SEALING AND NON-SEALING FAULTS ALONG A MAJOR WRENCH TREND IN THE KAKAP AREA, WEST NATUNA BASIN

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Oil entrapments at KG, KRN and KR oil fields occur in three-way dip closures against normal faults splaying from a large wrench zone. These relatively small fields have produced more than 27.2 MMBO and 30.3 BCFG since 1995.

Study of fault plane profiles shows that faults seal the accumulation of hydrocarbons in these fields. Upthrown oil reservoirs are juxtaposed against water bearing sands and or shales in the downthrown panels. The faults provide an updip seal for the hydrocarbon accumulations in some closures, but in others the faults failed to trap oil or gas.

This study derives an empirical model based on observations of trapping conditions and analysis of fault plane profiles. 3-D seismic data cover the study area, and seismic interpretations support the accuracy of mapping the upthrown and downthrown fault panels. Observed relationships among cross-fault lithologies are:

1. Faults seal hydrocarbon-bearing sandstones juxtaposed against water bearing sandstones where the fault throw is more than about 300 ft.
2. Faults juxtaposing sand against sand are generally non-sealing where the fault throw is less than about 300 ft. Hydrocarbon entrapment by faults with less than 300 ft of throw does occur, however, where the reservoir is in contact with a shale interval across a normal fault.
3. Normal faults juxtaposing sand against thick, laterally continuous shale are generally sealing regardless of throw.
4. The net-to-gross ratio of sand to shale on both sides of the fault affects the seal capacity of the fault trap.

The seal for faults with greater than 300 ft of throw apparently results from emplacement of boundary material or granulation of sand grains. The sealing material for faults with less throw most likely consists of smear formed by ductile deformation of shale beds during fault slip.