

## A review of the mid-Carboniferous – Permian, Canning Basin

by AJ Mory

Mid-Carboniferous–Permian strata have been intersected in 256 petroleum wells and at least 100 mineral boreholes in the Canning Basin. To evaluate the petroleum potential of this part of the succession, available data, and especially organic geochemistry, have to be compared spatially and stratigraphically, i.e. formation picks in these wells and bores have to be consistent. For petroleum wells this relies heavily on interpreting wireline and micropaleontological data — data not always available for mineral boreholes, and practically not at all for outcrop, where most of the type sections were established. Biostratigraphic data are available for 151 of the petroleum wells and fewer than one quarter of the mineral holes, but correlation difficulties abound due to the limited sections for which biostratigraphic data are available, the varying vintages and resolution of that data, and reworking of microfossils. Other difficulties exist because of the predominance of the Grant Group on the Barbwire Terrace in available petroleum core from the basin (9.9 km out of the 11.4 km of core cut from strata of this age).

The presence of the mid- to upper Carboniferous Reeves Formation can only be confirmed with any certainty in 18 wells, of which 13 are in the Fitzroy Trough and its southeastern extension. The unit is up to 1250 m thick, dominantly fluvial in character, and was previously included in the glacial Grant Group. Nevertheless, there appears to be a significant break between the two units spanning the Asselian. In other wells in which the formation has been identified it is thin, with just one palynological zone represented, implying reworking of the palynoflora into the base of the Grant Group.

The Grant Group (and the laterally equivalent Paterson Formation in the south of the basin) is represented in the majority of wells in the basin and appears to lie entirely within the *confluens* Zone (early Sakmarian). Neither of the two competing stratigraphic divisions in the northern and central parts of the basin (e.g. Crowe and Towner (1976) — Fitzroy Trough: Carolyn, Winifred, and Betty Formations; Redfern (1991) — Barbwire Terrace: Clianthus, Calytrix, and Hoya Formations) can be applied across the whole basin, nor can the cessation of glacial deposition be used convincingly for regional correlation across the basin. The

group is generally 300–800 m thick, and represents the most rapid period of deposition in the basin; however, the debate as to the dominance of tectonic (Eyles and Eyles, 2000; Eyles et al., 2001) versus glacial (Redfern, 1991; Redfern and Williams, 2002) influences during deposition of this unit is not easily resolved (Mory et al., 2008).

The Poole Sandstone is a dominantly deltaic unit of late Sakmarian age restricted to the *pseudoreticulata* Zone, and is characterized by upward-coarsening cycles in the northwestern and central parts of the basin. These cycles grade eastwards into massive channel facies, probably denoting a stronger fluvial influence, thereby hindering differentiation from similar facies at the top of the Grant Group.

The shale-dominated Artinskian–Kungurian Noonkanbah Formation represents the most marine part of the succession, and thus has attracted the most paleontological interest. The unit is up to 640 m thick, with the major depocentre coinciding with the Fitzroy Trough.

The Roadian–Wuchiapingian Liveringa Group represents a period of fluviodeltaic deposition, mostly preserved in the Fitzroy Trough and Lennard Shelf. Deposition coincided with sporadic igneous activity that continued into the Early Triassic. The intrusions are mostly confined to the Fitzroy Trough and are the most likely reason for the end of significant onshore deposition in the mid-Triassic. In petroleum wells the group usually is in the uppermost 500 m, with virtually no cores cut and with limited wireline data.

As most of the Permian lies above the oil window, the dominant economic potential of the succession is in hosting hydrocarbons, particularly below the semi-regional seals of the Calytrix and Winifred Formations in the Grant Group, as demonstrated by the small oil fields in the Lennard Shelf. Nevertheless, the Noonkanbah Formation still has potential as a seal over the Poole Sandstone, and for non-conventional gas accumulations. Thermal-quality coal seams in the basal Liveringa Group are the main focus of current mineral exploration along the southern limb and eastern closure of the Grant Range–Mount Wynne anticline.

## References

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