

PS Oil and Gas in Eastern New Zealand: Fresh Insights from the Pegasus Basin*

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Abstract

The East Coast Basin of New Zealand's North Island has long tantalized oil explorers with an abundance of oil and gas seeps and potential trapping structures. All three wells drilled offshore have encountered promising gas shows. The basin lies entirely on the deforming Australian Plate within a Neogene subduction margin; its southeastern margin lies directly against the undrilled Pegasus Basin, which lies on the subducting Pacific Plate. Prior to the onset of Neogene subduction at c. 23 Ma, both basins were part of the same remnant of the Triassic-Cretaceous Gondwana subduction margin. Whereas the East Coast Basin has since accumulated great thicknesses of Neogene sediment and been deformed by a post-23 Ma tectonic overprint, the Pegasus Basin has remained relatively unscathed and therefore provides an undeformed mirror image of the pre-Neogene succession of source and reservoir rocks. In 2010 the New Zealand Government acquired 3,000 km of high quality 2D seismic across the Pegasus Basin in an attempt to understand the likelihood of finding commercially-viable accumulations of oil and gas in this unexplored part of New Zealand. These new seismic data show a range of large potential trapping structures, most associated with seismic anomalies including bright-spots, flat-spots, amplitude suppression, and velocity push-down effects. Additionally, an extensive bottom-simulating reflector (BSR) indicates the widespread presence of a gas hydrate layer. Six play types identified in Pegasus Basin include thrust anticlines along the margin with the East Coast Basin, thrust anticlines along the fossil Gondwana subduction margin, blind thrusts in Neogene turbidites in front of the East Coast margin, stratigraphic pinch-outs of Neogene turbidites, traps beneath a gas hydrate layer, and compound stratigraphic/BSR traps. Presently, the distribution of Cretaceous and Paleogene source rocks in the offshore of the East Coast Basin is poorly known due to the pervasive post-23 Ma tectonic overprint and the thick blanket of Neogene strata that hinders seismic imaging of older strata. Our revised geological model of eastern New Zealand, using the succession mapped in the Pegasus Basin, provides new controls on the thickness of Cretaceous and Paleogene rocks that should underlie southern offshore East Coast Basin. This new knowledge will in turn help to better understand the region's petroleum systems, which should lead to the discovery of large oil and gas reserves.