

Fluvial to tidal transition in the Mekong River delta, Vietnam

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The Mekong River delta extends from its apex at Phnom Penh in Cambodia to the Vietnamese coast, and from the Saigon River mouth in the east to Cape Camau in the west. The delta plain area exceeds 50,000 km². The delta has prograded more than 200 km during the last 6-7 ka. The middle Holocene sea-level highstand is recognized at ~2 m above present sea level in this region. The delta owes its great size to the combination of a huge sediment supply and a stable sea level for the last 6-7 ka. The area around the mouth of the Mekong is meso-tidal with a maximum tidal range of 3.2-3.8 m. Tidal effects are obvious in the water level as far as ~100 to 150 km upstream from the river mouth throughout the year, but particularly in dry seasons. The zero meter level of the river channel thalweg is ~600 km upstream, in Cambodia. Freshwater and sediment discharges from upstream occur mostly in the wet season from May to November; however, ocean tides exert strong influences in the dry season, including re-suspension of sediment in river channels.

To better quantify the influence of river discharge and tides on river-bottom sediments, we collected >250 surface samples from distributary channels across the entire delta in Vietnam from the border to the five river mouths during the dry season (January-May 2015), and from one distributary channel from the border to the river mouth during the wet season (October 2015) with simultaneous CTD measurements. In the dry season, river- and tide-dominated areas can be spatially distinguished by the sedimentary facies (grain size and sedimentary structures) of channel bottom sediments. Tidal rhythmites (sand-mud couplets) are common as far as ~100 km upstream from the river mouths, and mud balls are often found in the middle reaches of distributaries. The spatial distribution of river- and tide-dominated areas is closely linked to channel morphology. The thalwegs of river channels show deepening trends, with large variations, downstream from the border and suddenly change to shallowing trends near their mouths. Coarse sediments are found mostly in regions with a deepening trend and sand-mud couplets are found in regions with a shallowing trend. During the wet season, most of the rivers are occupied by freshwater, and the 0.5 pss salinity line is only ~5 km upstream from the river mouth. Nevertheless, sand-mud couplets are recognized up to ~100 km upstream from the river mouth in this freshwater environment.

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