# Columbus Basin Linked Structural Assemblages

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## Abstract

The Columbus Basin is a Plio/Pleistocene gravity driven extensional system superimposed on a Miocene foredeep, with a linkage to older phases of deformation. Jurassic rifting and structural modification of the Mesozoic passive margin has created NW-SE and SW-NE topographic trends. Subsequent foredeep development has resulted in a north dipping homocline and Miocene to Pleistocene SW-NE transpressional ridges. This paper shows how regional stresses, sediment load and the shale detachment have controlled and influenced the Columbus Basin fabrics.

The Columbus basin has a clear detachment that separates the gravity driven extensional system from the deeper structural fabric. The older fabric affects the thickness of the overlying shale detachment zone, which in turn affects the nature of the gravity driven faults. This soft linked effect of the Jurassic rift fabric through the detachment allowed rift geometries to influence accommodation zones. Jurassic fabric may also have been reactivated by the present day stress regimes and have become soft linked transfer zones in the Plio/Pleistocene section.

The Plio/Pleistocene fault systems consist of master counter regional and regional faults. Subsidiary faults accommodate hanging-wall deformation, fault tip zones, damage zones and footwall collapse zones. Transpressional anticlines reflect progressive compression of the basin from the NW initiating escape tectonics to the NE. When transpressional anticlines and extensional anticlines constructively interfere, crestal collapse faulting occurs. The regional faults form due to sediment load, transpressional shear and the counter regional hanging-wall rotation. The geometry of the passive margin facilitates the formation of an older family of regional faults to the southern part of the basin that were subsequently captured and reused by the younger gravity driven fault system. In addition, the thickness of the detachment zone affects the geometry of the regional faults. The faults are more listric to the north, where the detachment zone is the thickest, and planar to the south, where the detachment zone is thinner. The regional faults are younger than the counter regional faults. Consequently the regional faults cut and intersect the counter regional faults, leading to a ‘lock up’ of the counter regional system when a new counter regional fault forms to accommodate further sediment deposition.

Plio/Pelistocene faults transfer deformation across accommodation and transfer zones. These zones are characterized by displacement transfer between similar faults – e.g., regional faults and areas where basin extension is transferred between different fault types. An example of the latter is evident to the south of the basin, where the counter regional fault system tips out and gives way southward to a regional fault system.

The northern Columbus basin is inverted, the signature of the foredeep fabric being clearly observed as affecting the extensional fabric. Inverted structures, anticlines and extensional faults have formed the major traps within the Columbus Basin. An understanding of these mechanisms, which control the nature of these traps, is thus vital in the future prediction and exploration of major hydrocarbon accumulation.