

Fault and fracture reactivation in the Penola Trough, Otway Basin

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FAULT REACTIVATION IN THE PENOLA TROUGH

ABSTRACT

The Penola Trough, onshore Otway Basin, is a failed rift structure trending NW-SE on the South Australian-Victorian border. Following its formation during the Late Jurassic, the trough has been subjected to alternating periods of extension and compression, leading to the reactivation under compression of many normal faults associated with the trough's formation during the rifting of Australia and Antarctica. Deposition of carbonaceous shales, fluvial and lacustrine clastics and coals formed a hydrocarbon system, which has accounted for several successful plays to date. Several palaeo-hydrocarbon columns have also been drilled, with the absence of any oil or gas attributed to the reactivation of normal faults breaking the sealing mechanism present and allowing trapped hydrocarbons to migrate elsewhere. This project aimed to locate the fault segments that were most likely to dilate, slip and fracture and consequently the areas where hydrocarbons were unlikely to remain trapped. In contrast to this, geothermal exploration is targeted on the fault segments where reactivation is prone. Seismic interpretation and subsequent fault modelling was undertaken, and stress profiles containing stress and lithology data were applied to the interpreted faults, revealing reactivation likelihoods. Fault segments striking NW-SE at shallow depths (<2000m deep) were found to be the most prone to dilation. Shallow fault segments were also found most likely to fracture and slip. This correlates with current data showing known economic gas accumulations to be dominant on E-W trending fault traps. Carbon dioxide sequestration efforts would also be most successful on these sealing traps, while geothermal energy plays should target NW-SE striking faults and their associated fracture networks for optimal permeability.

KEYWORDS

Otway Basin, in-situ stress, fault reactivation, Penola Trough, fault, seismic

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