

New Insights into the Geology and Petroleum Prospectivity of the Northern Arafura Basin, Offshore Northern Australia

Struckmeyer, Heike I.M., Jennifer M. Totterdell, and Karen L. Earl, Geoscience Australia, Canberra, Australia

Strong evidence for at least one active Palaeozoic petroleum system in the undrilled northern Arafura Basin is provided by a new geological framework study, based on seismic and new well interpretations, and a seepage survey. Evidence for hydrocarbon generation is provided by oil and gas shows and indications and interstitial solid bitumens in wells in the Goulburn Graben, SAR anomalies, and shallow gas indications in sub-bottom profile, side-scan sonar and echosounder data. Deposition in the Arafura Basin commenced in the Neoproterozoic during a period of upper crustal extension that resulted in the formation of large NE-SW trending half graben.

The overlying Palaeozoic section is more or less structurally conformable, despite long periods of non-deposition and erosion. Potential source rocks were deposited in the Middle Cambrian, Late Devonian and Late Carboniferous to Early Permian, in shallow-marine and deltaic environments. In comparison with the highly-deformed Goulburn Graben in the southern part of the basin, the northern Arafura Basin has undergone only minor deformation. As a result, many of the risk factors for the accumulation of hydrocarbons identified in the Goulburn Graben, such as timing of generation and expulsion, and reservoir quality, are reduced in this region.

New geohistory models suggest that early expelled hydrocarbons are likely to be preserved in the northern Arafura Basin, and that in some locations, expulsion from Early Palaeozoic source rocks occurred in the Mesozoic to Cenozoic. Early formed traps are likely to have remained intact and reservoir quality should be higher as a result of reduced hydrothermal alteration and/or shallower burial.