

**PETROLEUM SYSTEMS OF A TRANSFORM PASSIVE MARGIN: OFFSHORE  
CÔTE D'IVOIRE, WEST AFRICA**

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Interpretation of a large regional database of bulk, molecular and isotopic analyses of sediments and oils are used to define the Petroleum Systems operating on the Ivorian margin of West Africa. With the opening of the South Atlantic, the east-west margin rifted dextrally during the Albo-Aptian along the failed Lagunes Trough and successfully along the southern margin of the Lion-Espoir-Belier high. An East African Rift analogue is adopted for the alluvial-lacustrine sedimentary fill of the Lagunes Trough. The emerging model requires source rocks to have accumulated during the Albian in a string of discrete lacustrine-brackish-marine basins along the now coast-parallel Lagunes Trough, while a second more marine organofacies develops in the successful rift of the Deep Ivorian Basin to the south (Figure 1).

Biomarker and isotopes from the eastern oil accumulations show that brackish-lacustrine Albian source rocks in the Lagunes Trough expelled early-mid mature oil which migrated southwards to the Belier and Kudu area accumulations and northward to the onshore Gnampon seeps. Source rocks in the western Lagunes Trough charge the Lion family of fields with isotopically heavy full maturity spectrum oil, but no onshore seeps are reported. Isotopes indicate that the 'Lion-type' source facies was repeated in the extreme east and charged the Gazelle field condensates and the onshore Eboinda seeps, together with the West Tano accumulation of offshore Ghana. The available evidence points to the Espoir area oil fields being charged from early-plus-mid mature Albian source rocks in the Deep Ivorian Basin to the south (Morrison et al., 1999). Drill Stem Tests from some exploration wells in the east point to a duplication of this pathway. Biomarker maturity suggests the Gazelle condensates derive from migrational fractionation rather than thermal cracking: no late thermal gas is recorded on this margin.

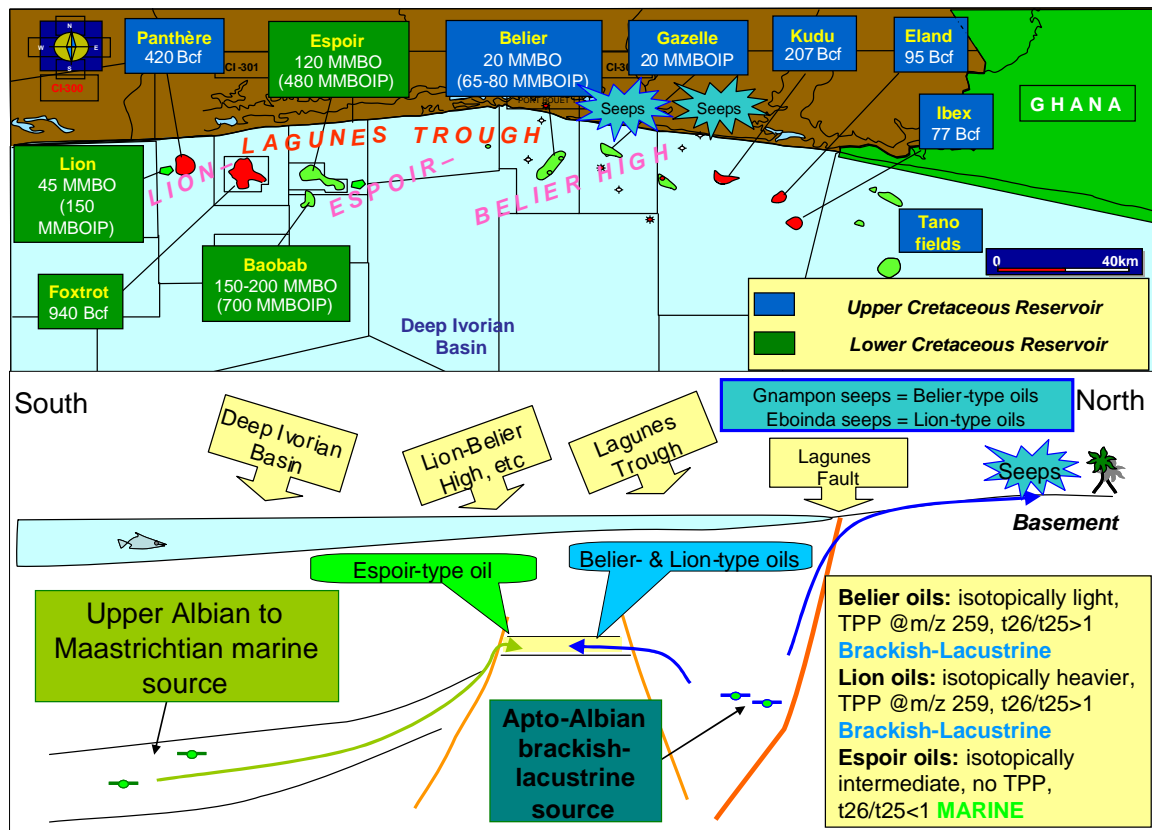


Figure 1. Location map (upper) and schematic cross-section (lower) illustrating the fields and petroleum systems operating offshore Côte d'Ivoire.

The biomarker oil maturity indicators were checked against the predictions of 1-D thermal geohistory modelling (Platte River's BasinMod<sup>®</sup>) calibrated against temperature and maturity gradients (vitrinite reflectance and Rock-Eval T<sub>max</sub>). Non-linear maturity gradients were common in wells penetrating lower Cretaceous sections. The heat flow history demanded by calibration showed syn-rift Aptian heat flows of some 100mW/m<sup>2</sup> falling rapidly, which then stabilize to present day values of about 43mW/m<sup>2</sup>. The effect of the high rifting heat flow was to 'cook' the deep (Aptian) source rocks of the Lagunes Trough before the reservoirs were deposited and structure & seal established. The biomarkers of present day accumulations are compatible with expulsion from the later rift sediments which reached maximum temperatures under Tertiary burial combined with the lower heat flow regime.

## REFERENCE

Morrison, J., Burgess, C., Cornford, C. and N'Zalasse, B., 1999. Hydrocarbon systems of the Abidjan margin, Côte d'Ivoire, Offshore West Africa 2000 Conference and Exhibition, 22nd March, 1999, Abidjan, Côte d'Ivoire, pp. 13.