

Structural Architecture and 4-D Evolution of the Central Exmouth Plateau, North West Shelf, Australia

Awad Bilal¹, Kenneth McClay¹, Nicola Scarselli¹

¹Earth Sciences, Royal Holloway University of London, Egham, Surrey, United Kingdom.

ABSTRACT

The Exmouth Plateau is a major NE-trending Mesozoic to Cenozoic marginal deep-water plateau within the prolific Northern Carnarvon Basin on the Northwest Shelf of Australia. Detailed analyses of three merged 3D seismic surveys that cover greater part of the Central Exmouth plateau were undertaken to understand the 4D tectono-stratigraphic evolution of the central Exmouth Plateau. Structural analyses identified three populations of extensional faults; (1) Lower to Mid Triassic north-northeast-trending listric growth faults; (2) Upper Triassic to Early Late Jurassic north to north-northeast-trending planar extensional faults, and (3) Cretaceous to Neogene reactivation of some of the north-northeast-trending Upper Triassic – Early Late Jurassic fault systems. Non-tectonic Cretaceous and Neogene polygonal faults also occur in post break-up sequences. Multi-attribute analyses also allowed the documentation of two fracture sets in the central Exmouth Plateau; (1) approximately north-northeast-trending fractures that are sub-parallel to the major fault systems, and (2) east–west-trending fractures that are approximately sub-parallel to the present-day stress field. The north-northeast trending Lower to Mid Triassic listric growth faults formed during the development of the giant Triassic Mungaroo delta system that extends over much of the Exmouth Plateau. Some of these deltaic faults underwent reactivation during the Late Triassic to Early Late Jurassic extension, and as well completely new small-displacement, domino style planar faults formed in the upper part of the Triassic delta strata. These latter faults are characterised by complex fault linkages along both strike and dip. They display only minor syn-extension sedimentation. The larger fault at the Upper Triassic and Jurassic levels are linked to re-activated delta faults at depth within the MTriassic Mungaroo strata. These are strongly affected by footwall degradation in the Jurassic. Reactivation of some of these planar faults occurred during the Early Cretaceous break-up along the outboard part of the Exmouth Plateau. This study proposes new 4D tectono-stratigraphic evolutionary models for this part of the NW Shelf of Australia.