Pre-salt Play Hydrocarbon Trap Evaluation within the Callanna Group in the eastern Officer Basin, South Australia, from recent drilling results

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Abstract

The Officer Basin represents one of the last remaining onshore frontier exploration areas in Australia. It has potential to contain several very large oil fields within horsts capped by thick salt. The pre-salt trap within the Callanna Group in eastern Officer Basin has never been studied because of lack seismic coverage and deep well controls. The Callanna Group sequence upward consists of Pindyin Sandstone and Alinya shale-salt-dolomite. Some oil shows have been correlated to Alinya shale source rock. The full sequence was intersected by three wells drilled recently, one in the eastern and two wells in western parts of the basin. These intersected units are well-correlated with its type section based on lithology, superposition and wireline logs. The Pindyin Sandstone shows primary porosity and permeability and the overlying salts are thick and seismically mappable. Though these wells failed to find hydrocarbon accumulations, they have significantly improved the understanding the petroleum potential in the basin.

The salt related structures in eastern Officer Basin are not as common as in Western Officer, Amadeus, Flinders Ranges, Eastern Siberia and South Oman Basins. The salt in eastern Officer Basin has been mobilized, while the salt in the western part of the basin is relatively stable. Salt features have been identified including salt anticlines, salt thickening and salt withdrawal collapse structures. At least seven salt anticlines are present but the outlines are uncertain because of poor seismic quality and coverage. They might have potential traps for the younger reservoir rocks e.g Murnaroo and Tarlina Sandstone. This study focuses on pre-salt hydrocarbon trap identification and evaluation (Pindyin Lead) through seismic mapping. Four structural time and depth maps have been generated and a total of 24 Pindyin Leads identified. The leads were classified into four groups: 1) a simple anticline, 2) drag rollover or anticline associated with reverse fault, 3) a gentle anticline or rollover associated with tilted graben due to an igneous intrusion or normal fault reactivation (reversed) and 4) Pindyin on-lapping against the sealing faults bounding the graben. The best pre-salt structural trap would be the simple anticline which has four way dip closure but it is not common in the basin and very deep to the target. The exploration should focus to identify this type of pre-salt play down dip the Murnaroo Platform where the depth to the Pindyin Sandstone is reachable. The second best Pindyin Lead is a gentle anticline in Manya and Wintinna Troughs, but it was defined by inadequate seismic controls. The most common pre-salt structural trap is a drag rollover or anticline associated with reverse faults, but it has high risk of the fault breach and poor reservoir rocks. Further study is needed to assess the trap closures, fault seal integrity, hydrocarbon generation and migration into trap.

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