Thick successions of climbing-ripple and scour-fill deposits in overbank/off-axis deep-water environments: Tanqua Karoo, South Africa and Magnolia field, Gulf of Mexico

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Outstanding exposures of climbing-ripple cross-laminated sandstones and interbedded scour-fill deposits of the Tanqua Karoo submarine fan system in South Africa serve as an excellent process-based analog for the ‘Magnolia’ field in the deep-water Gulf of Mexico due to similarities in facies, grain size, and architecture. Thick (> 40 m), fine grained successions of high N:G climbing-ripple cross-laminated (CRCL) sandstone, unusual in most turbidite systems, are present in both the Tanqua Karoo and Magnolia. This study suggests that CRCL-sandstone successions in both systems represent off-axis/overbank deposits. The interbedded scour-fill intervals simply represent more energetic events or fairways in a system otherwise dominated by deposition.

The westernmost outcrops of ‘Fan 3’ in the Permian aged Tanqua Karoo contain 50 m of CRCL-sandstone and CRL-siltstone with interbedded scour surfaces filled with CRCL, flat-laminated, and massive sandstone. These deposits are interpreted here to represent an off-axis environment. This is corroborated by over 500 paleocurrents, which indicate that these outcrops are
not levee deposits sourced from channels to the east. Rather, this interval represents the off-axis portion of flows feeding the channels from the southwest. Scour size and abundance decreases to the west, away from the axis.

Core taken from the Magnolia field (Lower Pleistocene) in the ‘Titan’ intraslope mini-basin contains 86 meters of CRCL-siltstone and sandstone and interbedded scour-fill intervals. Previously interpreted as amalgamated channels, the core is here interpreted to occupy the overbank setting of a low sediment supply offstacking channel complex. Using the Tanqua Karoo as a process-based analog, this new interpretation better suits the sedimentary facies and reservoir connectivity seen in Magnolia and can help to develop a better constrained reservoir model.