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## A Seismic Study of the Mekong Subaqueous Delta: proximal versus distal accumulation

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### Abstract

The Mekong River Delta is one of the largest in Asia. To understand its sediment distribution, thickness, mass budget, stratigraphic sequences and sediment-transport process, extensive geophysical and geochemical surveys were conducted on the inner and portions of the adjacent continental shelf. Analyses of >80 high-resolution Chirp-sonar profiles show the Mekong River has formed a classic sigmoidal cross-shelf clinoform, up to 15 m thick, with topset, foreset and bottomset facies, but constrained to water depths of <20 m. Beyond this depth, the East Sea/western South China Sea shelf is dominated by relict silt, sand and gravel with patches of early to middle Holocene mud deposits. Parallel to shore, the Mekong-derived sediment has extended >250 km southwestward to the tip of the Ca Mau Peninsula, forming a distal mud depocenter up to 22 m thick, and extending into the Gulf of Thailand. A large erosional trough or channel (up to 8 m deeper than the surrounding seafloor and parallel to the shore) was found on the top of the clinoform, east of the Ca Mau Peninsula.

Based on the thicknesses and distribution revealed by Chirp sonar profiles, the total estimated volume of the Mekong River subaqueous clinoform on the shelf is  $\sim 120 \text{ km}^3$ , which is equivalent to  $\sim 120\text{-}140 \times 10^9$  tons of sediment using an average sediment dry-bulk density of 1.0-1.2 g/cm<sup>3</sup>. Assuming the subaqueous deltaic deposit has formed within  $\sim 1000$  yr, the calculated millennial-timescale average sediment discharge to the shelf could be  $120\text{-}140 \times 10^6$  tons per year. Spatially, the proximal subaqueous delta has accumulated  $\sim 45 \times 10^9$  tons ( $\sim 33\%$ ) of sediment; the distal part around the Ca Mau Peninsula has received  $\sim 55 \times 10^9$  tons ( $\sim 42\%$ ) of sediment; and the remaining  $\sim 35 \times 10^9$  tons ( $\sim 25\%$ ) has accumulated within the central transition area, although the coastline and shoreface in this area are presently eroding. The spatially averaged 1000-yr-scale accumulate rate is up to 2 cm/yr.

Compared to other tide-dominated fluvial dispersal systems, the Mekong River system has a relatively young ( $\leq 1000$  yr) subaqueous delta, a shallow rollover at 4-6 m water depth, gentle foreset gradients ( $0.03\text{-}0.57^\circ$ ), and a short cross-shelf dimension of 15–20 km within 20-m water depths. Like the Amazon, Po, and Yangtze rivers, the Mekong River has developed a pervasive along-shelf deposit, which in this case extends >250 km to the southwest as a result of the superimposed tidal processes, wave-induced resuspension, and a strong winter-monsoon coastal current.

**Keywords:** Mekong Delta; clinoform; subaqueous delta; along-shelf transport; sediment accumulation rate; Chirp sonar profiles; seismic stratigraphy

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