

SEAL POTENTIAL IN CRETACEOUS AND LATE JURASSIC ROCKS OF THE VULCAN SUB-BASIN, NORTH WEST SHELF AUSTRALIA

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The occurrence of paleo-oil columns in Late Jurassic and Cretaceous reservoirs in the Vulcan sub-basin suggests that hydrocarbon accumulations have leaked. It is unclear whether accumulations have leaked through breach of top seal or fault seal. This paper evaluates the top seal potential for hydrocarbon accumulations in the Vulcan Sub-basin. Seal potential (SP) combines seal capacity (the hydrocarbon column height that can physically be held back by a seal), seal geometry (the areal extent and thickness of the seal) and seal integrity (rock mechanical properties of the seal). Seal capacities are measured using mercury injection capillary pressure calculations. Areal extent is evaluated using sedimentological and sequence stratigraphic principles. Thickness is determined empirically from well logs and seismic data. Seal integrity is derived from a brittleness index. In addition, a component relating to data quality and quantity is included in seal potential evaluation.

Lower Vulcan Formation SP ranges from low to high due to variations in seal capacity and thickness risks as well as data quality and quantity. High SP occurs in the main depocentres and low SP occurs on paleo-highs and basin margins. Upper Vulcan Formation SP ranges from low to moderate due to variations in seal capacity and data issues. Moderate SP occurs in depocentres and low SP on basin margins. In the Echuca Shoals Formation seal capacity, seal extent and integrity as well as data quality and quantity are good. However, seal thickness is inconsistent, resulting in SP variations from good to poor as a function of thickness. Jamieson Formation has high seal capacities, is thick and laterally extensive, however the seal potential is locally moderate (e.g. on the Ashmore Platform) due to integrity issues. Woolaston, Gibson and Fenelon (WGF) Formations are grouped together as the regional seal and in this group SP varies from low to high. The WGF rocks have high seal capacities, are laterally extensive and thick and the data quality and quantity is good. The main risk is integrity, which increases from northwest to southeast in the basin.

Based on the overall seal potential analyses, almost all seals in the area are capable of holding back hydrocarbon columns greater than present or paleocolumns encountered. This suggests that hydrocarbon leakage in the Vulcan Sub-Basin was unlikely to have occurred as a result of top seal capillary failure.