

# GEORGINA BASIN

## Carbonate Ramp Facies And Oil Plays In The Middle-Late Cambrian, Southern Georgina Basin, Australia

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The southern Georgina Basin is a greenfields exploration province covering over 100 000 km<sup>2</sup> in central Australia. The highly prospective Early-Middle to Late Cambrian sedimentary succession denotes a basin-wide upward-shallowing sequence, up to 900 m thick. Recent seismic studies have identified thick tidal channel/deltaic clastics in the Steamboat Sandstone. These have potential to trap hundreds of mmbbl oil in place. Later unroofing of the basin has resulted in this play occurring at depths of 300–1000 m (Figures 1–5).

The prospective section ranges from platformal Thornton Limestone, unconformably overlain by marine anoxic shale (lower Arthur Creek Formation-outer ramp facies), grading to increasingly oxic, mixed clastic/carbonate sediments (upper Arthur Creek Formation-middle ramp facies), capped by near-shoreline oolitic carbonate and quartz-rich sandstone (Steamboat Sandstone-inner ramp facies). The Arthur Creek Formation was deposited during a greenhouse climate, on a broad low-gradient ramp, which steepened distally towards the Toko Syncline. This section is, in turn, overlain by peritidal sediments of the Hagen Member, which formed by aggradation of a complex carbonate/evaporite/siliciclastic succession, deposited in an intermittently emergent epeiric sea.

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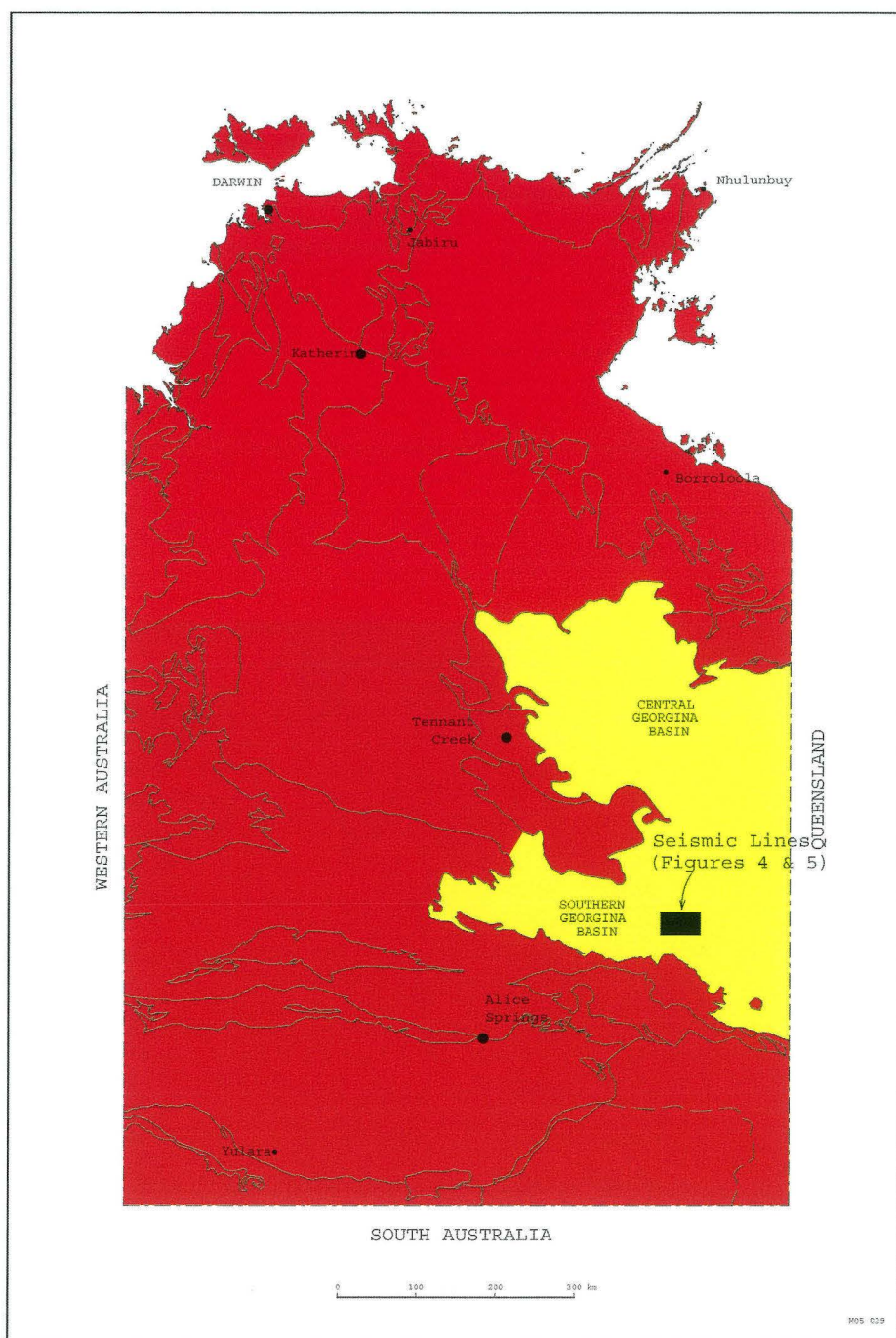


Figure 1. Extent of Georgina Basin within the Northern Territory.

Rich, oil-prone microbial source rocks in the lower Arthur Creek/upper Thornton section are pivotal to the exploration effort in this basin and there is evidence of widespread oil migration. Maturation modelling, constrained by apatite fission track data and supported by petrological evidence, indicate widespread oil generation and migration during the Ordovician, prior to structuring associated with the Devonian–Carboniferous Alice Springs Orogeny. Thus, early-formed stratigraphic plays and structural plays associated with the Delamerian Orogeny (Late Cambrian–Early Ordovician) are highly prospective.

The sheet-like Thornton Limestone/basal Arthur Creek Formation reservoir–seal couplet favours structural entrapment. Grainstone shoals and debris flows in the upper Arthur Creek Formation provide opportunities for really extensive structural/stratigraphic traps tapping relatively thin, high-performance reservoirs. Seismic signatures within the Steamboat Sandstone depict stacked beach ridge/barrier/deltaic facies and tidal channels up to 200 m thick, with potential to entrap hundreds of mmbbl (Figures 2–5). The basal Hagen Member, which is often tight, sometimes comprises cavernous shoreline grainstones sealed by evaporites in the western part of the basin, where the shoals overlap basement. Unroofing of the basin during the Alice Springs Orogeny dictates shallow target depths of 300–1000 m over most of the study area. ■

AGE	FORMATION	HC SHOWS
TERTIARY		
MESOZOIC	HOCRAJ	
MID DEVONIAN	DULCIE Sst	
EARLY & MIDDLE ORDOVICIAN	TOMAHAWK	Gas show B Bitumen
LATE CAMBRIAN	ARRNTHRUNGA EUROWIE Sst Mbr HAGEN Mbr	B Bitumen Oil show
MIDDLE CAMBRIAN	ARTHUR CREEK FORMATION 'Hot Shale' THORNTONIA Lst	Oil show Oil show
EARLY CAMBRIAN	RED HEART DOLOSTONE Mt BALDWIN Fm	
NEO-PROTEROZOIC	ELKERA GRANT BLUFF	

Figure 2. Stratigraphy of the southern Georgina Basin.

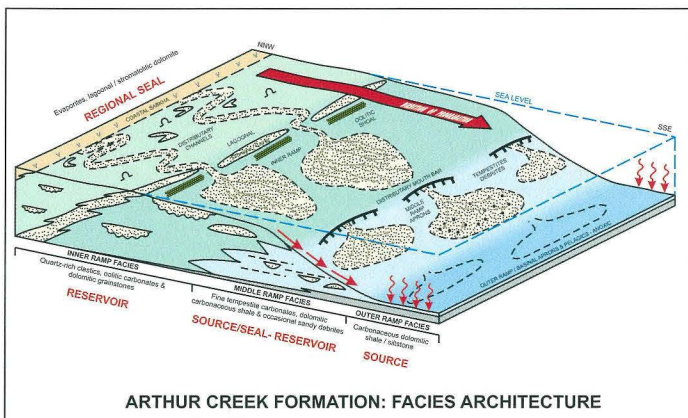


Figure 3. Facies architecture of the Arthur Creek Formation/Steamboat Sandstone.

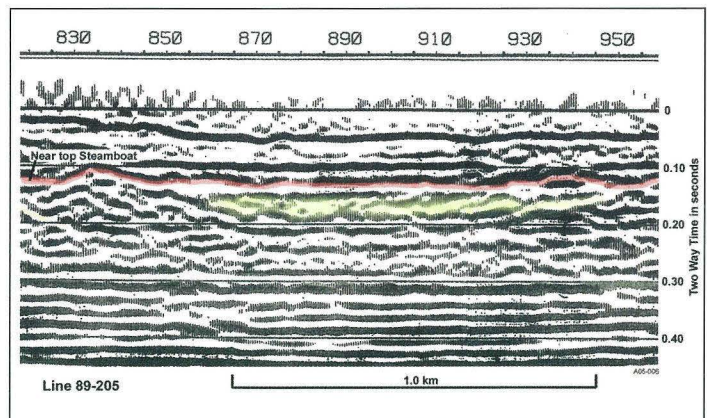


Figure 4. Thick tidal channel facies (yellow) in the Steamboat Sandstone, southern Georgina Basin.