DEPOSITIONAL MODELS OF BARRIER ISLAND SHORELINES

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During the past decade, subsurface studies on modern shorelines, primarily on the U.S. Gulf and East coasts, have provided the basis for significantly more sophisticated barrier island depositional models. These studies have documented the effects of wave energy, tidal range and storms in determining sedimentary sequences and sand body geometry. Facies relations and preservation potential of barrier islands are controlled by sea level fluctuations and sediment supply. Shoreline orientation is controlled by structural setting and antecedent topography.

As a result of Holocene sea level rise, most modern barrier islands are transgressive, and are characterized by thin sequences of burrowed lagoonal muds overlain by horizontally bedded washover-foreshore sands of storm origin. Transgressive barriers have a sheet-like geometry, low preservation potential and are rarely recognized in ancient deposits. Although less common in modern settings, seaward prograding (regressive) barrier islands are highly depositional, and characterized by thick, coarsening-up sequences of burrowed to crossbedded fine sand. Regressive barriers have a lenticular geometry, thicken and fine seaward, and are common reservoirs. The shore-parallel migration of tidal inlets results in significant reworking of both types of barrier islands, depositing thick fining-up sequences of crossbedded coarse sand. Inlet deposits can account for up to 50 per cent of Holocene barrier shorelines and have a greater preservation potential than most other barrier-associated facies. Inlet geometries vary from wedge (wave-dominated) to U-shaped (tide-dominated).

Best reservoir potential and thickest sand accumulations occur in the shoreface and tidal inlet associated facies. Upper shoreface to foreshore facies are dominantly an orthoquartzitic, well sorted, fine to medium sand with little or no detrital clays due to winnowing and lack of burrowing. Tidal inlet channels and deltas may be similar lithologically except they include poorly sorted fine to coarse sand and shell.

Modern shoreline studies have greatly enhanced recognition of ancient barrier sequences and prediction of reservoir distribution and behaviour. Cretaceous barrier island reservoirs in the Western Interior include the Muddy Sandstone and Almond Formation at Patrick Draw Field. Micro to mesotidal strike oriented regressive barriers and dip oriented cross-barrier sand bodies are observed.