

NEW INSIGHTS INTO THE PETROLEUM PROSPECTIVITY OF THE PAPUAN FORELAND (PAPUA NEW GUINEA)

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The Papuan Basin is a large structurally-inverted depocentre (Fig. 1). The basin was initiated in the latest Permian and early Triassic by rifting associated to the break-up of eastern Gondwana. As a result, a protracted, northward-facing passive margin developed along northern Australia. The formation of the Papuan fold-and-thrust belt (FTB) started during the Oligocene as the oblique convergence between the Australian and Pacific lithospheric plates progressed. The Papuan FTB is made up of deformed Mesozoic clastic rocks and Cenozoic limestones, and is bound to the south by the stable Fly Platform and foreland area, containing similar rocks, but essentially undeformed.

The Papuan Basin has been the main focus of the century-long petroleum exploration history in Papua New Guinea. Petroleum occurrences are widespread across the Papuan Basin, with commercial production limited to the central parts of the Papuan FTB. The foreland has also been the site of a significant exploration effort, with several accumulations discovered to date (*e.g.* Elevala, Kimu, Koko, Puk Puk; Fig. 1), although it has not resulted in any commercial production. The producing accumulations in the central FTB (*e.g.* Gobe, Hides, the Kutubu area fields, Mananda, Moran; Fig. 1) are sourced from marine clay-rich sources with abundant terrestrially-derived organic matter and deposited under oxic conditions. These oils show many similarities with Westralian-sourced oils from the Australian Northwest Shelf. However, there is ample evidence that active petroleum systems other than the Jurassic-sourced exist within, and away from, the central FTB (*e.g.* Murray *et al.*, 1993; Waples and Wulff, 1996; George *et al.*, 1997, 2004; Volk *et al.*, 2005; Ahmed *et al.*, 2012). Complex migration and charging histories seem the norm, rather than the exception, in the Papuan Basin, both in the FTB and the foreland, as revealed by segmented oil family distributions (Waples and Wulff, 1996), field-scale variability (*e.g.* in the Hides oil and gas field; Waples and Wulff, 1996), complex fluid inclusion (FI) populations, and contrasting “free” versus FI oil compositions (George *et al.*, 1997; Volk *et al.*, 2005).

In this contribution, we present new petroleum geochemical data on source rocks, oil seeps and oil samples (tested oils and FI oils) from exploration wells across the Papuan foreland that provide new insights into the petroleum prospectivity of the area. Our oil data confirm that foreland oils are geochemically distinct from the Jurassic-sourced oils that are predominant in the FTB. In particular, several wells show evidences of algal-dominated, lacustrine source rocks similar to those originally identified in the area by George *et al.* (2004) and Volk *et al.* (2005), significantly extending the lateral distribution of these petroleum systems. The existence of additional effective source rocks in the Papuan foreland, sourced from carbonate-influenced lithologies, is also indicated by the geochemical analysis of one oil seep. The age of the indicated lacustrine sources of the Papuan foreland is unconstrained, but we explore one of the potential candidates by re-visiting one of the few wells that have penetrated the pre-Jurassic section. Our work continues to delve into the idea

that future petroleum exploration in Papua New Guinea need not to be restricted to the Jurassic source–Cretaceous reservoir play that dominates in the FTB.

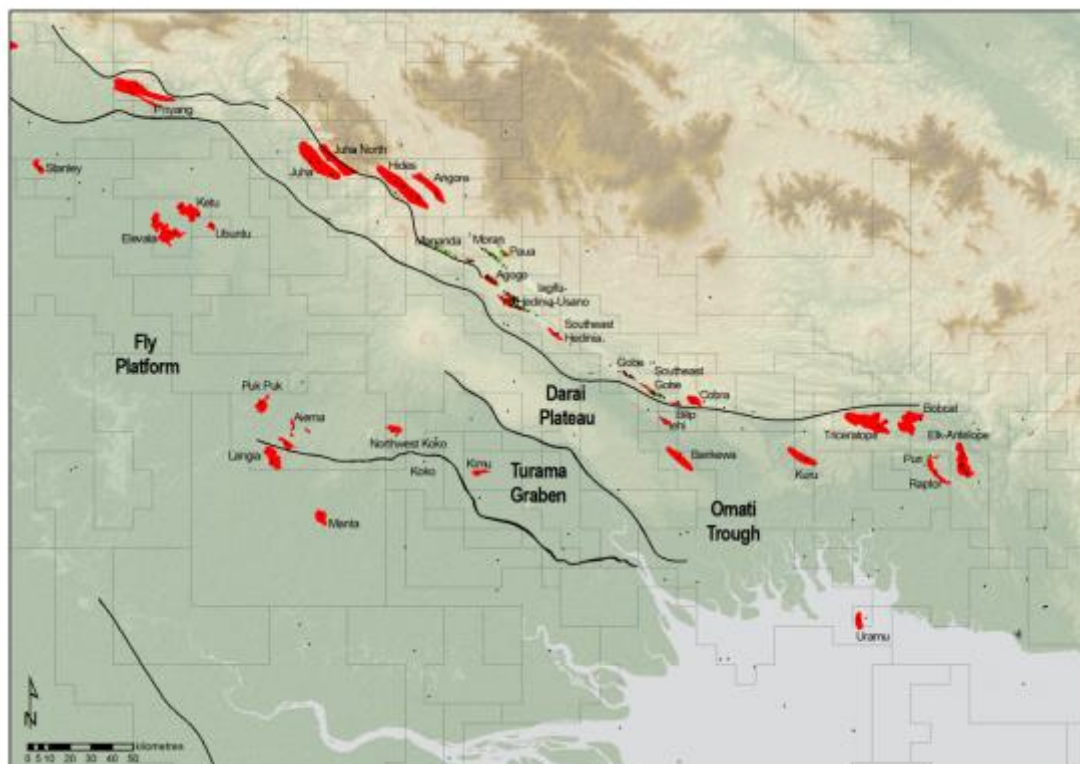


Figure 1 Map showing the area of interest of the present study.

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