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# Petroleum prospectivity and $CO_2$ storage assessment in the offshore Browse Basin, North West Shelf, Western Australia & Ashmore Cartier

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The Paleozoic to Cenozoic Browse Basin, offshore Australia's North West Shelf, is being explored for hydrocarbons. It hosts large undeveloped gas and condensate accumulations, and is soon to become Australia's next major conventional liquefied natural gas province. The basin was identified as potentially suitable for offshore geological storage of $CO_2$ due to its favourable geological setting on a passive margin, and its proximity to offshore gas resources containing naturally high amounts of $CO_2$.

Under the Australian Government's National CO2 Infrastructure Plan (NCIP), Geoscience Australia undertook a regional-scale basin analysis to assess the long-term $CO_2$ storage potential in the basin, while simultaneously considering hydrocarbon prospectivity. The assessment included information from over 60 wells, regional 2D and 3D seismic reflection surveys and potential field data, as well as newly acquired pre-competitive data derived from an airborne magnetic survey, two marine surveys, and the geochemical analysis of oils, gases and source rocks.

The dual purpose basin analysis provided a new understanding of the basin's Cretaceous succession based on new information regarding basin evolution, sequence stratigraphy, structural architecture and petroleum systems. The basin's tectonostratigraphic framework was updated, and the integration of revised and recalibrated biostratigraphic data with well log and seismic interpretations has enabled an improved understanding of variations in depositional facies and the spatial distribution of reservoir, seal, and source rock (condensed) sections. The outputs include models and maps of environments of deposition, petroleum systems and play fairways.

Three main stratigraphic play types, relevant to both $CO_2$ storage and hydrocarbon potential, were identified: basin margin, clinoform topset and submarine fan. The Lower Cretaceous basin margin plays and the Upper Cretaceous (early Campanian) submarine fan play may be the most prospective for $CO_2$ storage. However, key risks include: up-dip migration of hydrocarbons from Cretaceous and older source rocks from the basin depocentres which may present a potential resource overlap on the Yampi Shelf and in the northern part of the Caswell Sub-basin; lack of top and lateral seal; reservoir sand connectivity in the Upper Cretaceous; and recent faulting that is optimally oriented for reactivation under the present stress-regime.

The extents of four previously documented petroleum systems were revised based on well-control, where hydrocarbon shows and accumulations from petroleum systems are known, and on seismic mapping of effective source rock kitchens. A dry-gas-prone petroleum system, probably sourced from

the Lower–Middle Jurassic Plover Formation, occurs across the entire basin. Three other petroleum systems, sourced by more liquid-prone source rocks within Jurassic and Lower Cretaceous sedimentary rocks, are presently only recognised within the Caswell Sub-basin. Seismic mapping suggests, however, that the succession also extends into the Barcoo Sub-basin.

Results from this project will guide future storage site selection in targeted reservoirs for the commercial deployment of CCS technology, and promote new hydrocarbon exploration opportunities.