

## **A Practical Application of Modern Depositional Analogs, Part I: Environments of Sand Deposition Associated with a Wave-Dominated Coastline, Nayarit, Mexico**

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### **Summary**

Geoscientists rely heavily upon depositional models to guide and constrain reservoir mapping and description. These conceptual models, for the most part, are constructed from studies of both modern depositional systems and their rock record analogs. In contrast to outcrop analogs, modern environments provide unambiguous ranges and limits for the scale and geometry of depositional elements. Other advantages of modern depositional analogs include the ability to: observe reservoir and non-reservoir facies (e.g. potential seals or baffles) across the entire depositional system; accurately define the processes operating during deposition; and accurately define the long- and short-term controls on those processes (e.g. climate, tectonics, eustacy, etc.).

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 geomorphic elements (e.g. barrier strandplain, bayhead delta, fluvial meander belt, etc.). These surface characterizations, when combined with vibrocore data, outcrops and geophysical studies, provide a more comprehensive 3-D view of the depositional system. Because of global variations in sediment supply, accommodation and coastal energy patterns, Holocene depositional systems in general can offer the range of potential stratigraphic stacking architectures (i.e. progradational, aggradational, or retrogradational) that are recorded in the stratal complexity of the rock record. This is particularly so when the range of the depositional analog is extended to include the associated late Pleistocene succession.

An often understated benefit of modern depositional analogs is the refined perspective that the field experience lends to the general understanding of previously published studies in sedimentology and stratigraphy. This benefit translates directly to ongoing exploration/exploitation programs by providing a more realistic perspective to the mapping and interpretation of subsurface data. With this intent, the Devon Canada Corporation has developed two modern sandstone 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 first field seminar examines a 150 km long stretch of wave-dominated, microtidal coastline in the state of Nayarit, western Mexico (Figure 1). This coastline contains several large sand-rich geomorphic elements associated with wave-dominated deltas and a broad coastal estuary formed during the late Holocene inter-glacial sea level rise. Sand-rich elements record the turning point

from transgression to regression, and provide modern depositional analogs for a variety of aerially extensive, regressive sheet sands that comprise a large proportion of the reservoirs within the Cretaceous interior seaway.

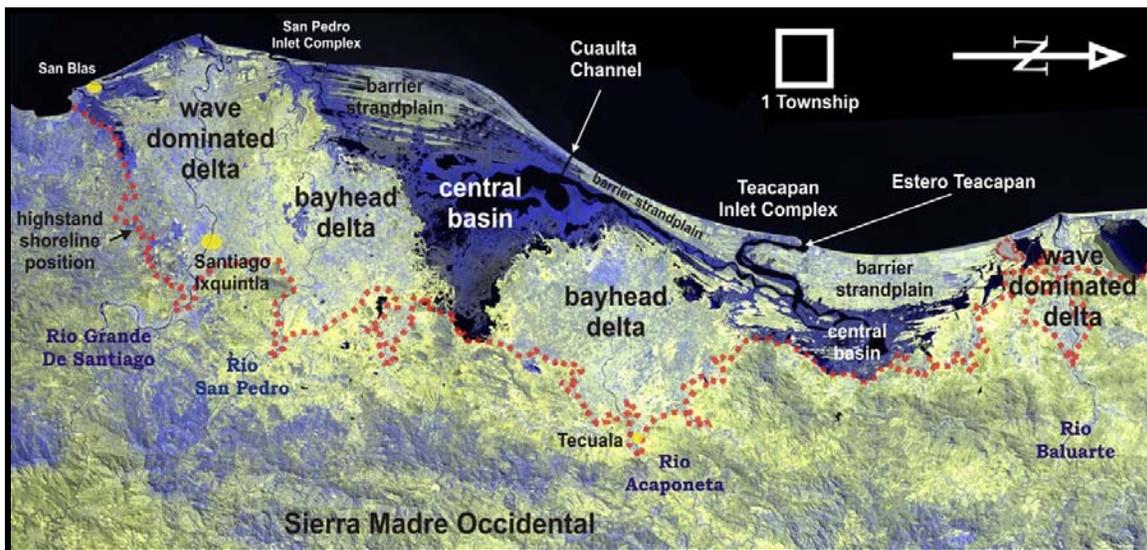


Figure 1: Satellite image of ~210 km of coastline of the state of Nayarit, Mexico showing key depositional elements and geographic locations associated with two Holocene-age wave-dominated deltas enclosing a wave-dominated microtidal estuary. (Landsat 5 image PR3144 900406, from Global Land Cover Facility (GLCF))

The Nayarit coastline was selected for study for three reasons: 1) it is frequently invoked as a depositional analog for many of our Mesozoic reservoirs formed under mixed, wave-influenced fluvio-estuarine conditions; 2) there are published data (lithologic, borehole and geophysical) that allow some 3-D extrapolation; and 3) it complements the second in-house field seminar that examines sedimentary environments associated with the macrotidal Colorado River estuary to the north.

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