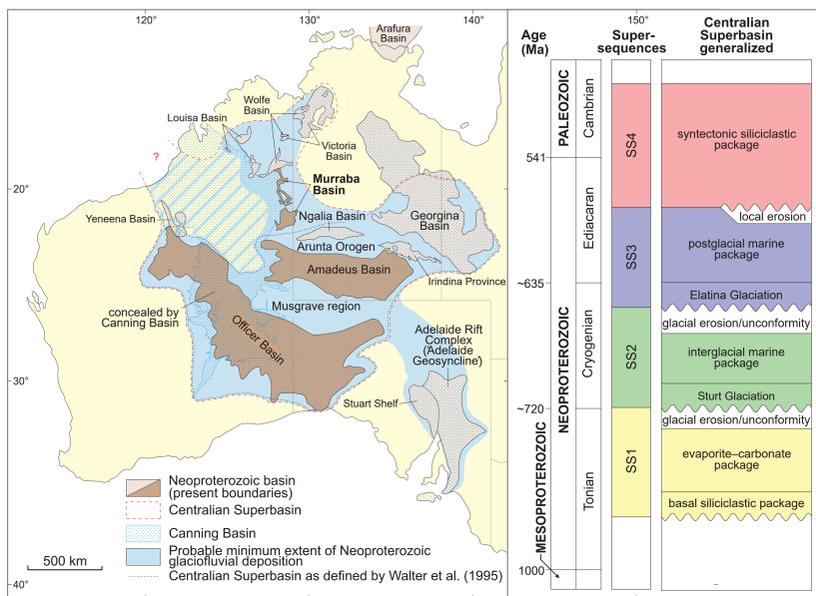


OFFICER BASIN

Hydrocarbon potential in WA

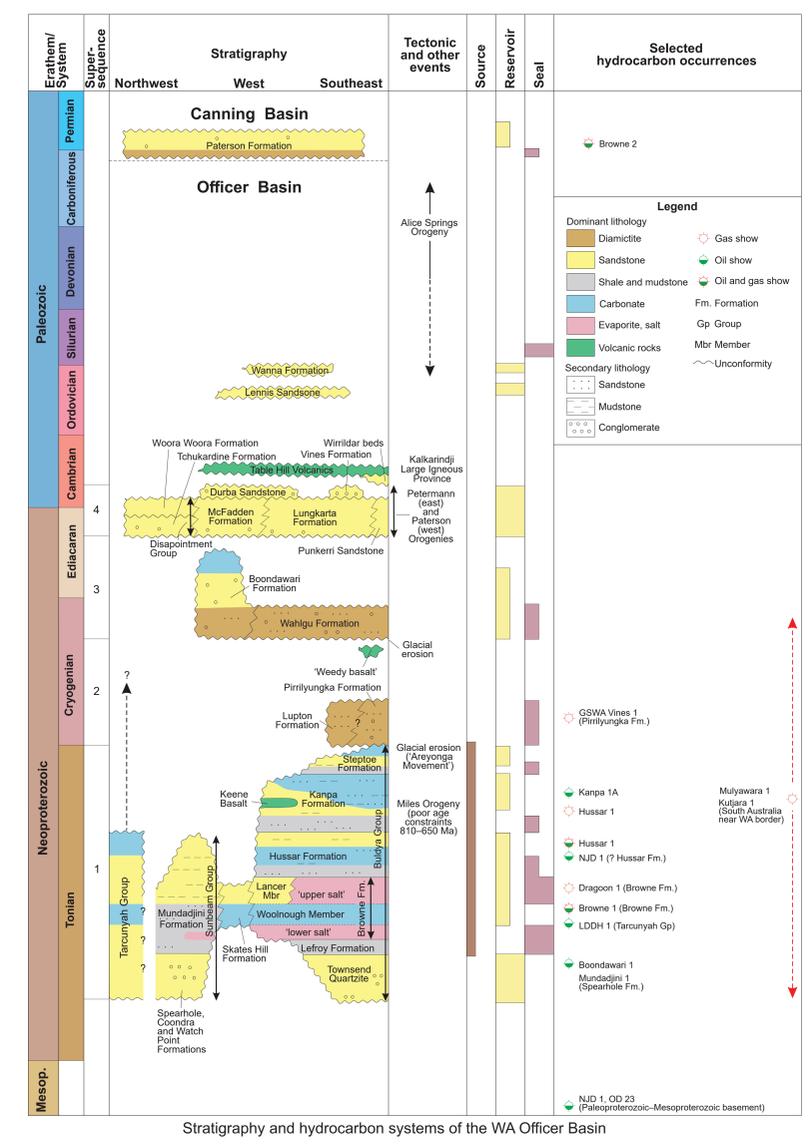
The Neoproterozoic–Paleozoic Officer Basin has seen limited hydrocarbon exploration in both Western Australia (WA) and South Australia (SA). Oil and gas shows in wells across the length of the basin confirm the presence of hydrocarbon sources in both the Neoproterozoic and Paleozoic parts of the basin stratigraphy, but thick Paleozoic strata are limited to SA. For this reason, only the Neoproterozoic section is perceived to have any prospectivity in Western Australia. As yet, no exploration has targeted sub-salt traps, which may also have prospectivity for helium resources by analogy to the closely related Amadeus Basin.



The Officer Basin is a component of the Centralian Superbasin, adjacent WA components of which also include the Amadeus and Murraba Basins (highlighted above). Metamorphosed equivalents in the Yeneena Basin extend under the Canning Basin. Deposition in the superbasin began in the early Neoproterozoic with a similar depositional history over an extensive area (see generalized stratigraphy above), until tectonic disruption in the late Neoproterozoic to early Cambrian formed separate Paleozoic basins



Interpreted bedrock (pre-Cenozoic) geological map of the WA Officer Basin and surrounding and overlying tectonic domains. Petroleum wells and mineral drillholes with hydrocarbon shows are indicated (see table for details)



Stratigraphy and hydrocarbon systems of the WA Officer Basin

Hydrocarbon prospectivity in WA Officer Basin

Limited hydrocarbon exploration has been undertaken in the WA Officer Basin. Most drilling has been stratigraphic in nature rather than trap-targeted exploration wells. The stratigraphy is similar to the Neoproterozoic component of the Amadeus Basin, which is a producing hydrocarbon province and is also prospective for sub-salt helium resources. Minor oil and gas shows in petroleum wells and mineral drillholes (see table) indicate some source potential and hydrocarbon generation within the basin. Potential source rocks have been identified in the Buldya and Tarcunyah Groups, and potential reservoir units are common. Potential seals (salt, shale and diamictite) are also common. Salt-related structures are common wherever thick salt is present.

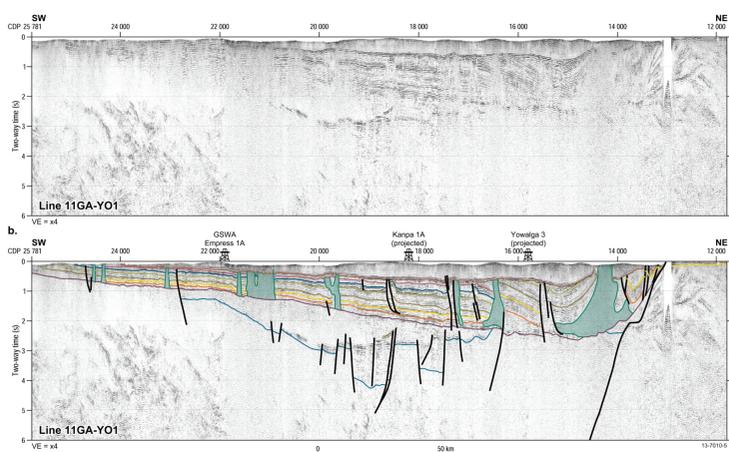
Helium prospectivity in WA Officer Basin

The WA Officer Basin has not been explored for helium resources. The potential for accumulation and trapping of basement-sourced helium resources is greatly enhanced in old basins with salt seals, as demonstrated by the very high helium content of sub-salt gas flows in the similar Amadeus Basin. The close stratigraphic parallels to the Amadeus Basin suggest that the Officer Basin should be considered a potential helium target. While stratigraphic wells have drilled through the salt seal to basement, no exploration wells have targeted sub-salt traps.

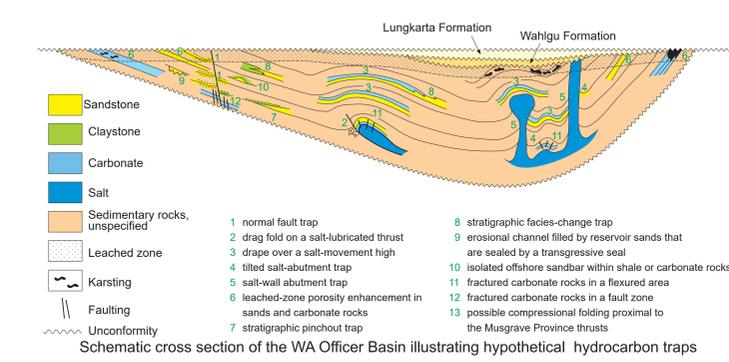


The Geological Survey of Western Australia (GSWA) undertook deep stratigraphic drilling in the Officer Basin in the 1990s and early 2000s. These fully cored holes, which included GSWA Lancer 1 shown above, significantly improved our knowledge of basin stratigraphy and depositional history

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Seismic transect of the Officer Basin along the Great Central Road (From Geoscience Australia Record 2013/28). A sparse seismic grid over part of the WA Officer Basin shows numerous salt structures related to widespread lower Neoproterozoic salt units. VE, vertical exaggeration



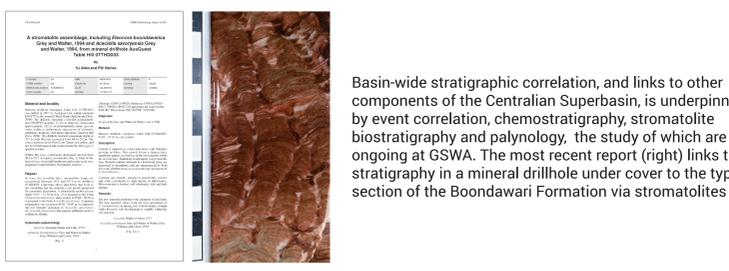
Schematic cross section of the WA Officer Basin illustrating hypothetical hydrocarbon traps

Year	Well	Show type	Reservoir	Age of reservoir
1965	Browne 1	Gas cut mud, cut fluorescence, trace oil in core	Browne Formation	Neoproterozoic
1965	Browne 2	Gas cut mud, cut fluorescence, trace oil in core	Paterson Formation	Permian
1981	WMC NJD 1*	Bleeding oil in core Bitumen in core	Browne Formation unnamed	Neoproterozoic ?Mesoproterozoic
1982	Draoon 1	Mud gas to 1% methane equivalent, including hydrocarbons up to pentane	Browne Formation	Neoproterozoic
1982	Hussar 1	Mud gas readings to 1000 ppm; Possible gas blow on air lift Trip gas up to 4.6%; 72% oil saturation from log analysis	Kanpa Formation Hussar Formation	Neoproterozoic
1982	Kanpa 1A	Dull yellow–orange fluorescence, light yellow–white cut fluorescence, brown oil stains in sandstone and dolomite cuttings	Kanpa Formation	Neoproterozoic
1993	Normandy Lake Disappointment LDDH1*	Bitumen in core	Tarcunyah Group	Neoproterozoic
1996	Jubilee GM Naberru OD 23*	Bleeding oil and bitumen in core	Scorpion Group	Paleoproterozoic–Mesoproterozoic
1997	Boondawari 1	40% oil fluorescence in core	Spearhole Formation	Neoproterozoic
1997	Mundadjini 1	10% oil fluorescence in core	Spearhole Formation	Neoproterozoic
1999	Vines 1	Total gas peaks 25 times background	Pirriylungka Formation	Neoproterozoic

Hydrocarbon shows in petroleum wells and mineral drillholes* in and near the WA Officer Basin. Map at top shows locations



Mineral exploration drillhole Normandy Lake Disappointment LDDH 1 contains black shales (Waters Formation, Tarcunyah Group), locally displaying good source rock properties Total Organic Carbon up to 2% and bitumen occurrences indicating hydrocarbon generation and migration



Basin-wide stratigraphic correlation, and links to other components of the Centralian Superbasin, is underpinned by event correlation, chemostratigraphy, stromatolite biostratigraphy and palynology, the study of which are ongoing at GSWA. The most recent report (right) links the stratigraphy in a mineral drillhole under cover to the type section of the Boondawari Formation via stromatolites