Structural and Tectonic Evolution of the Gippsland Basin – Analysis of Local 3D and Regional 2D Seismic Data

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Australia's Gippsland Basin has proven reserves of 4.1 billion barrels of oil and 13 TCF gas mainly trapped in Paleocene deltaic reservoirs within slightly inverted hangingwalls of large extensional faults. The deeper structural geometry has been poorly understood, but renewed exploration efforts demand evaluation of deeper targets and an improved understanding of the basin architecture. Detailed analysis of the Tuna 3D seismic and 7000km of 2D seismic has produced a new model for the basin's structural-tectonic evolution. In the Early Cretaceous, the first rift event involved a highly oblique rifting mechanism, which created NE-SW trending en echelon Strzelecki depocenters bounded to the north and south by partially linked faults. Following major uplift and erosion along the basin edges in the Cenomanian, a transitional rift phase resulted from Tasman Sea rifting. This event produced NE-SW trending faults, which initially reactivated Strzelecki faults and toward the end of the rift phase resulted in E-W trending fault linkages. At Tuna, major NE-SW striking growth faults controlled the deposition of lacustrine Emperor Subgroup. A Santonian change in stress direction resulted in the widespread propagation of new NW-SE trending extensional faults, which cross-cut faults of earlier rift events. As the basin underwent initial thermal sag from the Maastrichtian to Paleocene, fault controlled subsidence enhanced NW-SE striking relay-ramp style normal faults. Evidence of long-lived intermittent folding and inversion is abundant in the north of the basin. The most pronounced compressional activity occurred by inversion of SE-dipping growth faults of the Turonian transitional rift phase.