Structural Controls On Present Day Hydrocarbon Leakage In The North West Shelf, Australia: New Information From The Integration Of Airborne Laser Fluorosensor (ALF) And Structural Data

By G.T. Cooper, C.R. Barnes, J.D. Bourne & G.J. Channon

Abstract

Airborne Laser Fluorosensor (ALF) data from the AC/P15 region of the Timor Sea have been interpreted in conjunction with high quality 2D Andromeda reflection seismic data. ALF anomalies are observed to occur at or near the tips of major Mesozoic faults. Detailed mapping suggests that these fault tips occur at zones of basement transition or 'polarity flips' where footwall and hanging wall blocks are linked via a system of soft-link relay ramps. These ramps act as hydrocarbon migration pathways from the source kitchens of the Cartier and Nancar Troughs.

These data suggest that the dilational reactivation of the tips of the Mesozoic faults during Tertiary extension results in the propagation of small-scale faults across the relay ramps, thus breaching the migration pathway. The position of faults which breach these ramps coincides with the position of the ALF anomalies. Thus most examples of hydrocarbon leakage as defined by ALF data are a function of migration pathway breaching during the evolution of relay ramps. This model is significantly different to contemporary models for leakage and breaching in the North West Shelf which assume that these phenomena rely on the reactivation of entire fault planes due to the prevailing stress regime, and/or the interaction of oblique faults of different age. The data suggest that leakage is related to fault tip propagation during fault segment linkage as part of the evolution of soft-link faults and is not a function of hard-link or basement transfer fault reactivation.

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