Tectonic Control on Late Devonian Reef Complex Evolution, Lennard Shelf, Northern Canning Basin, Australia

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Mixed carbonate-siliciclastic deposition along the northern margin of the Fitzroy Trough (northern Canning Basin) was strongly controlled by extensional tectonism and half-graben development in the Late Devonian. Tilt block highs were favourable sites for reef complexes which are now preserved in exhumed limestone ranges on the inner Lennard Shelf as well as deeply buried reef complexes, some of which host oil, across the middle and outer Shelf. Half graben and large inter-reef basins were filled predominantly with siliciclastic sediments shed from the adjacent Kimberley landmass. Coarser (conglomeratic) equivalents deposited in deltaic systems are exposed within and adjacent to the limestone ranges.

Contemporaneous faulting during reef evolution is interpreted from pinnacle development and/or subaerial exposure surfaces on footwall blocks coeval with deeper water deposition on the hangingwalls. Outcrop studies form the basis for a platform evolution model for the northwestern Lennard Shelf in which third-order sequence boundaries define seven discrete (approx. 1-3 myr) phases of platform growth and demise. This model provides a framework for analysis of half-graben fills and, in particular, to assess the character of predicted lowstand deposits through integration of seismic, sedimentologic and biostratigraphic data. Various carbonate units as well as mounds and/or reef complexes are recognised in the half-graben fills. The similarity between these buildups and those which host oil, along with others interpreted on the outer Shelf, emphasize both a complex paleogeography and underexploration of the Lennard Shelf to date.