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The Influence of the Timing of Subsidence and Climate in Determining whether Individual Rift Basins will become petroliferous or not.

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Petroleum Exploration drilling in East African Tertiary Rift basins has had mixed results to date. Just two out of eight basins that have seen some exploration drilling have resulted in successes. These are the Albert Rift in Uganda and the South-Lokichar basin in northern Kenya where widespread oil discoveries have been made since late 2005. In contrast, there has been a distinct lack of success in other basins thus far, these include, the Lake Edward and Rhino Camp basins in Uganda, the North Kerio and Turkana basins in Kenya, the Omo and Chew Bahir Basins in Ethiopia and the Rukwa basin in Tanzania. Whilst most of these basins are not yet fully explored they look to be non-petroliferous right now. What important elements might these basins lack to have precluded hydrocarbon generation? Is low success rate likely to be the norm in East African rift basins in general?

Whilst all rift basins have suitable reservoir rocks and potential for trapping geometries both structural and stratigraphic, extensive, thick and high quality source rocks appear to be lacking in some.
Some key requirements for source rock development are likely to be:

1. The presence of a large topographic low/trough in which an extensive rift lake formed
2. This trough needs to have been deep at a time when the climate was conducive to high run-off and the formation of deep lakes with anoxic bottom waters.
3. High run-off and deep lake development need to have persisted over a prolonged period. Rates of deep water sedimentation are less than 5mm per year and the resultant organic argillite would compact down to less than 2mm over time. Source rocks like the Lokone Shale in the South Lokichar basin, up to 600m thick would have taken over 300000 years to accumulate.
4. Long term burial into or through the oil window needs to have occurred.

Currently in the East African Rift there are likely only three out of 25 extensive lakes systems with substantially extensive anoxia on their lake floors namely Lakes Kivu (<500mWD), Malawi (<700mWD) and Tanganyika (<1450mWD).

Palynology studies in Kenya have proven to be indicators of periods of high abundance and diversity of land plants and algae. Intervals of high recovery of spores and pollen are indicative of wet periods favorable for deep lake development, anoxia and resultant source rock accumulation. The lower Miocene is one of these periods during which time the Lokone Source shale accumulated in the South Lokichar Basin. However, since that period and particularly during the Pliocene-to-Recent period the

region seems to have progressively dried out. Similar palynology studies from boreholes in the Albert Rift confirm the recent drying out of the region and therefore a progressively decreasing likelihood of the development of long lived deep water anoxic lakes.

Is a substantial Lower Miocene (or older) source rock needed for East African rift basins to be petroliferous? Are basins with rift fill largely younger than Lower Miocene highly likely to be barren?