# Depositional Framework of Petroleum Systems, Browse Basin, Offshore North West Shelf, Australia

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## ABSTRACT

The Browse Basin is a proven hydrocarbon province hosting gas with associated condensate on Australia's North West Shelf. Geoscience Australia has undertaken a multi-disciplinary study to identify the various hydrocarbon sources and high-graded areas of increased liquids prospectivity within a primarily gas-prone province. Updated biostratigraphy, well correlations, seismic and paleogeographic and play fairway interpretations were completed for ten Hettangian to Maastrichtian supersequences. These data together with geochemical analyses were integrated into a regional petroleum systems model to better understand source rock distribution, character, generation potential and play prospectivity. Isochore maps and depositional environmental models suggest multiple source rock units in compartmentalised Jurassic–Cretaceous source pods resulting in four geochemically distinct petroleum systems. Source pod location is influenced by regional basin architecture and entrenched fluvial systems forming a complex network of sedimentary inputs to the basin. Gas generated by the Lower–Middle Jurassic source rocks within the J10–J20 supersequences (Plover Formation) have migrated through the basin and accumulated at multiple stratigraphic levels. The Jurassic J10–J50 supersequences (Plover and lower Vulcan formations) in the Heywood Graben have generated fluids of a different composition to those elsewhere in the basin, and are most similar to a petroleum system in the neighbouring Bonaparte Basin. Gases with the highest liquid content are reservoired within the K10 supersequence (Brewster Member, Vulcan Formation) in the Ichthys/Prelude and Burnside accumulations. These fluids are probably sourced by shales of the Upper Jurassic–Lower Cretaceous J40–K10 supersequences (Vulcan Formation) encasing the K10 sandstone reservoir. Marine Lower Cretaceous source rocks in the K20–K30 supersequences (Echuca Shoals Formation) have sourced oil and gas in Cretaceous reservoirs of the Caswell Sub-basin and on the Yampi Shelf. The latter accumulations contain a mixture of Cretaceous oil mixed with gas generated by higher maturity Jurassic source rocks. A proposed scenario is that these Cretaceous-sourced liquids were mobilised and carried to the shelf edge by co-migrating Plover-derived gas with subsequent biodegradation and leakage. These results open up shallow liquid-prone plays, in the southern Caswell Sub-basin and on the basin margins.