Regional Integrated Technologies Reviews Deepwater Petroleum Geology potential off South/Southeast Asia

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Abstract

Massive regional 2D/3D seismic data acquisition programs, processed in time and depth, have revealed the sub-surface landscape offshore Asia and Southeast Asia. These surveys conducted in the last two decades were complemented in several instances by potential field measurements of gravity, magnetics, resistivity, magneto-tellurics, controlled source electromagnetic and developments of deep-water drilling programs that would simultaneously integrate all data. The contemporaneous geophysical libraries in these regions encompass now data in all of the basins off South Asia, Southeast Asia and Australasia. It has broaden the scope of hydrocarbon exploration in its continuous search in the understanding of new petroleum provinces. There are now several producing basins in the largely un-explored deepwater regions off India, Malaysia, Philippines, Brunei, Indonesia and Northwest Australia. This paper studies the role of modern integrated technologies, mainly regional seismic lines in the assessment of major structural and stratigraphic features so as to foster exploration plays in deepwater provinces of the region.

The tectonic fabric of this region deepwater realm results from motion of the Eurasian-Sunda, Indian Ocean-Australian, and Philippine Sea Plates. Motion of the Indian Ocean plate is approximately towards the north and the Philippine Sea Plate approximately towards the WNW, both plates converging on the relatively stable Eurasian-Sunda Craton. Convergence along the southern margin of the Eurasian Plate takes place by subduction of Indian Oceanic crust and by westerly propagating collision of the Australian continental crust with the island arcs to the north of the Sunda Trench. Along the eastern flank of the SE Eurasian plate convergence is accommodated by subduction of the Philippine Sea Plate.

In the Tertiary basins of the Southeast Asia Sunda Archipelago a common pattern of cyclical sedimentation is linked to a series of transgressions and regressions. The most important transgressions occurred during Eocene–early Oligocene, and late Oligocene early-middle Miocene times. Regressions are notable during the mid-Miocene, with the main regressive event extending from late Miocene to early Pliocene. These regressive cycles mark periods of intense tectonic activity, which led to tectonic inversion of basins with consequent uplift of back-arc rifts and realignment of principal fault systems. Numerous structural and stratigraphic plays are recognized within Indonesia's basins, the main reservoir types are transgressive and regressive clastic sequences associated with structural closures and pinch-outs, carbonate build-ups and reefs. Source rocks consist mostly of lacustrine shales and coals, which are abundant in the Eocene, and Oligocene sequences. Seals generally extend regionally, although occasionally inter-bedded shale sequences may cap smaller structures. Depocentres are located close to producing reservoirs and the most effective migration paths are through sand carrier beds and leaky faults, which are also proximal to reservoirs.

Most deepwater plays, Tertiary and Mesozoic reservoirs, occur in basins with pre-Tertiary substratum. Significant deepwater exploratory discoveries were made off India's KG Basin, Indonesia's Makassar Strait and Arafura Sea, Philippines Palawan Basin and Sulu Seas and Timor Sea - Northwest Australia. In India, exploration efforts in deepwater focuses in the sub-basalt Mesozoic off Western India, the Tertiary sequences off its eastern coast and in the Andaman Sea. In the pre-Tertiary basins of the Archipelago the main reservoirs occur in the Jurassic sands and Permian carbonates. New technology advancements in seismic reflection data acquisition of P and S waves, seismic refraction, seismic data processing and potential data integration enhances the pre/post-drilling imaging characterization of reservoirs.