

Mixed braided and leveed channel turbidite facies successions, sediment partitioning and depositional elements of the Oligocene-Miocene Crocker Fan System, NW Borneo, SE Asia

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The Oligocene-Miocene West Crocker Formation of NW Borneo represents a laterally extensive, 'unconfined' basin-floor turbidite fan complex that was deposited in an accretionary foredeep basin. The system covers more than 25,000 sq km, rivaling in size and sediment volume many of the world-class modern and ancient turbidite systems. The turbidite system comprises at least 1,000 meters of sand-rich composite depositional sequences.

Exceptional vertical exposures provide the framework for interpretation. Vertical facies successions logged along a 100-km strike section record a sand-rich turbidite system constructed of end-member turbidite depositional facies. (1) coarse-grained, sand-rich leveed channels transitional to braid-plain distributary channelized sheets/lobes and (2) mixed sand-rich to mud-rich leveed-channel bypass systems.

Leveed channel systems overall fine- and/or thin-upward successions of aggradational/fill and lateral/spill of channel axis and margin facies, proximal levee and distal overbank levee facies; clay plugged avulsed channels and splays. The braid-plain distributary channel lobe complex is characterized by thickening and coarsening upward facies succession associated with sand-rich leveed-channel elements. Mega-mass transport complexes present but rare.

Facies successions are interpreted as channel-levee migration of sand-rich or mixed sand-mud systems, stacked multi-story channels, and low-relief anastomosing distributary channel lobe elements; and/or splays.

Individual channel complexes are between 15 to 60 meters thick net > 80% sandstone. Sand-rich leveed-channel axis and terminal braid-plain channel facies consist of mega-beds (2-3.5 meters thick) of medium to very coarse sand in massive poorly sorted, trough cross bedded, diffuse wavy parallel layered, hummocky aggradational in-phase bedforms, planar grain-sorted parallel layered sheet bedforms with dewatering structures. Processes range from traction confined to high-density rapidly decelerated flows. The channel margin facies and braid-plain sheet facies consists of massive to diffusely laminated, coarse to medium sands with flow-stripped, ripple-laminated to debris flow couplets of slurry flow-debrite caps. Inter channel braid plain bars are constructed of shingled, lenticular bedforms and common debrite couplets.

Mixed sand-mud leveed channel complexes, up to 60 meters thick, grade upward from stacked multistory channel mega-beds to thinning and fining-upward proximal and distal levee facies characterized by flow-stripped ripple laminated (climbing and in-phase ripples) and delicate surge climbing ripple sets