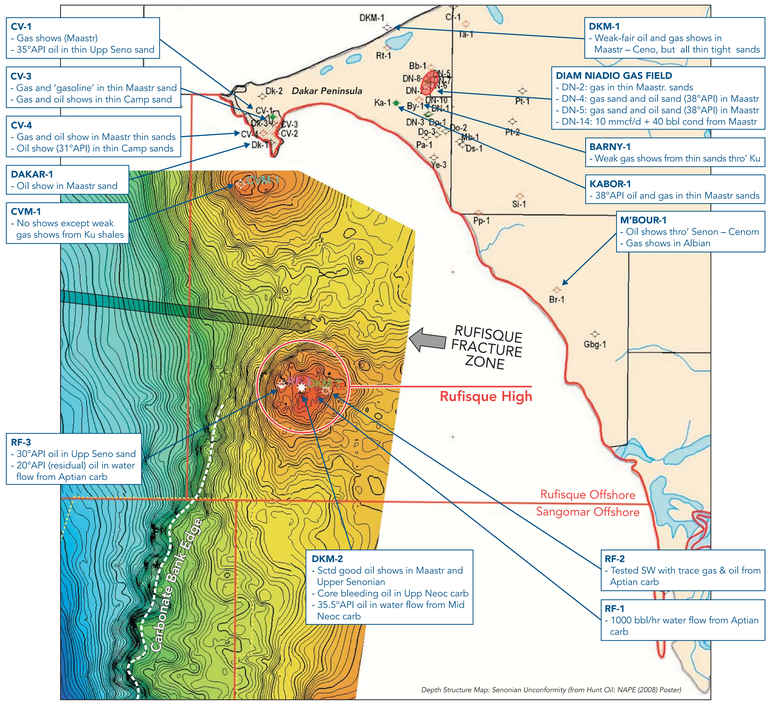
Variation in Crustal Extension and its Implication for Hydrocarbon Habitat in the Dakar – Rufisque Area, Senegal

Dakar – Rufisque Area: HC Occurrences



Evolution of the Dakar – Rufisque area

- During Tr - JL rifting, the sector between the Rufisque and Cayar fracture zones (Dakar Compartment) suffered a higher degree of extension than the sector to the south.
- As a result, when significant sedimentation overlapped the Ju – KL carbonate bank and started to load extended continental crust in Apto – Albian times, the Dakar Compartment subsided more rapidly than the sector to the south.
- N-S compression in Santonian times caused uplift of the rigid (less extended) Rufisque High to the south of the Rufisque fracture zone and concomitant subsidence in the Dakar Compartment. This tectonism was accompanied by the initiation of basic igneous intrusion along 'leaky' transforms, e.g. Cayar sea-mount. Burial graphs (see poster 3) suggest that the Dakar area at this time suffered no major uplift.
- The Rufisque Compartment subsided little during Maastrichtian – Palaeogene times, in contrast to the Dakar Compartment to the north.
- In the Oligo-Miocene, the Dakar area suffered a major hypabyssal – volcanic igneous event, which climaxed in MiM-MiU times with the formation of the Dakar Arch (inverting the pre-existing Ku - MiL basin (see seismic line on poster 3).
- High present-day temperatures from the Rufisque wells imply the presence of a deep Quaternary (?) intrusion (tho' the wells show no shallow intrusions or volcanicity).

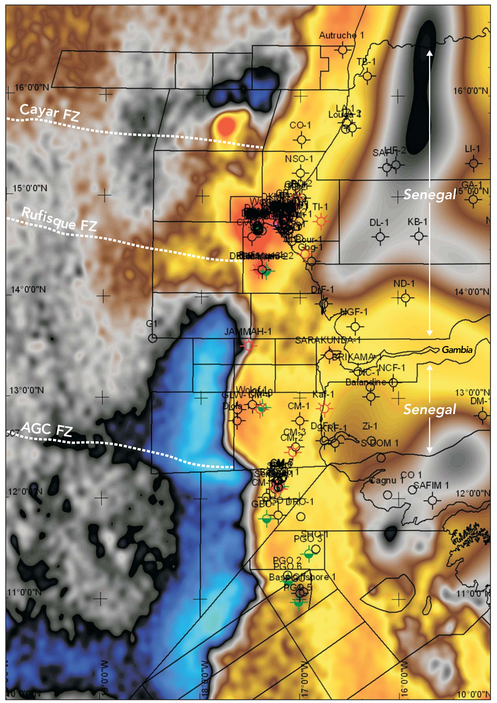
Implications for Petroleum Geology

- Compartmentalisation of the Senegal Margin has had a profound effect on heat-flow, thickness and burial history of potential source rock sequences in the Jurassic and Cretaceous.
- The Dakar Compartment is postulated to have the thinner crust (higher β factor during rifting) and accumulated thicker post-rift sediments. This, combined with higher heat-flow, has resulted in gas being the dominant hydrocarbon phase discovered (e.g. Gadiaga and Diam Niadio gas fields).
- In the adjacent Rufisque Compartment, heat flows are lower and sedimentary sequences are thinner. As a result, maturity of the Jurassic and Cretaceous sequences are substantially lower and Cretaceous source rocks have the potential to be within the oil generative window. However, lack of well control outboard of the Late Jurassic-Early Cretaceous carbonate margin makes prediction of maturity speculative and uncalibrated.

Suggestions for Further Work

- Current well data can't separate the results of igneous heating from the results of deep burial. A GeoThermometry Study (AFTA etc) would yield better data on timing of uplift and on maximum palaeo-temperatures, necessary for the construction of a more definitive hydrocarbon charge model for the area.

Free Air Satellite Gravity (Sandwell)



+75 mgal (red) to -75 mgal (blue)

The postulated igneous underpinnings of the Dakar High and the Rufisque High are supported by gravity data.

The carbonate margin is highlighted by the sharp transition from warm to cold colours in the southern half of the map. From Rufisque northwards the signature of the carbonate margin is masked by the Neogene igneous centre; by the fact that the margin closely parallels the coastline; and by poor gravity coverage onshore.

The Cayar Seamount is well seen (~15.5° N).

Note the re-entrant of the carbonate margin at the termination of the AGC Fracture Zone (the mirror image of the Rufisque setting).

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