

Structural analysis and 3D modelling of detachments in Delta—Deepwater Fold-Thrust Belts with particular emphasis on the White Pointer and Hammerhead Deltas of the Ceduna Sub-basin, Bight Basin, South Australia

Justin MacDonald
University of Adelaide, Australian School of Petroleum
Adelaide, Australia
jmacdonald@asp.adelaide.edu.au

Large deltas exhibiting extensional faults are commonly linked to down-slope deepwater fold-thrust belts; here, described as delta—deepwater fold-thrust belts (DDWFTBs). Delta—deepwater fold-thrust belts form at continental margins due to the rapid deposition of basinward prograding deltaic sediments above extensive salt or thick, overpressured shale. The tectonics of a DDWFTB system is primarily driven by gravitational forces. Margin-parallel gravitational extensional stresses on the delta top drive down-dip compressional stresses in the deepwater fold-thrust belt (or delta toe); thus, generating a linked and (usually) balanced system of extension and compression above a single basal detachment. The lithology, thickness and dip orientation of this detachment horizon are first order parameters that control the style of tectonic structures forming above the detachment; and thus control many aspects of associated petroleum systems; for example, fault/fracture size and orientation, fold style, fluid migration pathways, and trap geometry and volume.

Currently, little is known about the behavior of detachment horizons in DDWFTBs and their influence on structural style. This project aims to quantify and qualify the controls on structural style within DDWFTBs so that the associated petroleum systems can be better exploited. Construction of 3D structural models, Finite Element Method based two-dimensional restorations and analytical modelling of the detachment thickness and taper angles ($\alpha + \beta$) that are characteristic of progradational delta systems are being undertaken to understand these controls. Research is focused on the relatively underexplored Late Cretaceous White Pointer and Hammerhead DDWFTBs in the Bight Basin, southern Australia.