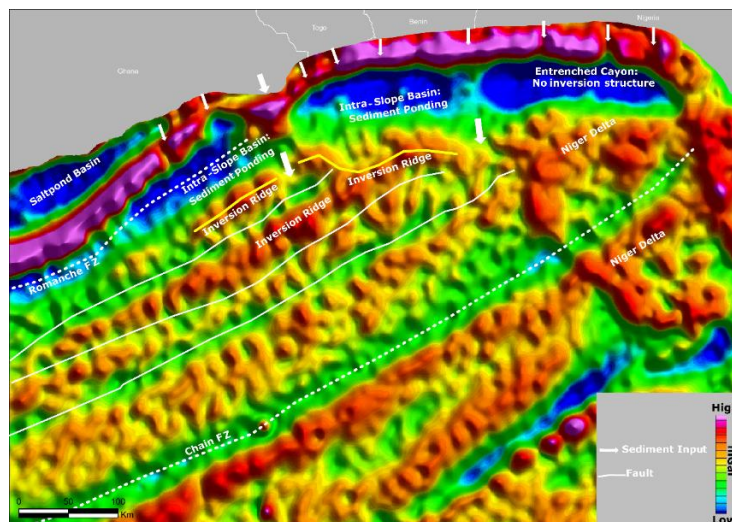


## Introduction

The Dahomey Embayment forms part of the West Africa Transform Margin (WATM). It covers the Keta basin in eastern Ghana, Togo, Benin and western Nigeria (Figure 1). It stretches from onshore to deepwater according to Brownfield and Charpentier (2006). There have been several hydrocarbon exploration successes on the shelf and slope in Togo, Benin and western Nigeria. However, the deepwater largely remains a frontier province and represents an exciting area for exploration.

Two main petroleum systems are encountered in the Embayment. Devonian to Neocomian age source rocks charge Devonian and Cretaceous reservoirs mainly found onshore and on the shelf. Turonian and Cenomanian reservoirs in the Seme, Ogo, Aje fields were charged by the Neocomian source. The second is the Lower Cretaceous Albian and Cenomanian source rocks, which charge Cretaceous reservoirs in the slope and deepwater setting. Reservoirs in the Hihon-1 and Fifa-1 discoveries were fed by these source rocks, proving the presence and maturity of the Lower Cretaceous source rocks that have successfully charged reservoirs in the Tano basin. The trapping on the shelf tends to be structural or combination of structural and stratigraphic.

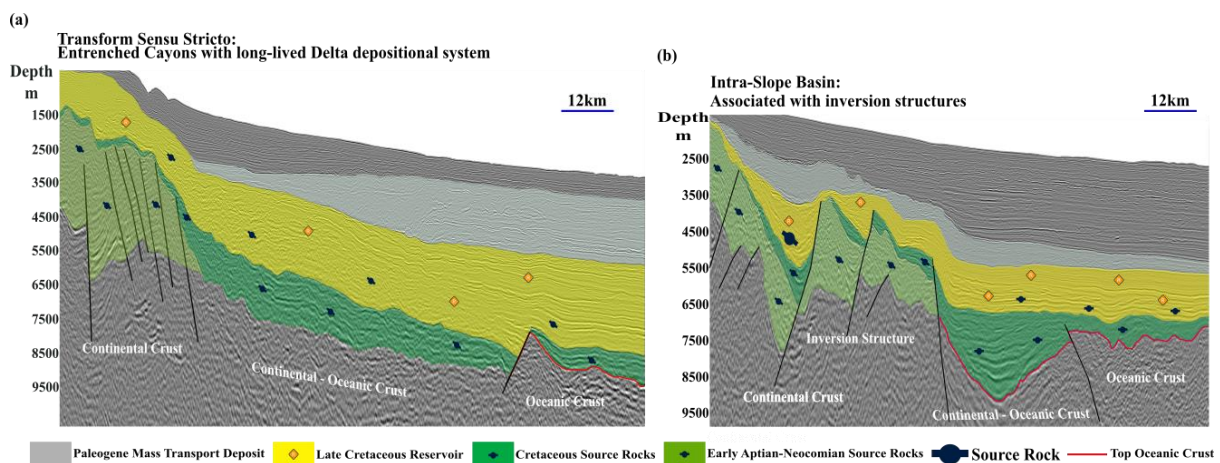


**Figure 1** 200 km high pass filtered Bouguer gravity map (2.0 g/cc) showing basin architecture and subbasins.

## Basin Architecture and Cretaceous Play Fairway

The margin is characterized by a narrow shelf and steep slope with long-lived fluvio-deltaic depositional systems (Cronin et al 2023). This is seen on the gravity map (Figure 1), where high pass filtered Bouguer gravity was used to map basement structures. This architecture developed as a result of tectonic movement along the Romanche and Chain Fracture Zones. The northwest limit of the margin is defined by the Romanche Transform Fault which splays into a horsetail fault system eastward, forming an inversion ridge leading to sediments ponding in the inboard. The Chain Fracture Zone constrains the southern limit of the margin. Two basin architectures are observed in the Dahomey Embayment. The first being the Transform Sensu Stricto (Cronin et al 2023) where sediments are transported from a narrow shelf onto a steep slope by entrenched canyons (Figure 2 (a)). Due to the long-lived delta systems associated with the canyons, this basin architecture is observed to have thick sediments from the slope to basin floor in a monocline structure. The second is the Intra-Slope Basins associated with the inversion structures causing sediment ponding on the slope and often having erosional gullies on the inversion structures leading to sediment transport onto the basin floor, forming turbidite and fan systems (Figure 2 (b)).

The Lower Cretaceous source rocks observed on seismic sections in the grabens and on the basin floor provide source kitchens for the slope to deepwater areas. The overburden is at least 6km thick on the basin floor and in the grabens, it is over 7km in some areas of the deepwater environment. The temperature measurement from wells on the slope indicate an average geothermal gradient of 30°C/km. The thin Continental Crust allows high heat flow through the system (MacGregor et al 2003). This shows that source rock with average 5% TOC in the outboard will be oil mature. The sandstone reservoirs in the Intra-Slope Basin tend to be well-sorted and mature, due to reworking and ponding of sediments on the slope. These sands are confined to erosional gullies on the inversion structures leading to confined turbidite and fan system development at the basin floor with little spreading. In comparison to the Entrenched Canyons system where there is little reworking and no ponding, the *Sensu Stricto* reservoir fairways are broad and widespread, forming large fan systems which tend to be mud-rich. The trapping on the slopes in both depositional cases tends to be a combination of stratigraphic and structural. In the Intra-Slope setting, the deepwater trapping is typically stratigraphic pinching out against inversion highs. Whilst the *Sensu Stricto* has a largely stratigraphic trapping style and may rely on regional highs for trapping.



**Figure 2** Seismic model of Cretaceous depositional system of the transform margin *Sensu Stricto* and Intra-Slope Basins.

## Conclusion

The Deepwater Dahomey Embayment shows high potential for hydrocarbon exploration. The presence of the Lower Cretaceous Source Rocks within grabens and on the basin floor provide an excellent source kitchen for the high-quality Cretaceous turbidite and fan reservoirs. The deepwater is characterized by large stratigraphic traps. The Lower Cretaceous source and Cretaceous reservoirs provide an excellent intercalated play fairway, which is analogous to the Tano Basin.

## References

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