

Source and Reservoir Rock Attributes of Mesoproterozoic Shale, Beetaloo Basin, Northern Territory, Australia

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Rock-eval data, petrophysical evaluations, and core descriptions from the Mesoproterozoic Kyalla and Velkerri Shales (1.4 Ga) in the Beetaloo Basin, Northern Territory, Australia exhibit very favorable characteristics for the production of oil and gas. The Kyalla and Velkerri Shale are composed of medium- gray to black, organic-rich, laminated shale, interbedded with thin siltstone and very fine-grained sandstone, deposited in shallow to moderate depth marine environments. In some parts of the Velkerri and Kyalla Shales there are what appear to be vertical, trace fossil burrows. The cores are commonly oil-stained. Organic matter is composed of liquid-prone, types I and II kerogen. Maximum cumulative thickness of these liquid-prone shales is 1,600 m. Total organic carbon (TOC) values range from 2 to 8 %. In particular, the middle Velkerri Shale (~300 m thick), the most organic-rich part of either shale interval, has an average TOC of 3.96 %. The calculated average original TOC in the middle Velkerri is 5.82 %. The present-day hydrocarbon index (HI) for the middle Velkerri is 281 mg HC/g TOC and the calculated original HI is 425 mg HC/g TOC. Tmax data indicates that the Kyalla and Velkerri Shales range in thermal maturity from immature to over-mature. The top of thermally mature Kyalla and Velkerri occurs at a depth of about 350 m and the top of thermally over-mature Kyalla and Velkerri occurs at a depth of about 1,500 m. Open hole logs indicate an increase in gamma ray and resistivity along with density and sonic porosity over intervals of elevated TOC. A linear relationship between TOC and density porosity is established which accounts for about 50% of the increase in porosity. The remaining porosity, with TOC subtracted, is interpreted to represent intergranular porosity which may store gas and/or oil and may provide a permeable path for commercial hydrocarbon production. An independent assessment of the recoverable gas resources from the Kyalla and Velkerri Shales is 23 trillion cubic feet. An assessment of recoverable oil from the upper Kyalla Shale is 17.8 billion barrels. We anticipate acquiring desorption and x-ray diffraction data as well as additional geochemical data from current drilling operations in the Beetaloo Basin.