

Australia's onshore basin inventories— foundational knowledge synthesis for better design of pre-competitive data acquisition



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Exploring for
the Future

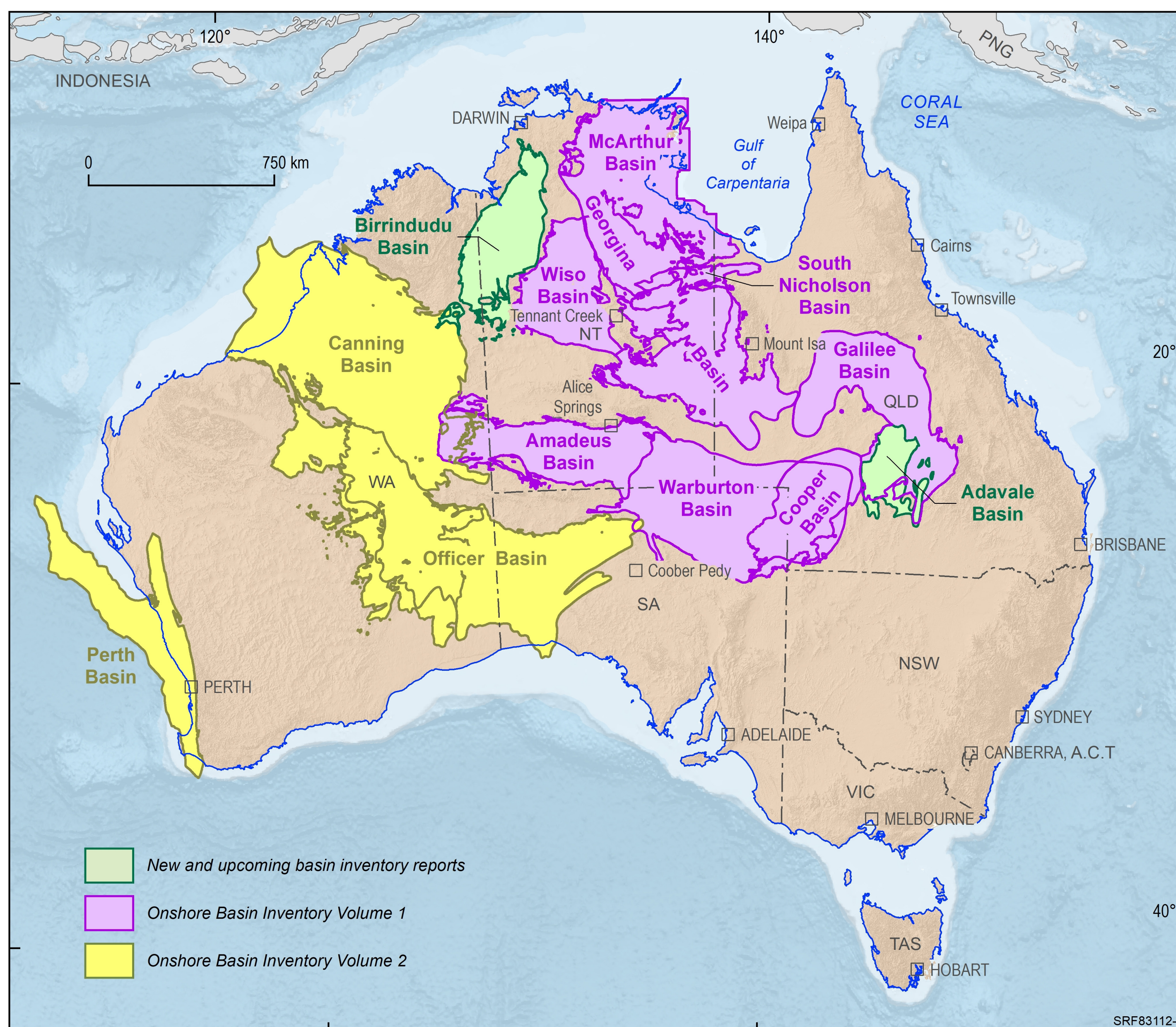
Australia's Onshore Basin Inventories

Foundational knowledge synthesis for better design of pre-competitive data acquisition

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Overview

The Onshore Basin Inventories project provides a whole-of-basin inventory of geology, petroleum systems, exploration status and data coverage of hydrocarbon-prone onshore Australian sedimentary basins. Under the Exploring for the Future (EFTF) program, several new onshore basin inventory reports are being delivered. These are supported by value-add products that address identified data gaps and evolve regional understanding of basin evolution and prospectivity. The Onshore Basin Inventories continue to provide scientific and strategic direction for pre-competitive data acquisition under the EFTF work program, guiding program planning and shaping post-acquisition analysis programs.



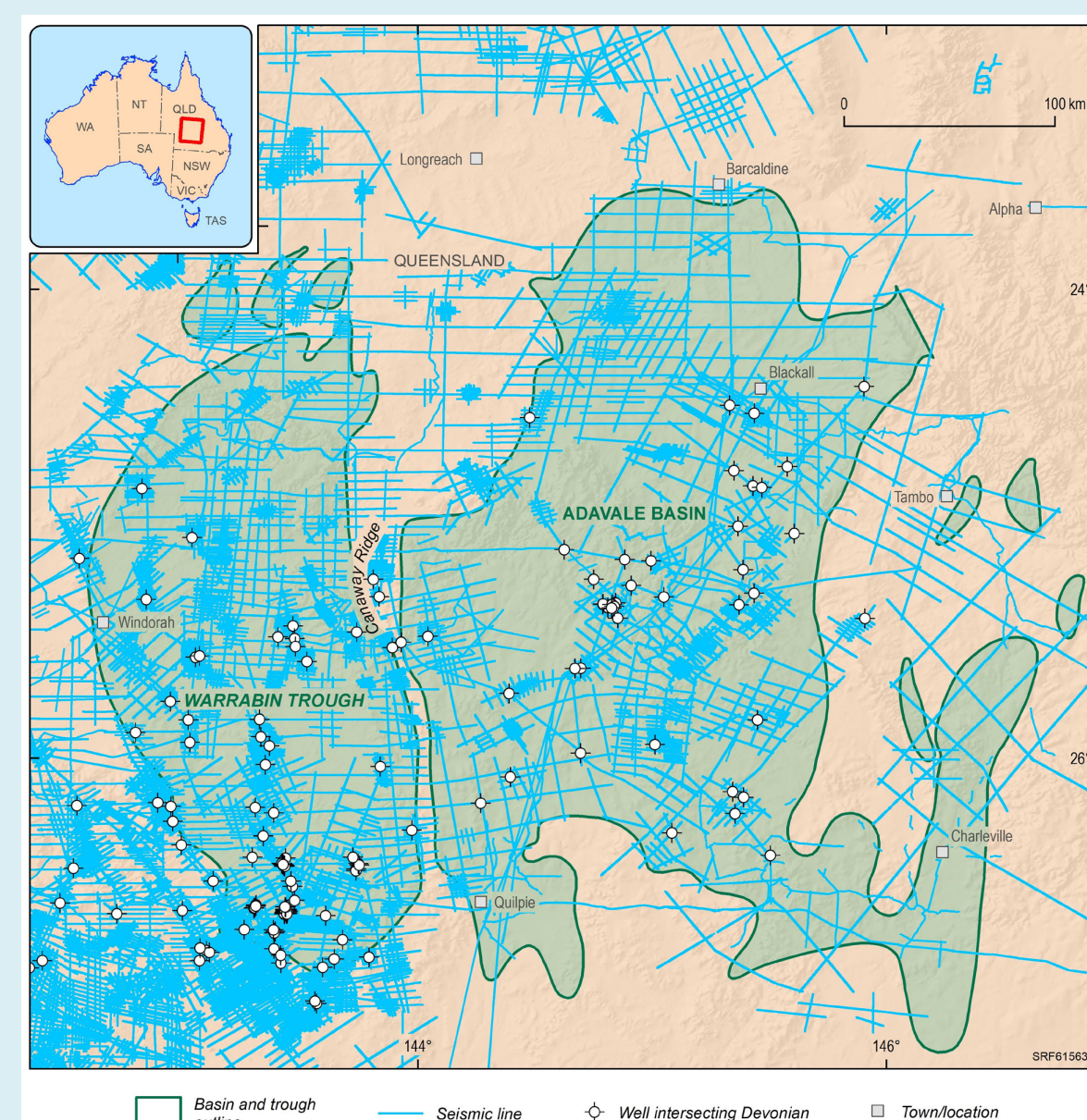
Basins addressed in Volume 1 (Carr et al., 2016) and Volume 2 (Hashimoto et al., 2018), of the Onshore Basin Inventory alongside basins newly addressed by the Onshore Basin Inventories.

New inventories

New basin reports are being released:

Adavale Basin

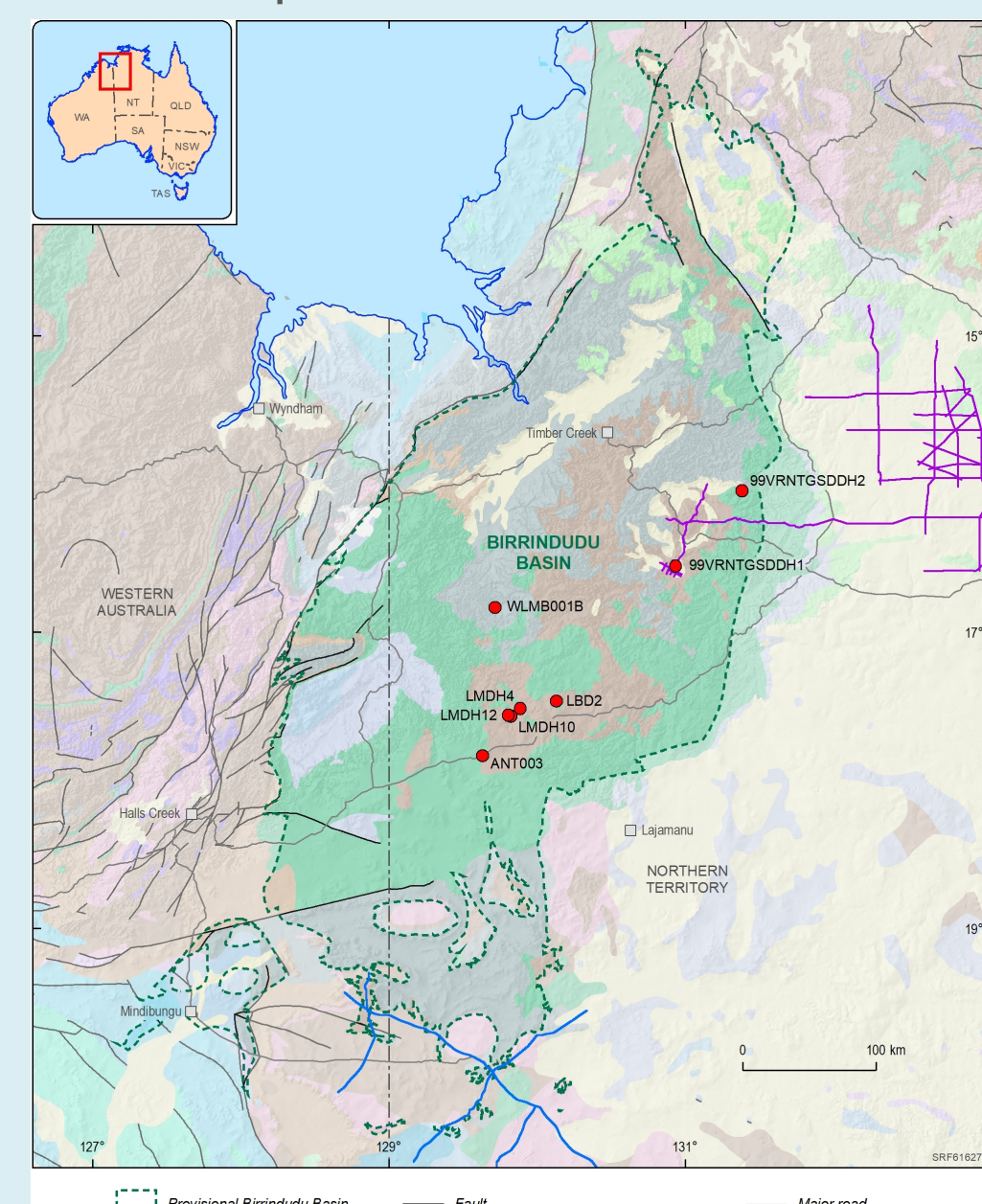
- Remains underexplored despite hosting a proven Devonian petroleum system that has sourced economic hydrocarbons.
- The central portions of the main depocentres remain poorly understood.
- Key recommendations for future work include:
 - Constructing a detailed 3D architecture using currently available information.
 - Acquisition of new samples to resolve stratigraphic uncertainties.
 - Application of modern interpretative and analytical techniques to further basin understanding.



Location of the 2D seismic reflection seismic lines, and petroleum exploration wells and stratigraphic drill holes in the Adavale Basin and Warrabin Trough.

Birrindudu Basin

- A Paleoproterozoic-Mesoproterozoic basin virtually unexplored for hydrocarbons.
- Physically linked to the McArthur Basin, including the hydrocarbon-rich Beetaloo Sub-basin.
- Basin knowledge is limited to surface mapping and related studies, with rare seismic data and limited shallow drill holes.
- Understanding the basin's petroleum potential requires the acquisition of more regional datasets such as deep-crustal reflection seismic, and targeted exploration including further drilling.



Regional map showing the provisional Birrindudu Basin outline (subject to revision). Selected drill holes sampled under the EFTF program are shown.

Acknowledgements and references

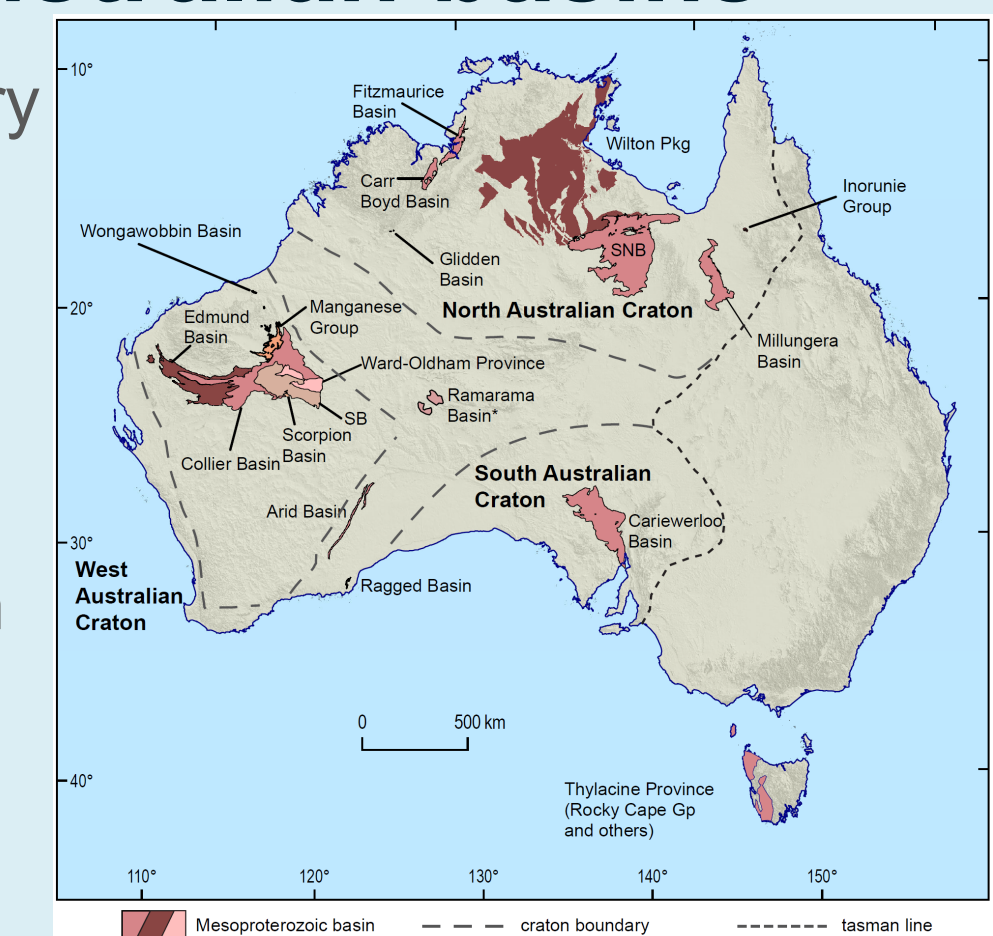
Thank you to Susannah K. MacFarlane, Tehani Palu, Emmanuelle Grosjean, Dianne Edwards, Chris Boreham, Kamal Khider, Liugi Wang, Jade Anderson, Chris Southby, Chris Carson, and Paul A. Henson for your significant contributions to this work, and to Cammie Wainman and Alan Steate for your constructive reviews. This paper is published with the permission of the CEO, Geoscience Australia.

Carr L.K., Korsch, R.J., Palu, T.J. (2016). Onshore Basin Inventory: the McArthur, South Nicholson, Georgina, Amadeus, Warburton, Wiso, Galilee and Cooper basins. Record 2016/004, Geoscience Australia, Canberra. <http://dx.doi.org/10.11636/Record.2016.004>

Hashimoto T., Bailey A.H.E., Chirinos A., Carr L.K. (2018) Onshore Basin Inventory Volume 2: The Canning, Perth and Officer basins. Record 2018/018, Geoscience Australia, Canberra. <http://dx.doi.org/10.11636/Record.2018.018>

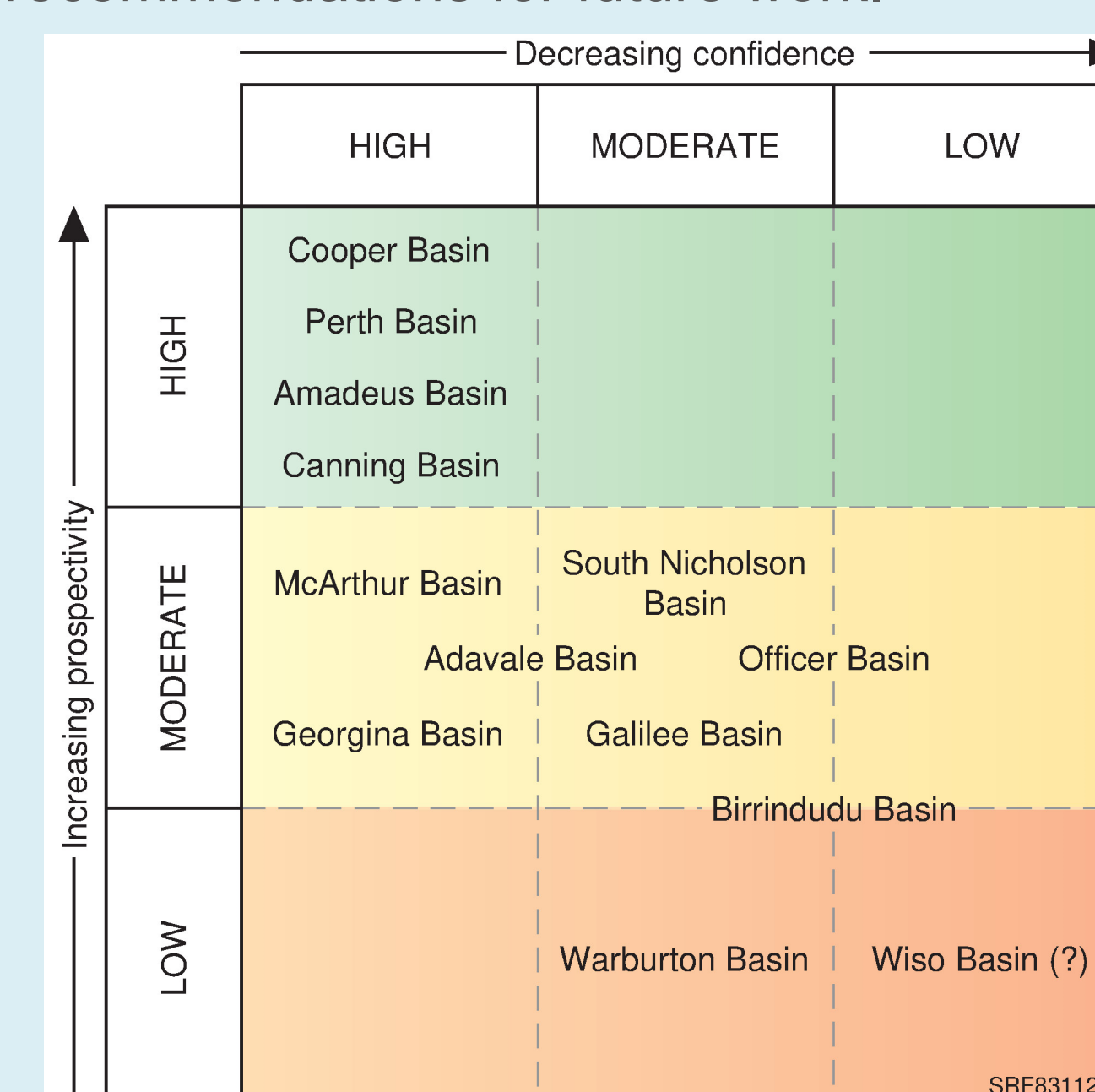
Review of Mesoproterozoic Australian basins

- A review of Australian Mesoproterozoic-age sedimentary basins was undertaken to improve understanding of basin successions of similar age to the Beetaloo Petroleum Supersystem.
- Provides an overview including a summary of location, stratigraphy and depositional environment, basin architecture, age constraints, known resources for each succession and recommendations for future work.
- May inform future programs aiming to improve understanding of prospective Proterozoic basins.



Informing pre-competitive data acquisition

A key aspect of the Onshore Basin Inventories is that they identify data and knowledge gaps, present critical science questions and key exploration uncertainties, and provide recommendations for future work.



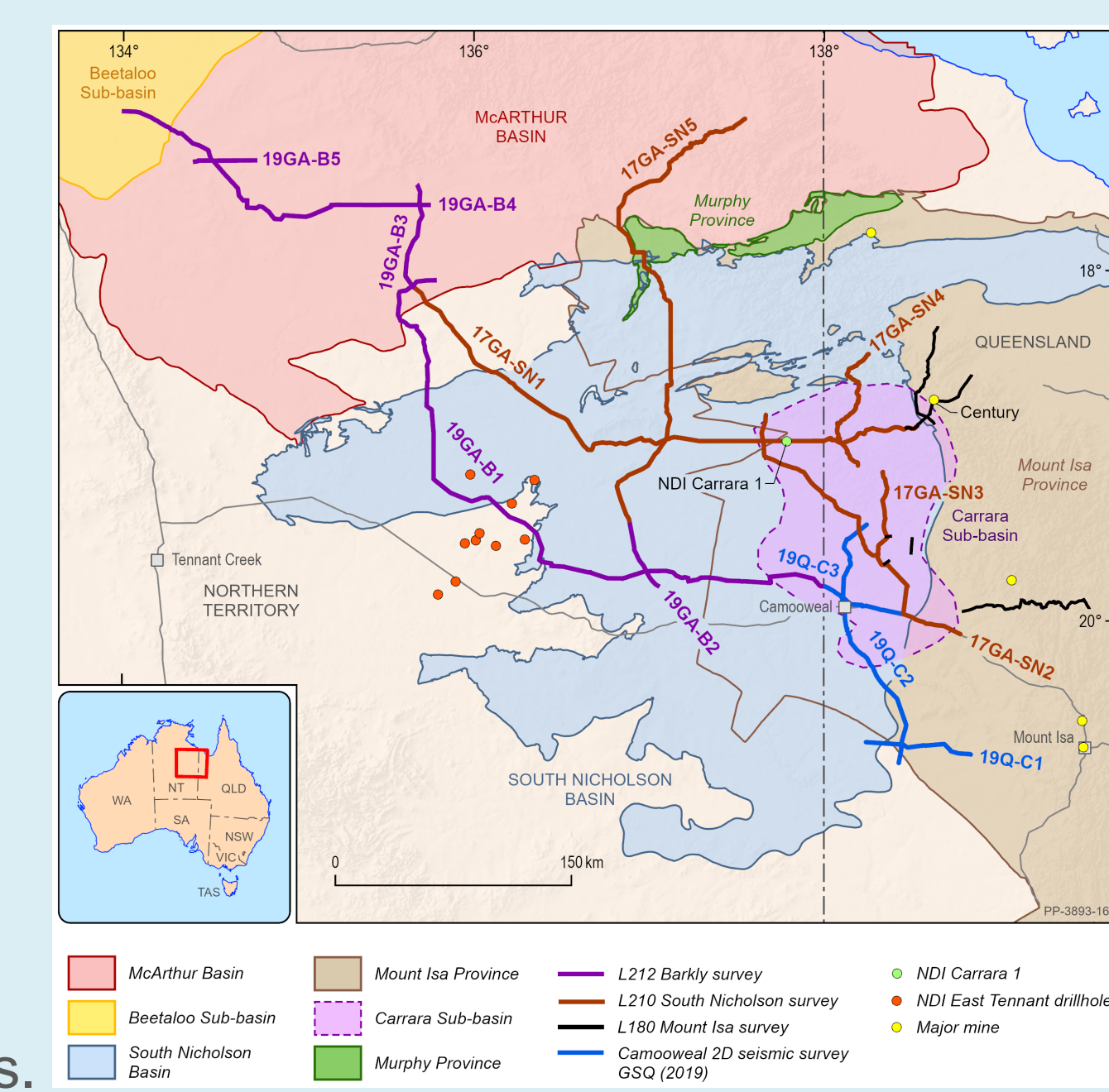
Prospectivity-confidence matrix for onshore basins assessed in Australia's Onshore Basin Inventory. The inventories provide relative basin prospectivity rankings, as well as an assessment of the confidence with which that assessment is made. These data allow for the creation of a prospectivity-confidence matrix such as displayed here. Basins are plotted by interpreted prospectivity on the Y axis, from low to high, against the confidence in that interpreted prospectivity on the X axis, also from low to high.

The matrix presented here has been utilised throughout the planning phase of the EFTF project to screen for basins where further work could enhance either basin prospectivity or confidence.

To date, the Onshore Basin Inventories have informed EFTF precompetitive programs in the South Nicholson region, the Kidson Sub-basin, and the Officer Basin. Consequently, new data acquisition in the frontier Birrindudu Basin is being undertaken.

South Nicholson region

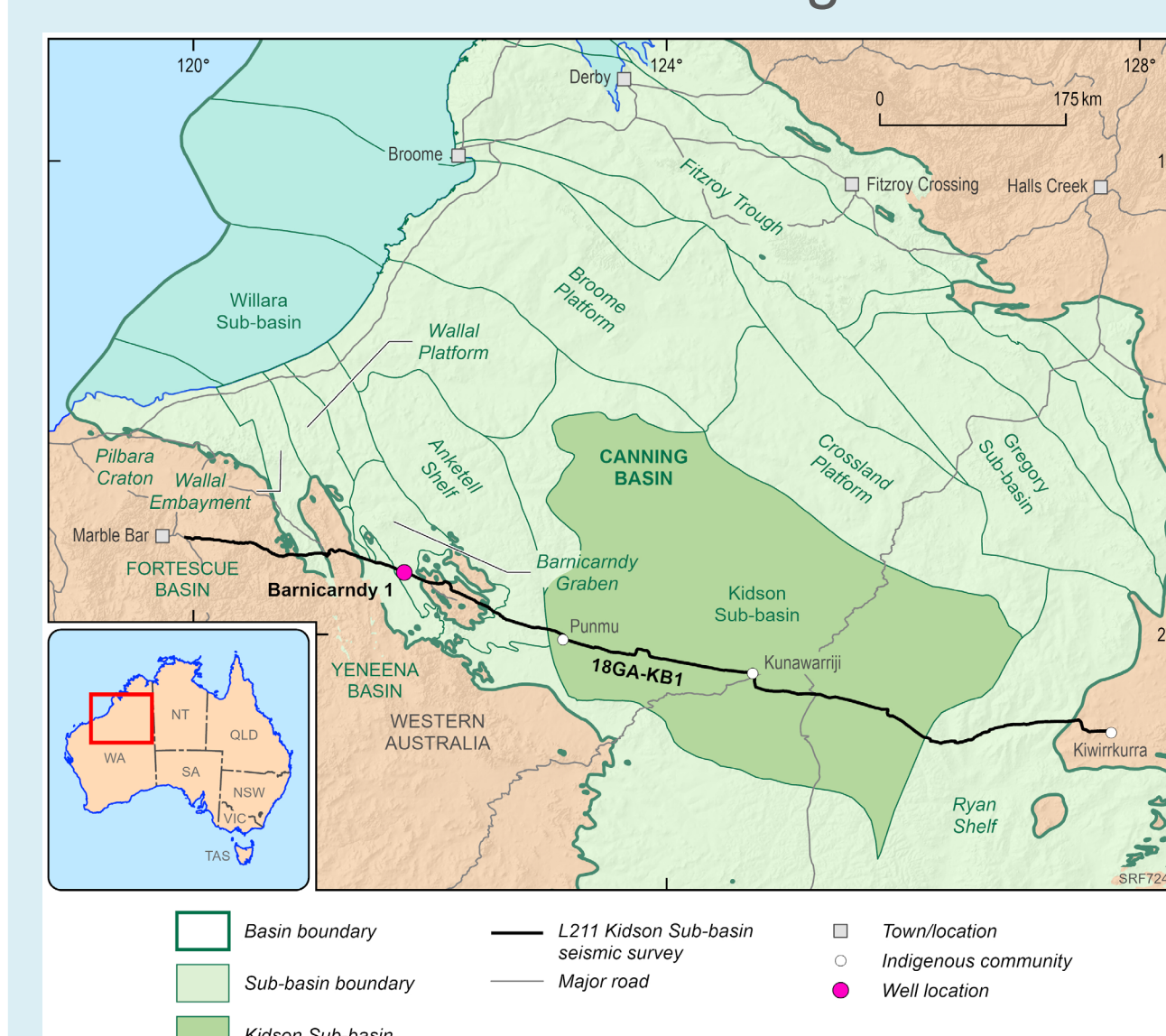
- Significant uncertainty around the subsurface architecture and petroleum systems of the South Nicholson Basin were identified in Volume 1.
- Hence, the EFTF program acquired two deep-reflection seismic surveys to define basin architecture and delineate sediment distribution in the South Nicholson region.
- The deep stratigraphic drill hole NDI Carrara 1 established the existence of effective Proterozoic petroleum system elements and enabled regional correlations.



Location of the deep stratigraphic drill hole NDI Carrara 1 and newly acquired seismic surveys across the South Nicholson region and the Carrara Sub-basin.

Kidson Sub-basin

- Seismic and well data coverage over the Canning basin is low, particularly in the Kidson Sub-basin.
- The EFTF program acquired the L211 deep-reflection seismic survey and drilled the stratigraphic drill hole Barricandy 1.
- Numerous analyses were undertaken on the almost fully cored well.
- Petroleum modelling predicts full maturation of Ordovician source rocks in the deeper parts of the Kidson Sub-basin.

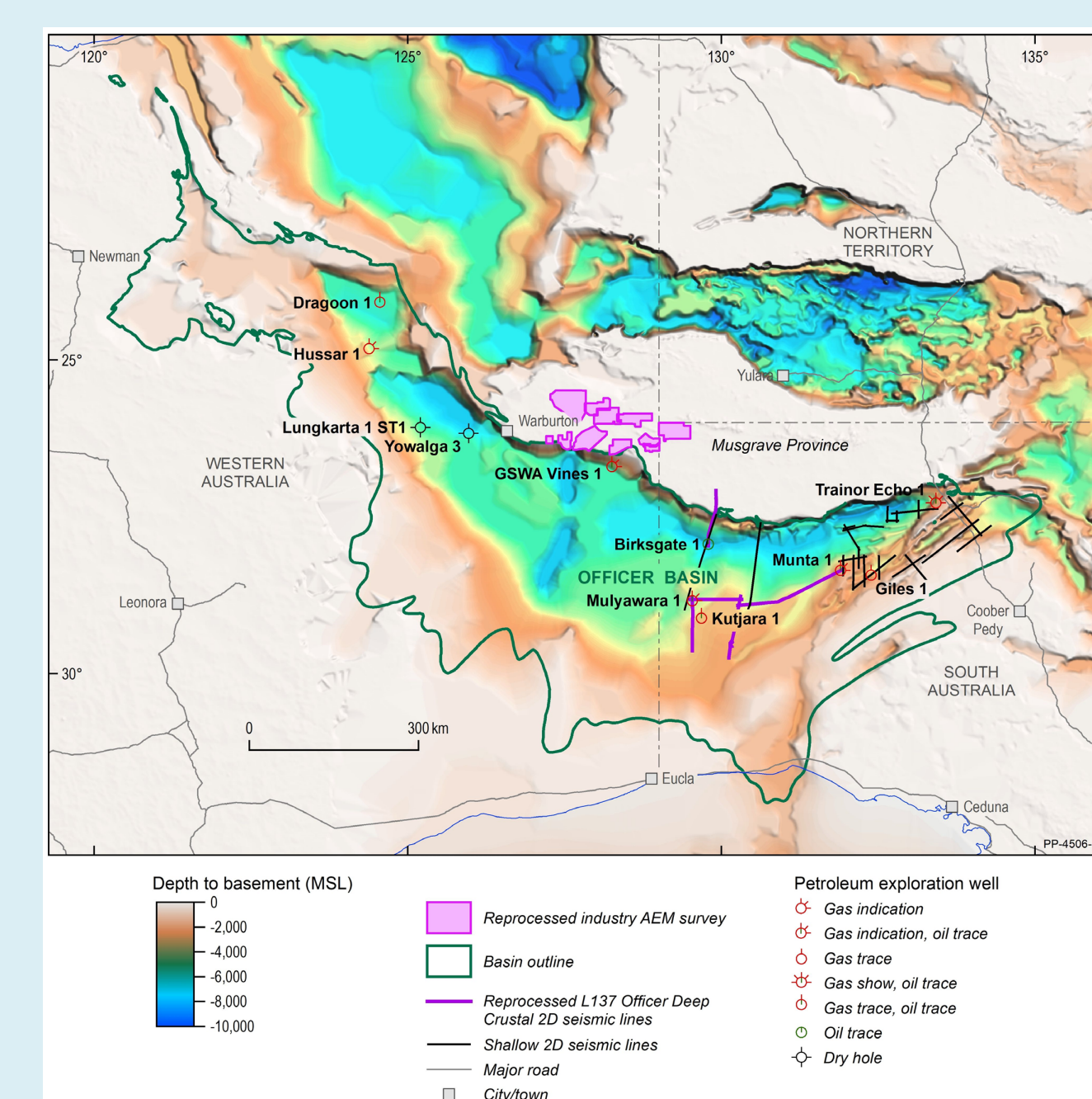


Location of the Kidson Basin L211 deep crustal seismic reflection survey and the Barricandy 1 deep stratigraphic drill hole relative to major tectonic elements of the onshore Canning Basin.

Officer Basin

The Onshore Basin Inventory Volume 2 recommended the acquisition of new seismic data and stratigraphic drilling. However, the EFTF program focused on maximising the value of legacy data:

- Reprocessed existing 2D seismic lines to better understand the evolution and tectonostratigraphy across western basin depocentres.
- Established a new chemostratigraphic framework to better correlate the eastern and western sections of the basin.
- Acquired additional geomechanical and petrophysical data to quantifies rock properties within likely reservoir, seal, and potential unconventional units.



Map showing the Officer-Musgrave region in both Western Australia and South Australia superimposed on OZ SEEBASE@ 2021, highlighting the work undertaken as part of the EFTF program following the recommendations of the Onshore Basin Inventory Volume 2.

Further information on all projects mentioned in this poster can be found at <https://www.eftf.ga.gov.au/explore-projects?page=2>



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