

# **Comparative Analysis of Ancient Mouth Bars and Subaqueous Terminal Distributary Channels in Three Deltas: The Permian Mackellar Formation of Antarctica, the Cretaceous Schrader Bluff Formation of Arctic Alaska, and the Cretaceous Loyd Formation of Colorado**

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## **Abstract**

We compare geometries-architectures of mouth bars (MB) and associated subaqueous terminal distributary channels (TDC) in three ancient river-dominated deltas. We discuss the reservoir potential of these architectural elements and identify barriers-baffles to flow. Although most deposits are interpreted to record alternating river-flood traction processes and fallout from plumes; fluctuating discharge and sediment supply, complex coastline geometries, grain size and salinity variations, and secondary tidal/wave processes likely controlled dissimilarities between systems.

A postglacial, paleopolar delta in the Mackellar Formation (Fm) of Antarctica contains an interval of 5-8 m thick, compensationally stacked TDCs with a central thick and laterally extensive "wings" (levees). TDCs and levees comprise trough cross-laminated, current-to climbing-rippled, or structureless/deformed medium-grained sandstones overlying prodelta and underlying proximal to distal delta-front deposits. MBs comprise low-angle planar, current, and climbing-ripple laminated sandstones interbedded with finer-grained deposits of hypopycnal plumes, all incised into by smaller TDCs.

A muddy, paleopolar delta in the Schrader Bluff Fm of Arctic Alaska contains lensoidal TDCs 0.1-1.5 m thick encased in prodelta to distal delta front deposits. TDCs comprise trough cross-stratified to structureless and rarely hummocky cross-stratified fine-grained clean sandstones. MBs are recorded by a 5 m thick multistory trough cross-stratified sandbody. In contrast, a sand-rich delta contains trough cross-stratified low width/depth TDCs up to 1.2 m thick and high width/depth TDCs up to 2 m thick. MBs are 3 to 20 m thick, multistory sandbodies comprising well- to moderately-sorted, fine- to coarse-grained, trough cross-stratified sandstone and 0.5 to 2.5 m thick foresets dominated by parallel lamination.

A delta in the Loyd Fm of Colorado contains foresets comprising commonly-burrowed low-angle planar-laminated fine-grained sandstones up to 1 m thick that alternate with flaser-wavy-lenticular bedded mudstone-siltstone. TDC's are 1-2 m thick and incise into MBs.

The thickest, and highest-quality sandstones, and likely the best reservoirs, are the large Mackellar Fm TDCs and Schrader Bluff Fm proximal MBs; however, MBs and TDCs in all three systems are potential reservoirs. Barriers-baffles include mud-rich drapes that result from fallout deposits (hypopycnal plumes) and/or tidal influence in these systems.