

EGU21-14931, updated on 28 Oct 2021

<https://doi.org/10.5194/egusphere-egu21-14931>

EGU General Assembly 2021

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Sedimentary signals of fluvial discharge variability under tide and wave influence: Miocene examples in NW Borneo

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The interaction of river and marine processes in the fluvial to marine transition zone (FMTZ) fundamentally impacts sedimentary dynamics and deposition. Heterolithics are important facies within ancient and modern FMTZs but the preserved signal of river flood, wave and tidal variations in heterolithics remains uncertain. This study integrates facies and ichnofacies characteristics of heterolithics in the Lambir Formation (Baram Delta Province, NW Borneo), with information of larger-scale stratigraphic architecture and modern analogue information, to interpret the preserved record of river flood deposits under the influence of tides and waves in an ancient FMTZ. Within the FMTZ of distributary channels, interpreted proximal–distal sedimentological and stratigraphic trends suggest: (1) a proximal fluvial-dominated, tide-influenced subzone; (2) a distal fluvial- to wave-dominated subzone; and (3) a conspicuously absent tide-dominated subzone. During coupled storm and river floods, fluvial processes dominated the FMTZ along major and minor distributary channels and channel mouths, causing significant overprinting of preceding interflood deposits and deposition of thicker, sandier event beds. Intervening interflood deposits are muddier, with increased bioturbation, and may variably preserve sedimentary indicators of tide and wave processes. Despite interpreted fluvial–tidal channel units and mangrove influence implying tidal processes, there is a paucity of unequivocal tidal indicators (e.g. cyclical heterolithic layering). This suggests that process preservation in the FMTZ preserved in the Lambir Formation primarily records episodic (flashy) river discharge, river flood and storm overprinting of tidal processes, and possible backwater dynamics.