

## **A Practical Application of Modern Depositional Analogs, Part II: Environments of Sand Deposition Associated with a Macrotidal Estuary, the Colorado River Delta, Baja California**

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### **Summary**

An often understated benefit of modern depositional analogs is the refined perspective that the field experience lends to the general understanding of sedimentology and stratigraphy. Modern depositional systems provide geoscientists and engineers with a clear 2-D appreciation for the areal extent, geometry, spatial distribution, and preferred orientation of reservoir scale depositional elements (e.g. chenier ridges, alluvial slopes, tidal channels, etc.). Exposure to modern depositional systems translates directly to a more realistic perspective in mapping and interpretation of subsurface data. With this intent, the Devon Canada Corporation has developed two modern clastic field seminars as an in-house professional development initiative for its geoscientists and engineers. These seven day field seminars expose participants to the wide range of environments of sand deposition and contrasting sand body architectures.

The Colorado River delta (Figure 1) is located in Baja California, Mexico, at the northern end of the Gulf of California, a Neogene-age rift basin created by strike-slip displacement of the Baja Peninsula along the San Andreas fault. The delta is located within a complex zone of strike slip faulting and oblique crustal extension. Five kilometers of deltaic deposits record approximately six million years of basin subsidence and sediment aggradation. The Holocene stage of delta development is represented by a macrotidal 'geomorphic' estuary (or tide-dominated delta) formed by the interglacial eustatic sea level rise and drowning of a broad lowstand delta.

The Colorado River delta was selected for study for several reasons. The 'geomorphic' estuary represents the type of depositional system commonly assigned to late transgression/early highstand deposits associated with several major unconformities in the Western Canada Sedimentary Basin. The estuary contains several coeval, sand-rich geomorphic elements that contrast strongly in areal extent, geometry, spatial distribution, and preferred orientation. The Colorado delta and Gulf of California have well documented depositional, climatic, eustatic and structural histories. Sea cliff outcrops of Pleistocene and Pliocene age strata flanking the estuary provide 3-D examination of coastal facies. Mesas on the delta plain and sea cliffs along the coast provide direct observation of unconformity development associated with tectonic, climatic and eustatic changes. Lastly and most important, the Colorado River delta is easily accessed with a large group of participants.



Figure 1: Satellite image of the northern Gulf of California showing key depositional elements associated with the fault-bounded, Holocene-age Colorado River 'geomorphic' estuary. (Landsat 7 image ETM+ PR38/38 020231, acquired through Radarsat)

The Colorado River Delta/Estuary contains several geomorphic elements that can be grouped into four broad depositional settings:

- 1) shallow marine estuarine funnel that contains an estuarine channel, large-scale tidal bars (including IHS point bars), actively shifting fluidized mud and sandy subtidal bar complexes;
- 2) narrow, sand-rich retrogradational barrier coastline created by combined flood tidal and longshore currents;
- 3) broad progradational coastal mudflat that contains saline playas and aeri-ally-restricted reservoir sands of several types, including a 45 km long chenier margin composed primarily of coquina sand deposits up to 5 m thick; and

- 4) non-marine settings that includes fluvial deltaic meander reaches, aeolian coastal dune complexes and broad, low gradient, sand-dominated alluvial slopes that flank the western and eastern margins of the basin.

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