

Hydrocarbon potential of pre-Tertiary sediments (Cretaceous/Jurassic?) on Tenggol Arch, West Malay Basin

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The pre-Tertiary basement structures onshore Peninsular Malaysia are dominated by three NW-SE trending tectonic zones: Western, Central and Eastern belts. Immediately offshore to the east is another parallel, tectonic zone whose top is marked by granitic-metamorphic rocks forming the island groups of Perhentian, Redang, Kapas and Tenggol islets. The latter cap the SE end of this tectonic zone that is known as Tenggol Arch. This is a 100-km wide basement platform and ramp separating the Malay Basin to its east from the Penyu Basin. The Arch is separated from the platform/ramp by the north-trending Tembikai Graben Complex.

At basement level, the regional Tenggol fault downthrows 2.5 km towards the Malay Basin. The eastern side of the Arch consists of (?)Triassic-Jurassic granitic rocks, while on the west are metamorphics whose top surface descends about 6 km via normal step faults to form the basement floor of the Penyu Basin. The basement surface of the Arch is part of the Southeast Asian, Cretaceous-Palaeocene peneplain surface that remained elevated throughout the Tertiary structuration of the adjacent Malay and Penyu basins. Only a kilometre of Tertiary sediments overlie the Tenggol Arch, while the basins contain at least 10 km and 6 km Tertiary strata, respectively.

The exploration for hydrocarbon in Malay Basin began when Esso and Conoco were awarded the first concessions in 1968 followed by Mobil in 1971. The first commercially exploitable oilfield, the Tapis field was discovered by Esso in 1969. After that is a history when significant amounts of hydrocarbon were discovered and the petroleum industry has contributed most to the wealth of the nation. All the discoveries were within the Tertiary sediments ranging from seismic Group M to Group D. To date two hydrocarbon complexes have been discovered on the Tenggol Arch namely Malong and Bertam. Both fields found significant amounts of hydrocarbon within the Early Mid Miocene reservoirs.

Deeper potentials of the pre-Tertiary basement overlying the Tenggol Arch has not been tested. Early exploration efforts did not focus on the deeper plays due limited understanding of the tectonic framework and seismic data. Recent efforts by PCSB have resulted in additional exploration potential within the 'deeper play' pre-Tertiary sediments. Seismic evidence indicates distinct stratification that possibly represents pre-Tertiary sediments.

The interpreted seismic was acquired as regional lines in 1993 and reached depths of 12 seconds. Special processing yielded meaningful responses from much deeper levels than were routinely penetrated.

New 3D data of the western PM306 block acquired by PCSB have also indicated distinct stratification that possibly represents pre-Tertiary sediments as observed in the PM307 block.

One of the critical elements of such a pre-Tertiary petroleum system is the distance of hydrocarbon migration.