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The Effect of Active Growth Folding onTurbidite Deposition: Insights from the Karoo Basin of South Africa

The turbidite outcrops of the Karoo Basin of south-western South Africa provide a superb opportunity to develop predictive 3-D reservoir models of turbidites that were deposited on both stable and actively deforming basin floors.

The early Karoo basin of southwestern South Africa was segmented into the Tanqua and Laingsburg sub-basins through the growth of antiform/synform pairs oblique to the dominant shortening direction in the bounding Cape Fold Belt. These structures grew episodically during deposition in the Laingsburg area but did not affect the Tanqua sub-basin.

Individual basin floor fans (50 - 300 m thick) are divided into high-frequency sequences that include sand-prone growth phases separated by fan-wide zones of reduced sand deposition. In both sub-basins, these high frequency sequences form zones for reservoir modelling. Sheet sandstones are arranged into upward-thickening and upward-thinning successions and stack in progradational, aggradational and retrogradational styles separated by laterally persistent mud-prone units (condensed intervals) that ultimately control vertical and horizontal effective permeability.

Basin floor fans in the Tanqua sub-basin exhibit ''lobate-type'' geometries. Thick sands in the centre of the fans give way to thinner-bedded heterolithic units towards the fan fringe area. Progradational units show ''clinoform-like'' geometries as progressive sand-prone units build basinwards. The main effect of punctuated growth folding on the Laingsburg basin floor fans was to elongate fan geometries parallel to the fold axes and to concentrate sand-rich flow fractions in syntectonic lows, resulting in starvation on and beyond highs. The main effect of growth folding on the Laingsburg slope systems is episodic cycling (in space and time) between ponded accommodation and bypass, resulting in complex facies patterns, net:gross trends and connectivity.