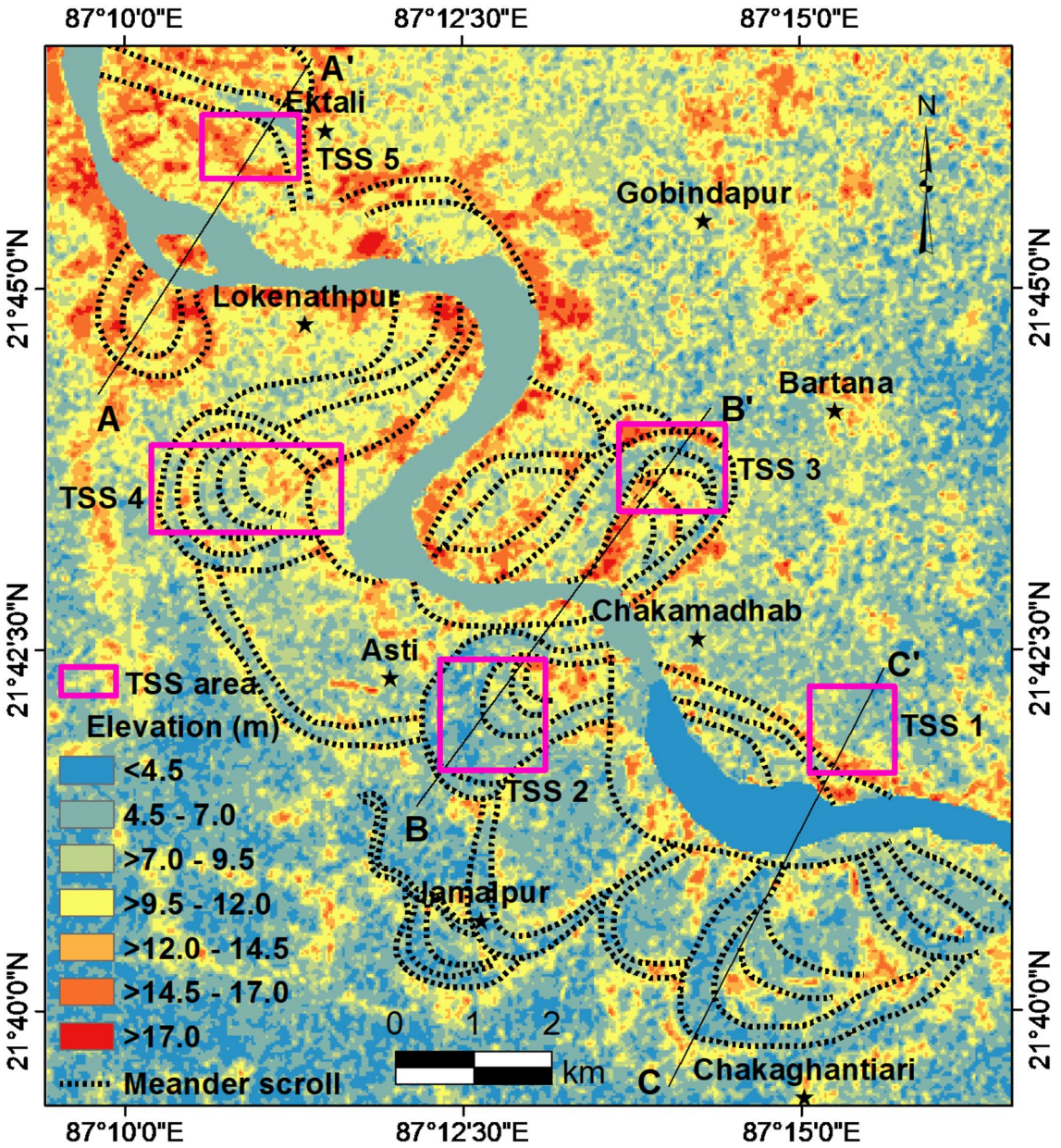

Fig. 2 Landscape composed of upper (> 12 m), middle (7–9.5 m), and lower (< 7 m) terraces in the lower Subarnarekha river basin. Palaeo meander scrolls aligned over middle-lower terraces. Five different areas of total station survey (TSS 1 to 5) have been indicated by rectangles. *AA′*, *BB′* and *CC′* are the position of cross-valley transects for analysis of micro-landforms

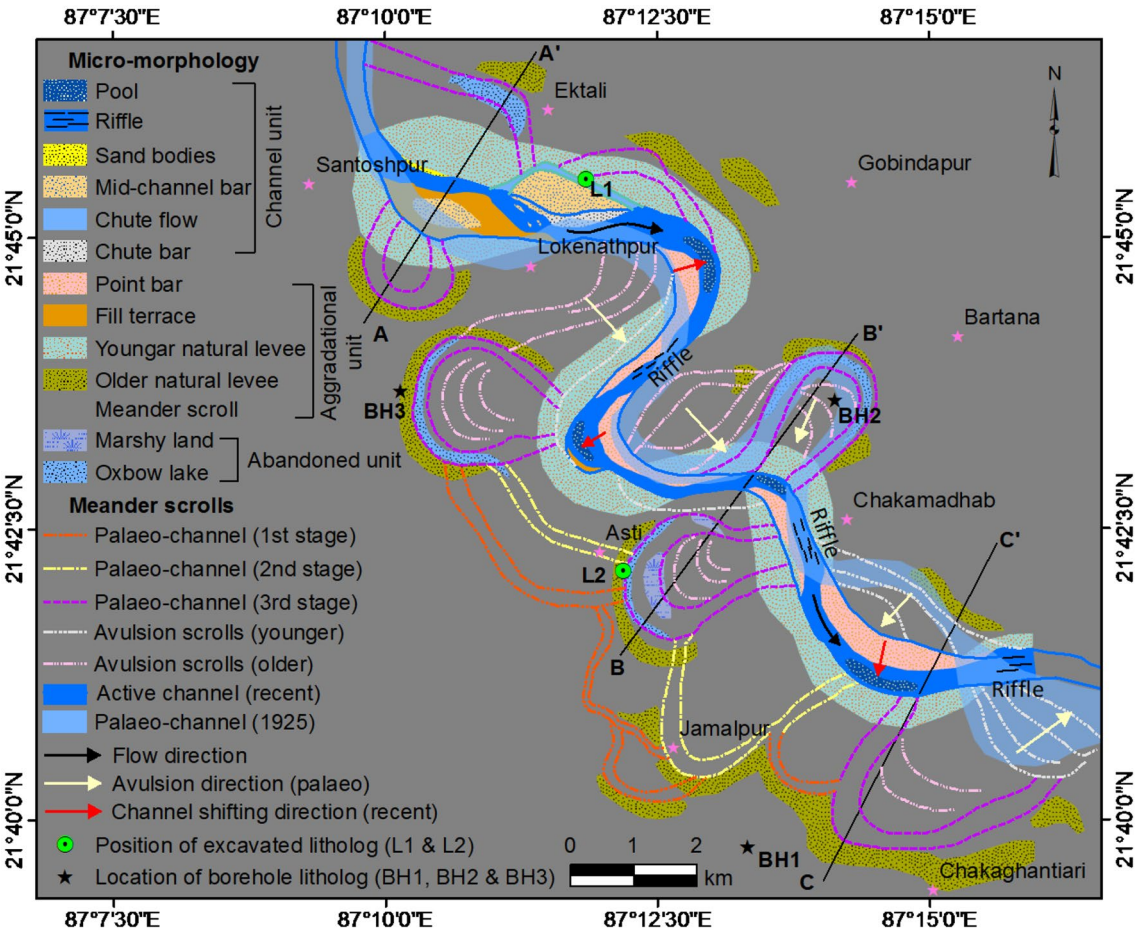

Fig. 3 Channel functional units with distinct micro-morphological features sculpted by avulsion processes during the past and recent period. *AA′*, *BB′* and *CC′* are the cross-valley transects

Fig. 4 Micro-geomorphological changes of the channel unit during 2007–2014 in the downstream section of Rajghat. The position of river course is demarcated in Fig. 1c.

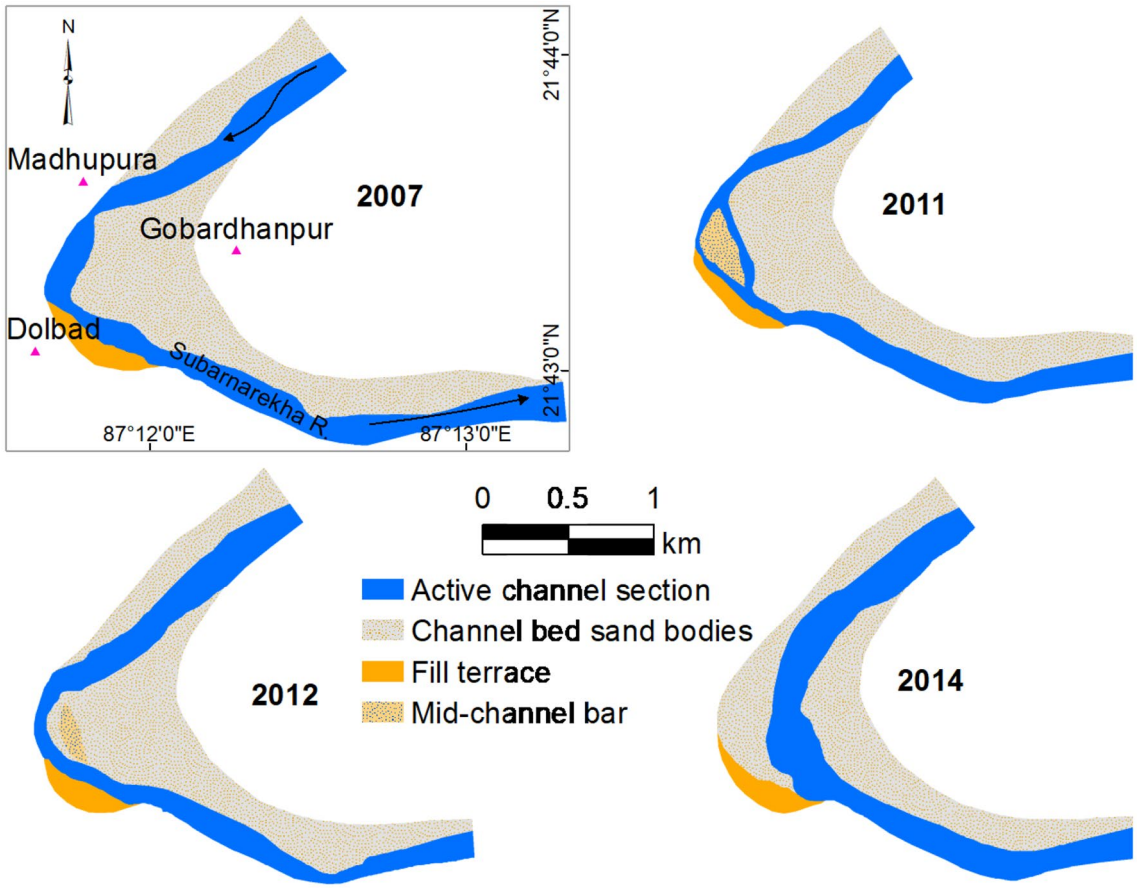

Fig. 5 Micro-geomorphological changes of the channel unit during 2007–2014 in the Asti section near Baliapal. The position of river course is demarcated in Fig. 1d

Fig. 6 Cross-sectional form of micro-landforms terraces discriminate the recent and palaeo-courses of the Subarnarekha river in three defined sections (AA′, BB′ and CC′), mentioned in Figs. 2 and 3.

Fig. 7 Yearwise distribution and trend of mean gauge height at the Rajghat gauge station and annual average sediment load at the Ghatshila gauge station of the Subarnarekha River during 1973–2012.

Fig. 8 Lithostratigraphic structure of sedimentary profiles of younger (L1) and older (L2) natural levee sites. Both photographs at top (a) and bottom (b) are the part of the same cross section of L1, which shows brownish-to-grayish colour. The positions of L1 and L2 mentioned in Fig. 3.

Fig. 9 Borehole lithostratigraphic structures and depositional environments of the ancient delta fan. The borehole locations are indicated in Fig. 3.

Table 1 Different functional units and micro-morphological features of the river course and floodplain areas

Functional units	Micro-morphology	Geometrical properties	Positions	Formation process	Field description
Channel unit	Pool	E_a : 4.28 CW_a : 375	Active channel bed	River hydraulic action	Active and shifts their position depending on river hydraulic action
	Riffle	E_a : 5.79 CW_a : 235			
	Mid-channel bar	E_a : 11.50 A_t : 1.15		Fluvial deposits	Erosive marginal part, and nearly stable and vegetated surface layer
	Chute bar	E_a : 8.62 A_t : 0.22		Degradation of mid-channel bar by storm flood	Degraded and almost abolished
	Chute flow	E_a : 10.21 A_t : 0.24	Active channel margin	Secondary flow during high flood events	Degraded and only active flow observed during extreme flood event
	Sand bodies	E_a : 6.35 A_t : 1.53		Flood deposits	Exists in same position and or change their position, shape and size depending on the flood nature
Aggradational unit	Point bar	E_a : 7.13 A_t : 2.76	Channel margin	Regular sedimentation during flood events	Most of the part is covered by vegetation (shrubs), and few areas altered due to agricultural practices
	Fill terrace	E_a : 7.43 A_t : 1.02		Fluvial sediment deposits during flood at the position of earlier cut terrace	Exists in the same position and or changing its position, shape and size depending on sedimentation nature
	Sand splay	E_a : 11.25 A_t : 0.07		Sand deposition during storm flood	Resides in the same location and utilized for cultivable land after removal of sand from the top layer
	Younger natural levee	E_a : 13.50 A_t : 12.90		Sedimentation over marginal areas of present river course during high flood discharge	Almost entirely occupied by dwellers for settlement and agricultural purpose
	Older natural levee	E_a : 12.25 A_t : 8.00	Floodplain	Sediment deposition in the marginal areas of the palaeo-river course during peak flood discharge	
	Ridge	E_a : 10.00		Excessive sediment deposits in channel fringe and floodplain area during the storm flood (sometimes found as older natural levees of the successive meander scrolls)	Used for vegetable cultivation
	Swale	E_a : 8.50		Fine grained sediment deposition in the floodplain areas (mostly found along the successive palaeo-river courses)	Used for rice paddy cultivation
	Floodplain	E_a : 6.00 S_a : 0.012		Overbank sediment deposition in the extensive low-lying areas on the both sides of the river course	Intensively used for agricultural activities and human settlement

Table 1 (continued)

Functional units	Micro-morphology	Geometrical properties	Positions	Formation process	Field description
Abandoned unit	Water bodies	E_a : 5.15	Floodplain	Natural ponding or pool position on the palaeo-river course, mostly altered by anthropogenic activities	Aquaculture farm
	Marshy land (with vegetal cover)	E_a : 5.00 A_t : 0.37		Natural depression areas of the floodplain, mainly form in the swale topographic condition	Primarily remained as marshy land and habitat for natural aquatic species, and few areas recently altered into aquaculture farm
	Natural wet depression (without vegetation cover)	E_a : 5.10 A_t : 0.55		Natural depression areas of the floodplain, mainly formed along the palaeo-river course	Mainly used as aquaculture farm
	Oxbow lake	E_a : 4.25 A_t : 1.56 R_c : 10.15		Isolated parts of palaeo-meander course formed after meander neck-cut	Initially remained as marshy land and habitat for natural aquatic species and recently altered into aquaculture farm
	Meander scroll	E_a : 9.50		Imprint of the avulsion of palaeo-river courses	Mostly altered by human activities (agricultural land and fisheries)

Note: E_a is the average elevation (m), CW_a is the average width of active channel (m), A_t is the total area (km^2), S_a is the average slope (m/m), and R_c is the average radius of curvature (m)

Table 2 Changing nature of different micro-morphological features of the downstream section of Rajghat (based on Fig. 4).

Table 3 Changing nature of different micro-morphological features of the Asti section near Baliapal (based on Fig. 3).

Table 5 Sedimentary characteristics of different layers of the excavated profile of older natural levee (L2)

Layer	Depth (m. bgl)	Material types	Structure/ fossil	Colour	Mean grain-size (μm)	Mode	Sorting	Skewness	Kurtosis
1st (top)	0.0–1.10	Medium–coarse silt	Horizontal planar lamination	Brownish	16.21	Unimodal	Moderately well sorted	Coarse	Platykurtic
2nd	1.11–2.30	Medium–fine sand	Trough cross bedding	Grayish	232.14	Bimodal	Moderately well sorted	Coarse	Mesokurtic
3rd	2.31–3.80	Mud	Decomposed root (*Avicennia* sp.)	Dark brown	1.22	Unimodal	Well sorted	Symmetrical	Platykurtic
4th	3.81–4.75	Coarse–medium sand	Trough cross bedding	Blackish gray	402.16	Bimodal	Moderately well sorted	Fine	Leptokurtic
5th	4.76–5.61	Sticky clay	Shells (*Ammonia* sp.) and decomposed root (*Acrostichum aureum*)	Dark black	0.42	Unimodal	Moderately sorted	Symmetrical	Platykurtic
6th (bottom)	5.62–6.11 (up to excavated layer)	Coarse silt	Decomposed root (*Acrostichum aureum*)	Blackish gray	21.31	Unimodal	Moderately well sorted	Symmetrical	Mesokurtic

Table 6 Comparative lithostratigraphic structures and depositional environments of the Subarnarekha deltaplain and Hugli delta region at Kolaghat

Layer	Borehole (BH2) at present study area (Subarnarekha deltaplain)					Kolaghat (left bank of Rupnarayan river) (Hait et al. 1996)		
	Depth (m. bgl)	Sedimentary layer	Age (YBP)	Geological age	Depositional environment/fossils	Depth (m. bgl)	Age (YBP)	Sedimentary nature
1st (top)	0–2.05	Coarse –medium sand	2640 ± 150 (Banerjee and Sen 1987)	Late Holocene (Meghalayan)	*Fluvial*: sedimentation over channel margin levee position during storm flood discharge	0.0–5.3	NM	Silty sand deposited under fluvial environment
2nd	2.06–5.50	Fine sand–silt	3470 ± 110 (Banerjee and Sen 1987)		*Fluvial*: sedimentation over the floodplain during high flood discharge during regression phase of sea-level	5.4–7.3	6900 ± 70	Peat layer deposited under estuarine with moderate tidal effects
3rd	5.51–7.85	Clay	6760 ± 50[1]	Middle Holocene (Northgrippian)	*Marine*: backwater deposits under moderate tidal effects, wet-humid swampy environment during slow rate of Flandrian transgression Fossils: *Acrostichum aureum; Ammonia* sp.	7.4–11.4	NM	Clay layer impregnated with kankar deposited under fluvial environment and arid climatic sub-phase
4th	7.86–12.60	Coarse–medium silt with fine sand	8000 ± 60 (Paul 2002)		*Marine*: overwash deposits over the older deltaplain at accelerated rate of transgression phase	11.5–16.8	NM	Clayey silt deposited under fluvial environment
5th	12.61–17.75	Clay with caliche nodules	10,800 ± 150 (Biswas 1993)	Early Holocene (Greenlandian)	*Fluvio-marine*: backwater cum fluvial deposits with prolonged arid climate	17.0–20.6	NM	Silty clay deposited under shallow marine environment

Table 6 (continued)

Layer	Borehole (BH2) at present study area (Subarnarekha deltaplain)					Kolaghat (left bank of Rupnarayan river) (Hait et al. 1996)		
	Depth (m. bgl)	Sedimentary layer	Age (YBP)	Geological age	Depositional environment/fossils	Depth (m. bgl)	Age (YBP)	Sedimentary nature
6th	17.76–19.75	Silt with very fine sand	15,000 ± 120 (Paul 2002)	Late Pleistocene (Tarantian)	*Marine*: brackish water tidal-flat deposits under the deltaic environment during accelerated rate of Flandrian transgression	20.8–23.6	NM	Silty clay deposited under estuarine with strong tidal effects
7th	19.76–26.95	Clay	32,200 ± 700[1]		*Marine*: initially deposited under shallow marine sequence and then a vertical upliftment might take place at the extreme extent of sea-level lowering Fossils: *Avicennia* sp.; *Ammonia* sp.	23.8–26.6	31,750 ± 2030	Clay deposited under estuarine environment
8th (bottom)	26.96–28.00 (up to drill position)	Fine sand	> 32,000 ± 700		*Fluvial*: sediment deposited over the ancient delta fan during the lowstand, then uplifted after deglaciation	26.8–30.0	NM	Silty clay deposited under fluvial environment

NM not mentioned

Note: [1]Dates are estimated in this present study.

Table 7 Micro-landforms of the functional units and quaternary processes

Landforms	Age (YBP)	Process of formation
Channel unit (pool, riffle, sand bodies, mid-channel bar, chute flow, chute bar)	Around 600–recent period	Fluctuating discharge of water and sediment and their interactions in diverse riverbed morphology
Aggradational unit (point bar, fill terrace, younger natural levee, older natural levee)	2640 ± 150 (Banerjee and Sen 1987)	Channel avulsion and sedimentation coupled with fluctuating discharge and base level of erosion
Abandoned unit (marshy land, oxbow lake, meander cutoff)	4810 ± 120 (Niyogi 1975)	Departing the river from palaeo-course to a new course with due effects from extreme discharge and valley cutting during marine regression phase

Note: Older natural levee of the aggradational unit was formed around 6000–5000 YBP.