

Impact of Late Mesozoic and Younger Tectonics on Half-Graben Filling and Petroleum Prospectivity of the Canterbury Basin, New Zealand

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ABSTRACT

Exploration in the Canterbury Basin, New Zealand, has been reinvigorated in the last 10 years and although wells indicate an active petroleum system there have been no economic discoveries in the basin to date. The geometries, thicknesses and lithologies of basin strata are strongly influenced by the Cretaceous and younger tectonic history which can be divided into three phases. (1) Mid-Cretaceous rifting associated with Gondwana breakup, (2) Late Cretaceous to Oligocene passive margin formation during post breakup drift and, (3) Oligocene-Recent contraction produced by oblique plate boundary convergence. Interpretation of mainly 2D seismic reflection lines and wells indicate that mid-Cretaceous rifting (~105-86.5 Ma) formed in association with NE-SW, E-W and NW-SE trending normal faults. These faults strike approximately parallel to the margins of New Zealand continental crust and accrued displacement synchronously. They formed due to distributed extension prior to Gondwana breakup, with maximum throws typically greatest on NE striking faults sub-parallel to the mid-ocean ridge system separating New Zealand and Antarctica. Fault displacements of up to 2-3 km produced fault-bound structural highs and under-filled half graben depocentres. Inactive fault 'scarps' were subsequently buried by prograding Late Cretaceous wedges of ~150km² which downlap growth strata. These wedges likely comprise siliciclastic sediment eroded from the hinterland and deposited either as fan delta or submarine fan during general deepening of water depths (and regional subsidence) in the drift phase. The rift-drift sedimentary succession offers considerable potential for source, reservoir and seal rocks in sub-basins, however, due to the structure of the basin, the faulting and the complex sedimentation patterns these sedimentary units are likely to be discontinuous, which may locally impact basin prospectivity