

Permo-Triassic Petroleum Systems of the East African Coastal Basins

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ABSTRACT

Direct and indirect geological and geochemical evidence suggests several large oil and gas accumulations found along the coastal margin of East Africa and Madagascar may have been charged by Permo-Triassic ('Karoo') source rocks. Two source candidates have been identified: (1) A basal Triassic shale deposited during a brief marine incursion from Tethys to the north. The facies can be traced as far south as central Tanzania (Selous & Mikumi Grabens) and central Madagascar (northern Morondava) along the western and eastern margins of an extensive paleo-rift system. It is tentatively typed to a distinctive isotopically light oil encountered at Calub gas field (Ogadon, Ethiopia), Tabaj Hill seep (Mandera Lugh, Kenya), Tsimiroro and Bemolanga paleo-accumulations (northern Morondava, Madagascar) and less certainly to the Wingayonga paleo-oil field (Rifiji, Tanzania). Its geographic extent suggests a once very prolific petroleum system largely dispersed by post-charge uplift, tilting and unroofing. (2) Permian (and more locally Triassic) sapropelic rich coals and carbonaceous mudstones enriched by algal and bacterial organic matter. This facies is well developed in the Selous (Tanzania), Rovuma (southern Tanzania-northern Mozambique) and Morondava basins, associated with numerous oil and gas shows in the south central Morondava and oil seeps in the southern Rovuma. These testify to a second regional petroleum system once contiguous with or on-trend with the Rovuma gas province offshore. Although definitive public domain geochemical evidence is limited, the apparent regional extent of the coal/carbonaceous mudstone facies and association with hydrocarbon shows, suggest it as a likely source for the Rovuma gas fields, charged late by fault controlled depressuring along the flanks of the Karimbas Graben system. A similar model is suggested for the Pande and Termane gas fields of central coastal Mozambique where Pliocene-Recent fault movement along the Urema-Chissenga fault system may have triggered a late gas charge from coals/carbonaceous mudstones in the southern seaward extension of the Zambezi Graben. Jurassic syn-rift and early post-rift source facies have been identified in Tanzania and Madagascar with younger source rocks further north but are only locally associated with significant hydrocarbon accumulations (Songo Songo, Pemba Island seep, ?Sunbird) and so far appear to be of secondary significance.