

Seismic geomorphology and stratigraphic evolution of the early Eocene lacustrine delta system in the northern steep slope of Dongying Depression, Bohai Bay Basin

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Abstracts: The Lower Eocene siliciclastics in the northern steep slope of Dongying Depression, Bohai Bay Basin, are interpreted as having been deposited by lacustrine deltas. Their stratigraphic evolution and geomorphological features are investigated on the base of an integrated analysis of cores, well-logging, and 3-D seismic data. Three types of lacustrine deltas are identified at the root of slope, including channelized subaqueous delta, non-channelized subaqueous delta and slump turbidity delta. The channelized subaqueous deltas, dominated by straight or slightly curved distributary channels in N-S direction, are mainly infilled with pebbly sandstones intercalated by mudstones. The non-channelized subaqueous deltas are lobate in plane-view as is shown on RMS amplitude maps, lacking major channels. The slump turbidity delta shows an elongate shape with a single, straight-to-weakly meandering channel fronted by large terminal splays. The vertical lacustrine succession of facies indicates that the Lower Eocene Formation in Dongying Depression can be divided into one sequence containing three system tracts and eight parasequence sets. The lowstand deltas are dominated by channelized subaqueous deltas and non-channelized subaqueous deltas, revealing the types of delta may vary along-strike covering short distances at the root of slope. The transgressive deltas have similar type to those lowstand in smaller scale, reflecting a retrogradation towards the upper slope. The slump turbidity deltas commonly occurred during the HST with non-channelized subaqueous deltas poor developed. Accumulation of these proximal sediments is inferred to reflect a complicated interplay between slope accommodation and sediment flux. The steep slope, evolved from a joining point of extensional fault scarps, preserves numerous gullies eroded into the base of slope. These gullies, acting as conduits for transporting sediments through the steep slope into the lacustrine basin, were downslope - oriented, ca 4 km long, ca 1 km wide and < 300 m deep. The deltaic deposits fed by sediment gravity flows frequently route through these slope gullies. The different types and distribution of lacustrine deltas are interpreted to be related to the intensity of fault movement and climate change, which creates the heterogeneity in the slope topography and source proximity. An integrated study on the stratigraphic evolution and morphology of deltas in lacustrine successions will contribute to new exploration strategies for the Dongying Depression, Bohai Bay Basin.

Key words: lacustrine environment; delta system; seismic geomorphology; gullies; northern steep slope; Bohai Bay