The Origin of Overpressure in the Carnarvon Basin, Western Australia from Porosity-Effective Stress Analysis

Van Ruth, Peter John, Richard Hillis, and Peter Tingate, University of Adelaide, Adelaide, SA, Australia

Porosity-effective stress analysis of 37 normally and overpressured wells in the Carnarvon Basin, Australia, identified 12 wells with overpressure generated by disequilibrium compaction, and four wells with overpressure generated by fluid expansion. Disequilibrium compaction is the dominant overpressure-generating mechanism in wells along the Rankin Trend as far South as Gorgon 1 and Spar 1. Fluid expansion is the dominant mechanism of overpressure generation in wells along the Barrow Trend and around the Alpha Arch. Disequilibrium compaction-generated overpressures occur, as would be expected, where the Tertiary sediment thickness is greatest and fluid expansion overpressures where the Tertiary is thinnest.

Indeed where the N-1 (35 Ma) reflector is greater than ~1500 m below seabed disequilibrium compaction overpressure are observed and where it is shallower than ~1500 m fluid expansion overpressures are observed. Log-based pore pressure detection using Eaton's (1972) method on p-wave acoustic data yielded the most accurate estimates with an exponent of three where the overpressure was generated by disequilibrium compaction, and an exponent of six where the overpressure was generated by fluid expansion.