

Browse Basin Petroleum Accumulations

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Browse Basin regional geology

The Browse Basin is a northeast-trending depocentre situated offshore on Australia's North West Shelf (Figure 1), covering an area of approximately 140,000 km². It contains in excess of 15,000 m thick Paleozoic, Mesozoic and Cenozoic sediments (Figure 2) that host significant, but as yet unproduced, resources of gas and minor oil. The basin was initiated as a series of intracratonic extensional half-graben during the Mississippian to Cisuralian (Symonds et al, 1994). Upper crustal faulting resulted in characteristic half-graben geometry with large-scale normal faults compartmentalising the basin into the Caswell, Barcoo and Seringapatam sub-basins. The Yampi and Leveque shelves and Prudhoe Terrace form the eastern margin of the basin where basement is overlain by Mesozoic sediments that host oil and gas accumulations.

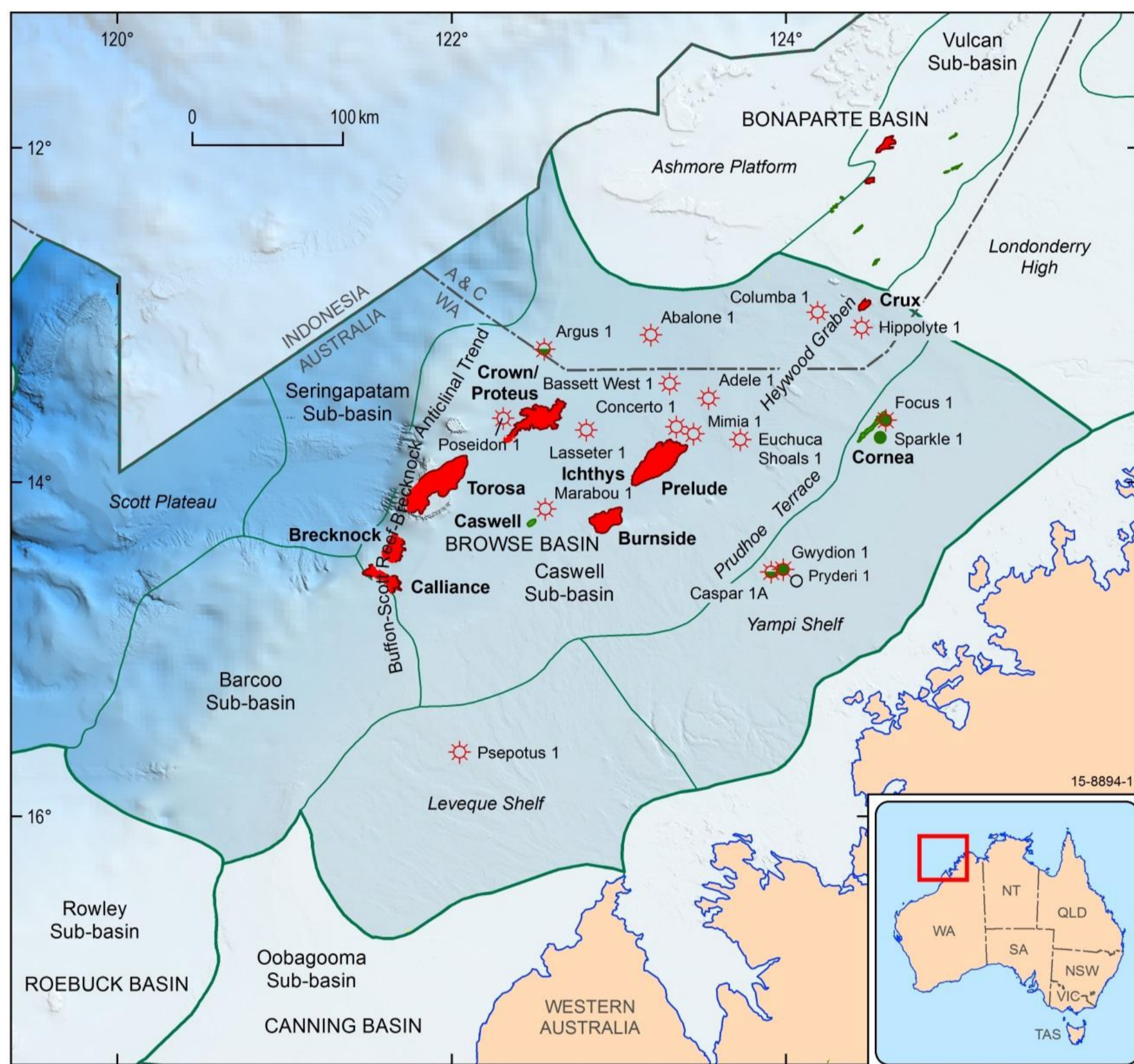


Figure 1. Distribution of oil and gas accumulations in the Browse Basin

Accumulations

Accumulations within the basin broadly include:

- Lower Cretaceous reservoir oil and gas on the Yampi and Leveque shelves at Cornea, Focus, Sparkle, Gwydion, Caspar and Psepotus (Figure 1);
- Brewster Member and Plover Formation reservoir gas in the central Caswell Sub-basin at Ichthys, Concerto, Mimia, Burnside, Bassett and Echuca Shoals;
- Plover Formation reservoir gas on the Scott Reef Trend at Calliance, Brecknock, Torosa, Poseidon, Kronos and Crown/Proteus;
- Nome Formation reservoir gas at Crux, Libra, Octans and Hippolyte.

While much of the reservoir petroleum in the Caswell Sub-basin is dry gas, significant volumes of wet gas are also preserved, and there is evidence of a widespread early oil charge that has been either absorbed by gas or remobilized onto the sub-basin margins.

Ichthys and Prelude area

The Ichthys accumulation is an anticlinal northeast-trending structure in the central Caswell Sub-basin. It is relatively unfaulted and has gas reservoir in multiple formations.

- The Plover Formation reservoir contains dry gas and has three culminations;
- The lower Vulcan 'Ichthys Formation' is generally gas saturated throughout the structure, has variable reservoir quality and appears to be in communication with the underlying Plover Formation reservoir.
- The Brewster Member of the upper Vulcan Formation is the main reservoir for the Ichthys/Prelude, Concerto and Mimia gas accumulations.

A montage of the Brewster Member depth structure map highlights the major gas discoveries associated with the Ichthys/Prelude, Concerto and Mimia accumulations (Figure 3).

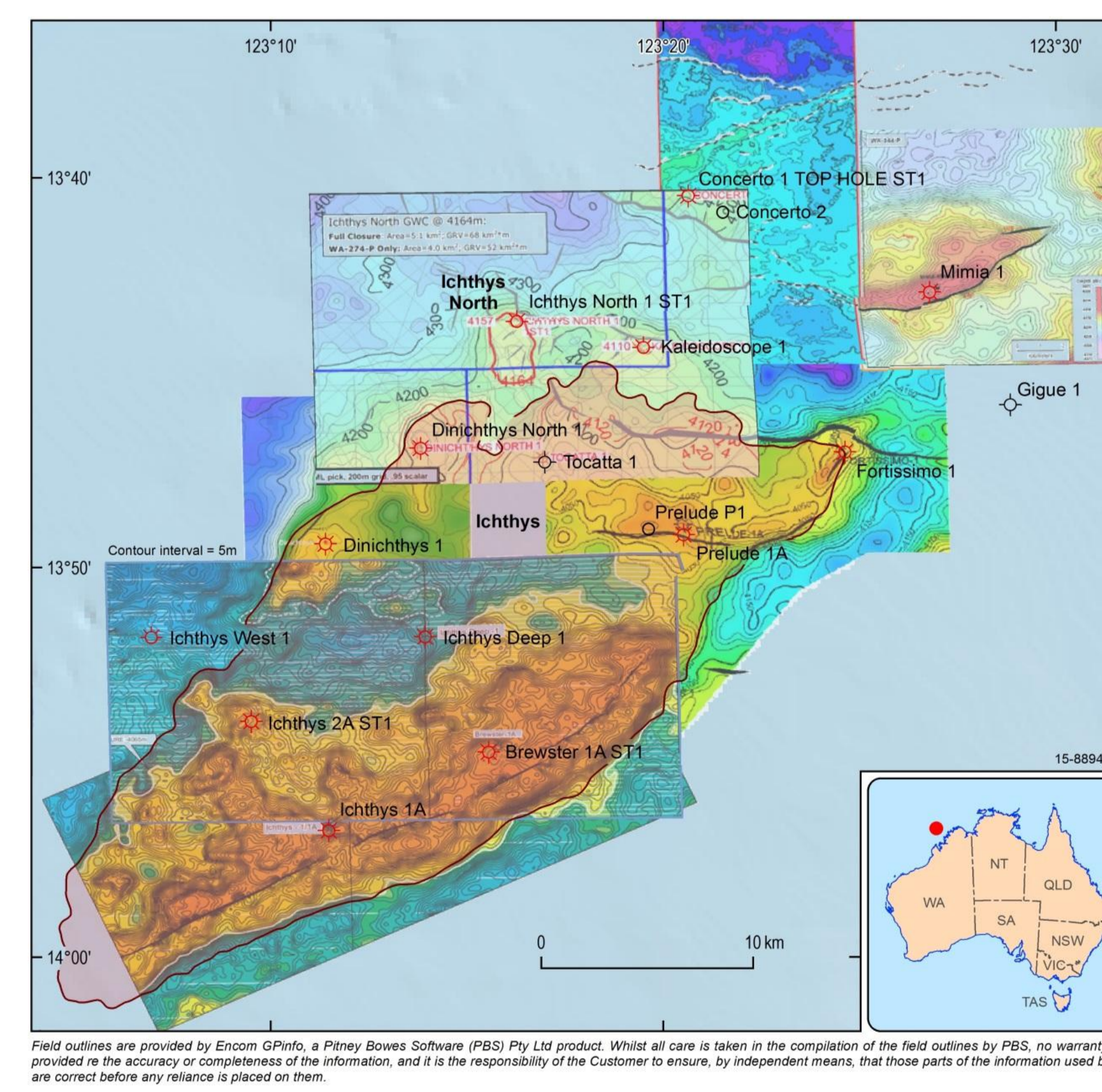


Figure 3. Ichthys/Prelude, Concerto and Mimia accumulations; Brewster Member depth structure montage compiled from well completion reports (cited in le Poidevin et al., 2015). Red/Orange colours are shallow, blue colours are deeper.

References

LE POIDEVIN, S., KUSKE, T.J., TEMPLE, P.R. AND EDWARDS, D.S., 2015—Browse Basin Australian Petroleum Accumulations Report 7 – 2nd Edition. Geoscience Australia Report, in press, Geocat 82545.

SYMONDS, P.A., COLLINS, C.D.N. AND BRADSHAW, J., 1994—Deep structure of the Browse Basin: implications for basin development and petroleum exploration. In: Purcell, P.G. and Purcell, R.R. (eds) The Sedimentary Basins of Western Australia: Proceedings of the Petroleum Exploration Society of Australia Symposium, Perth, 1994, 315–331.

Scott Reef Trend area

The Torosa structure is a northeast-plunging asymmetric faulted Jurassic anticline situated on the Scott Reef Trend (Figure 4).

- The western flank is bounded by major fault zones and the eastern flank is dip closed;
- The main reservoir and largest pay zone is in the Plover Formation with additional dry gas potential in the underlying Nome Formation;
- Sealed by Lower Cretaceous marine shales.

The Brecknock and Calliance structures to the south are faulted anticlines, trending east-northeast and southeast, respectively.

- Dry gas is reservoir in the Plover Formation.

The Poseidon and Crown structures lie to the northeast as a pair of tilted fault blocks.

- Dry gas is of variable composition and is reservoir across the Montara, Plover and Nome formations.

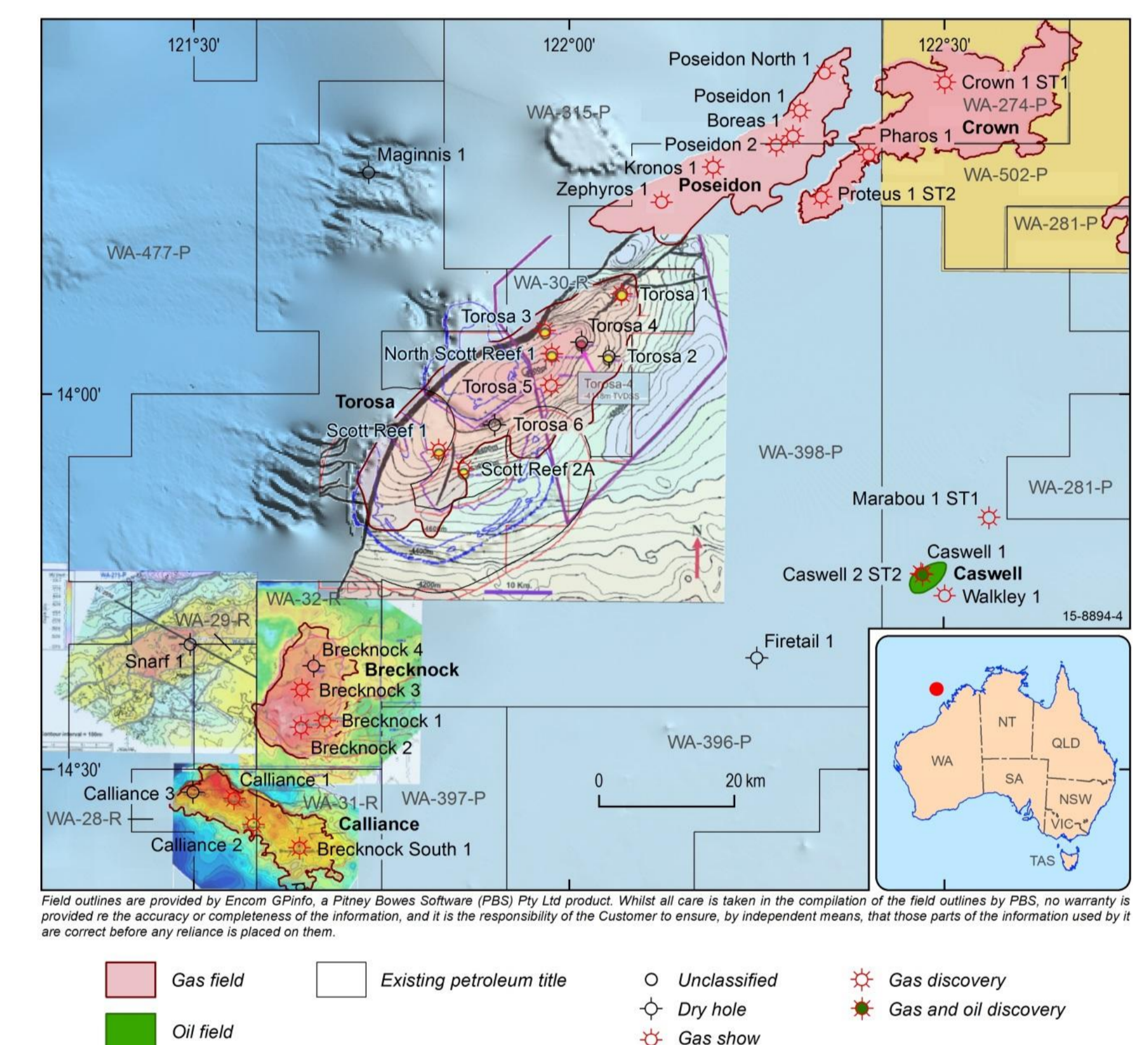


Figure 4. The Scott Reef Trend area accumulations; Plover Formation depth structure montage and accumulation locations (compiled from well completion reports cited in le Poidevin et al., 2015). Red/Orange colours are shallow, blues are deeper.

Conclusions

The Browse Basin is still relatively under-explored by international comparison, nevertheless it hosts significant petroleum accumulations suitable for development. The basin is mostly gas-prone, with some oil potential. The structures that host many of the known accumulations within the basin are complex, with a complicated tectonic and hydrocarbon charge history.

Only a few significant accumulations were discussed here, but a picture can start to be drawn about the structures and possible migration pathways for hydrocarbons from the depocentres in the Caswell Sub-basin onto the basin margins. Understanding basin evolution is essential to identifying pathways, fill-spill chains, preserved hydrocarbons and where additional petroleum accumulations might be located.

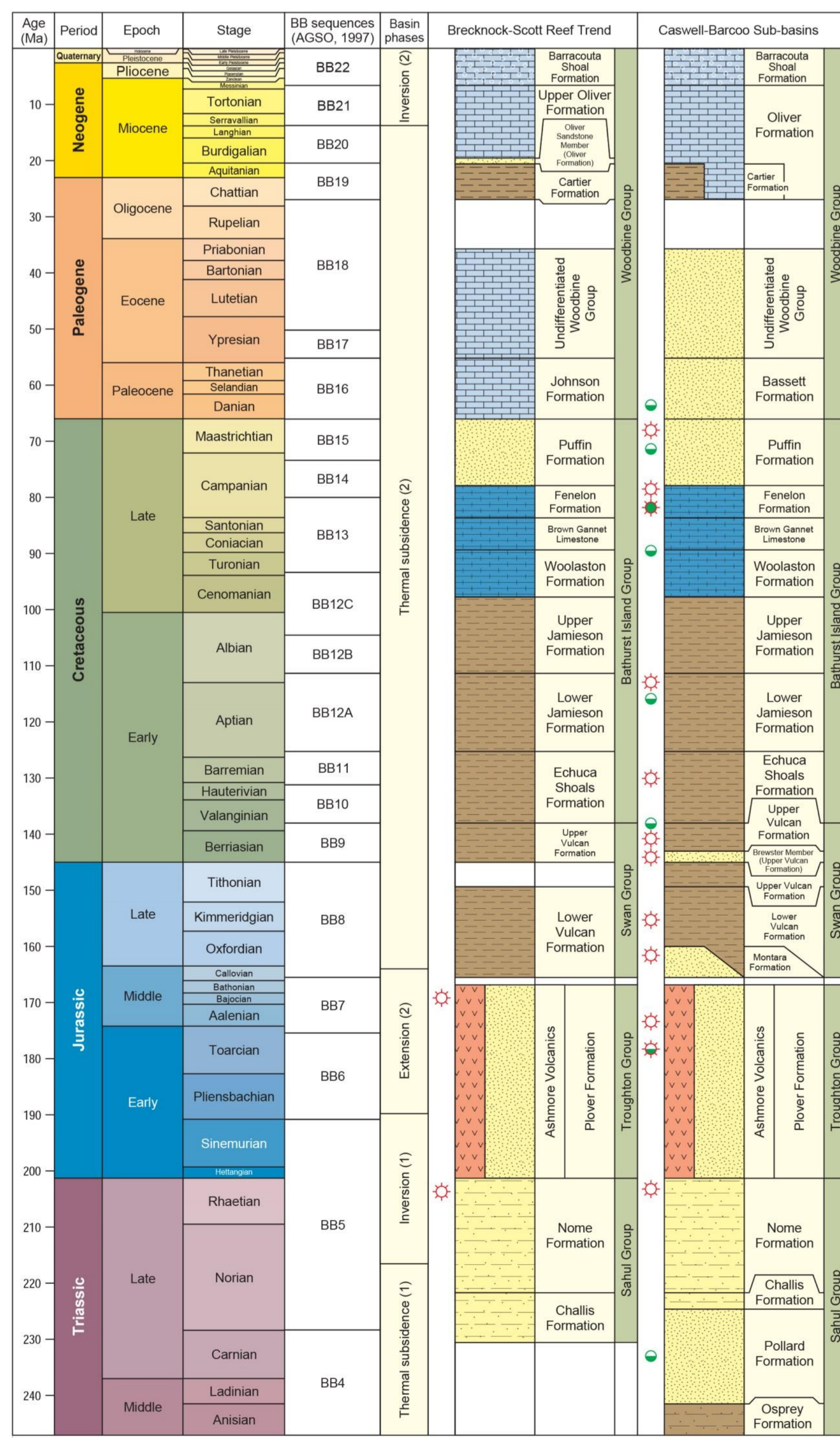


Figure 2. Stratigraphy of the Scott Reef Trend and Caswell Sub-basin of the Browse Basin

