Structural architecture of the outer Beagle Sub-basin, North West Shelf, Australia

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The Mesozoic Beagle Sub-basin covers ~30,000 km^2 and comprises a series of north-south-trending horsts and grabens crosscut by subordinate northeast-trending faults. The Outer Beagle Platform forms the peripheral and structurally transitional northwest boundary of the basin in the Northern Carnarvon Basin (NCB) in 50–1000 m of water 250 km offshore on Australia's North West Shelf.

Structural analysis of the Canning TQ3D three-dimensional seismic survey identified four major fault populations of extensional faults constraining the evolution of the Outer Beagle Platform; (1) Upper Triassic–Jurassic north–south-trending extensional syn-rift faults, (2) Upper Triassic–Jurassic northeast-trending (3) Cretaceous polygonal non-tectonic fault tiers, and (4) Cenozoic en echelon conjugate fault arrays ('hour-glass' faults). Seismic interpretation utilizing attribute analysis illustrates that nucleation of north–south-trending normal faults and subsequent dextral oblique-slip displacement results in characteristic 120° and 60° rhomboidal faulting.

Decoupled non-tectonic Cretaceous polygonal fault arrays partition the superjacent Cenozoic en echelon conjugate fault arrays from subjacent Upper Triassic–Jurassic north–south-trending tectonic extensional syn-rift faults. Monoclinic draping of post-rift Cretaceous–Cenozoic post-rift strata across these rhomboidal horsts results in >60° dipping en echelon fault arrays soft-linked to the subjacent tectonic fabric.

This study illustrates the evolution of the Outer Beagle Platform with implications for understanding the distribution, segmentation, linkages and age of complex trans-tensional faults within the NCB. The results preclude principle strike-slip motion as the causative mechanism of the en echelon and rhomboidal fault architecture and demonstrate the influence of extension oblique to pre-existing Paleozoic fault trends.

2013 West Australian Basins Symposium