

Pre- and Post-Salt Prospectivity Analysis of the South Gabon Basin

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SUMMARY

The study addresses the hydrocarbon prospectivity of offshore Gabon with a particular focus on the South Gabon Basin based on detailed 3D PGS/DGH MegaSurvey seismic and well data interpretation. It describes the geology, structure and hydrocarbon potential of the South Gabon Basin.

The Gabon Basin consists of three sub-basins; the North Gabon, South Gabon and the Interior Basin. It is located within the larger Aptian Salt Basin of equatorial West Africa that stretches from southern Cameroon to Angola.

Both the North and South Gabon basins have been found to be potentially prospective during this study. The pre-salt section is structurally complicated as compared to the post-salt section and it has been difficult to image seismically. Numerous structural and stratigraphic traps have been identified and evaluated. Fan/channel systems have been mapped in both pre- and post- salt sections. Within the deeper pre-salt section, tilted fault blocks containing high amplitudes have been mapped suggesting potential sand presence and possible DHIs. Post salt sediments are dominated by 4-way dip closures and stratigraphic trapping mechanisms.

Introduction

The study addresses the hydrocarbon prospectivity analysis of the offshore Gabon region with a particular focus on the South Gabon Basin based on detailed interpretation of merged 3D seismic surveys and well data. It describes the geology, structure and hydrocarbon potential of the offshore South Gabon basinal area.

Gabon is situated in the west coast of Africa (figure 1) bounded by Cameroon, Equatorial Guinea, Congo and the Atlantic Ocean. Oil and gas exploration in Gabon dates back to the 1920s with the first commercial discovery, the Ozouri field, which was made by Elf and brought on-stream in 1956. Between then and the late 1990s a large number of oil and gas discoveries were made both onshore and offshore. Production has long been established from the pre-salt section onshore and shallow water offshore but this has not yet been extended to the deeper water offshore which is highlighted in this study and where both pre- and post-salt sections have been found to be prospective. The pre-salt section is structurally complicated and has been difficult to image seismically compared to the better seismic imaging in the post-salt section due to its less complicated geological structure.

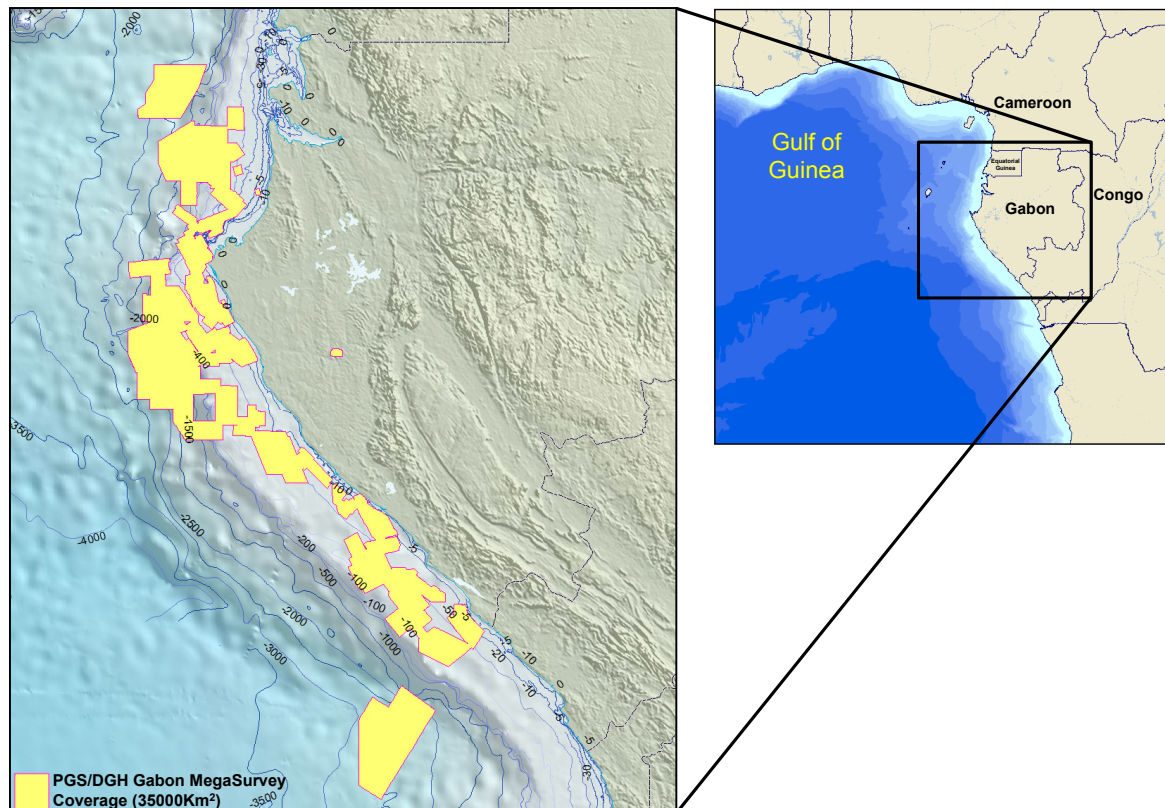


Figure 1 Geographical Location of Gabon and the study area.

Geological Background, Stratigraphy and Basin Evolution

The Gabon Basin is located in the larger Aptian Salt Basin of Equatorial West Africa, part of the salt basin complex that stretches from southern Cameroon to Angola, limited to the north by Guinea Ridge and to the south by the Walvis Ridge. Both of these ridges are volcanic basement features.

The Gabon Basin consists of three sub-basins; the North Gabon, South Gabon and Interior basins (figure 2), each of which has a different geological history.

These basins were initiated during the rifting phase as the Atlantic opened, and developed further during the post-rift/sag phase. The basin fill is divided into three major sedimentary megasequences; the pre-rift, the syn-rift and the post-rift megasequence.

Pre-rift rocks are only encountered along the eastern flank of the Interior Basin (up to 600m thick) where they comprise continental, fluvial and lacustrine sediments of Carboniferous to Jurassic age. No pre-rift sediments have been penetrated in either the North or South Gabon basins. In Gabon, the onset of rifting started during Neocomian–Berriasian times (144M years ago) and led to the formation of an extensional fault system which resulted in the formation of a series of graben and horst structures within the metamorphic basement complexes. The oldest syn-rift sediments in Gabon are found in the Interior Basin, which is separated from the offshore basinal areas by the Lambarene Horst. The end of the rifting has been dated and associated with the magnetic anomaly that suggested that the rift duration can be approximated to about 25M years. Gabon is segmented by NE-SW trending strike slip faults defining zones with different tectonic and stratigraphic histories.

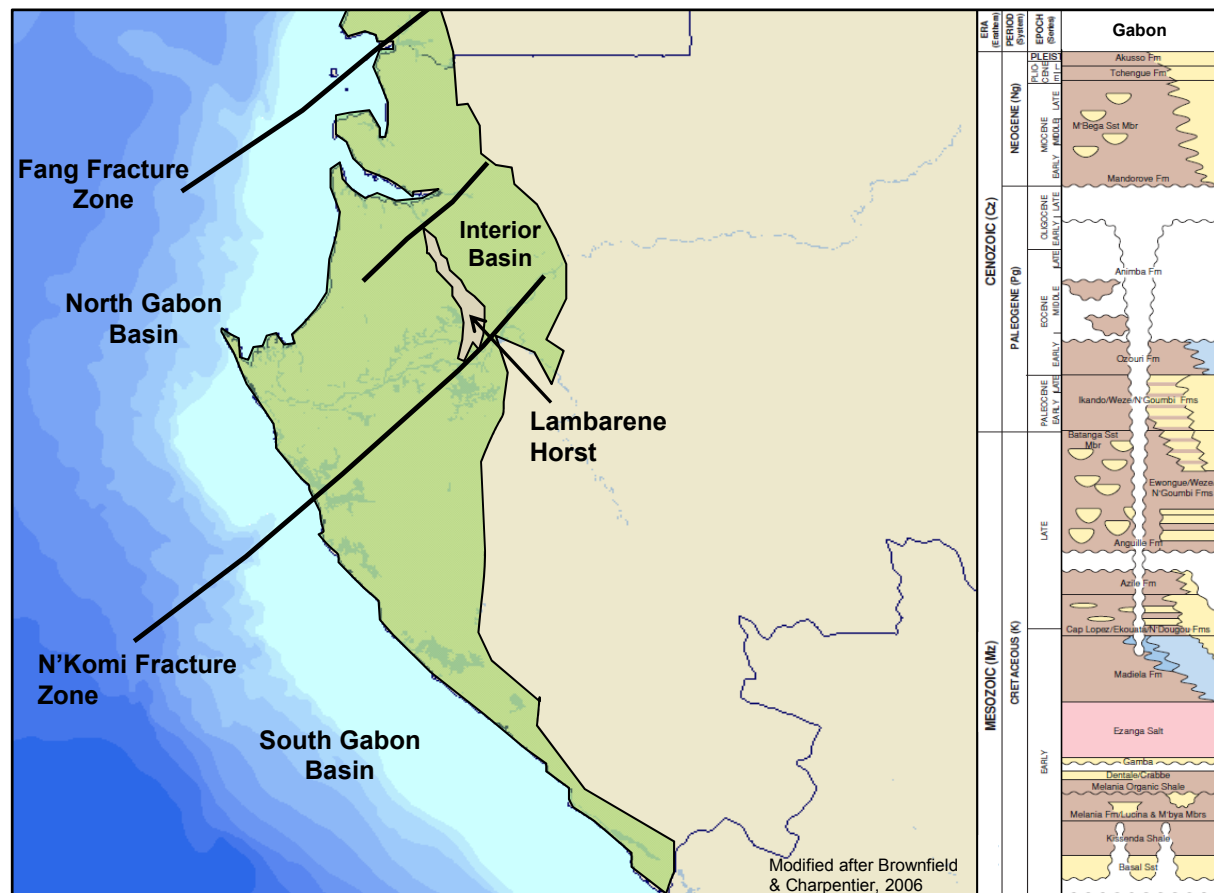


Figure 2 Tectonic Elements and stratigraphy of offshore Gabon.

Post-rift rocks range from Aptian to Holocene in age and represent the opening of the Atlantic and the subsequent drift of equatorial West Africa from South America. The initial post-rift rocks are of early to mid-Aptian age and consist of continental, fluvial and lagoonal rocks deposited as rifting ceased, followed by a period of extensive accumulation of evaporite units. Younger post-rift rocks were deposited in two distinct regimes; transgressive units consisting of shelf clastic and carbonates followed by progradational units along the continental margin and open-ocean basinal units.

Hydrocarbon Prospectivity Analysis

Numerous structural and stratigraphic traps have been identified and evaluated during this study of the deepwater section offshore. Figure 3 shows a seismic section from the northern part of the South Gabon Basin demonstrating pre- and post-salt hydrocarbon potential. The fan/channel systems, considered to be part of the Gamba Sandstone, have been identified and mapped below the salt. The Gamba Sandstone is a known reservoir unit offshore Gabon and discoveries, for example the Etame Field, have been made within this unit. Within the deeper section, tilted fault blocks have been identified with brighter seismic amplitude character suggesting potential sand presence and possible DHIs. These sands are thought to be of the Dentale Formation which is a proven reservoir in the shallower water regions. Post-salt sediments offer additional potential in the form of a variety of trapping styles including 4-way dip closures and stratigraphic pinch-outs. Brighter amplitudes observed in the post-salt carbonate section may indicate the presence of hydrocarbons, although further work is required to establish this.

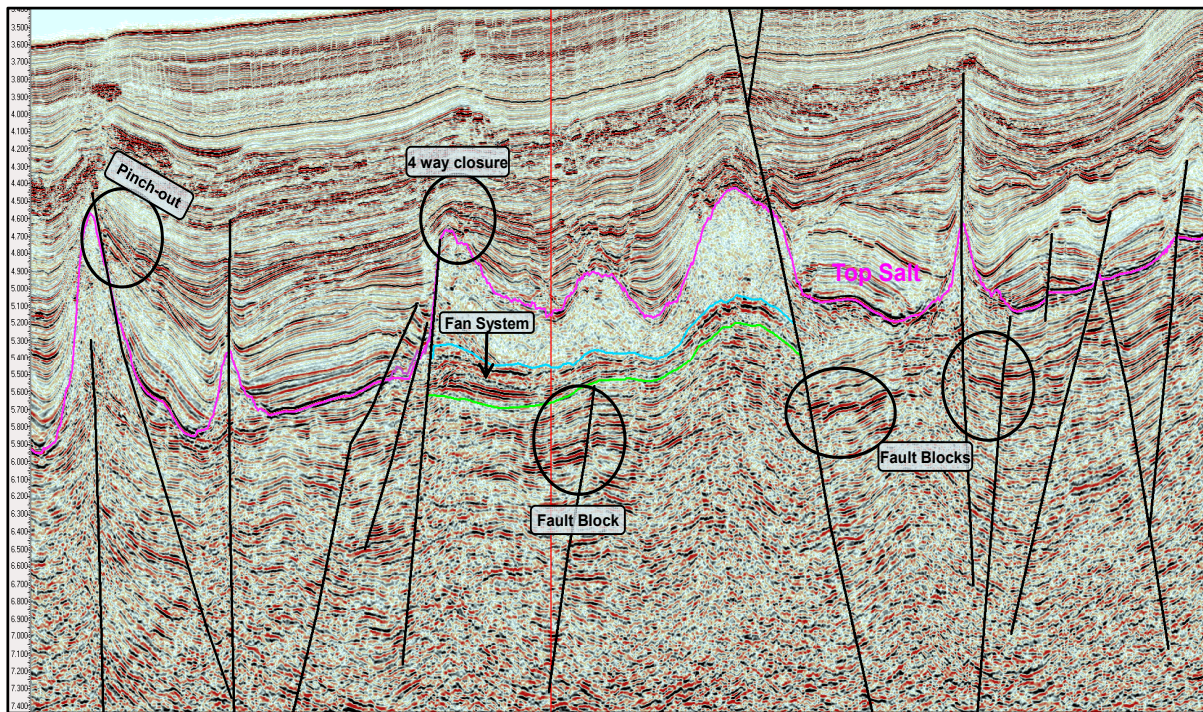


Figure 3 Various types of potential hydrocarbon traps imaged and interpreted on seismic.

Figure 4 is a seismic profile taken from the southern part of the South Gabon Basin and shows multiple trapping styles within the pre- and post-salt sections. The Etame Field may be a direct analogue to the aforementioned pre-salt traps. Good quality sands in the Gamba and Dentale Formations are likely to be present beneath the salt, trapped and sealed to make an effective hydrocarbon system, and charged from proven pre-salt mature source rocks. The post-salt potential traps are considered to be present within the Madiela Formation carbonates, which is a known reservoir in the area.

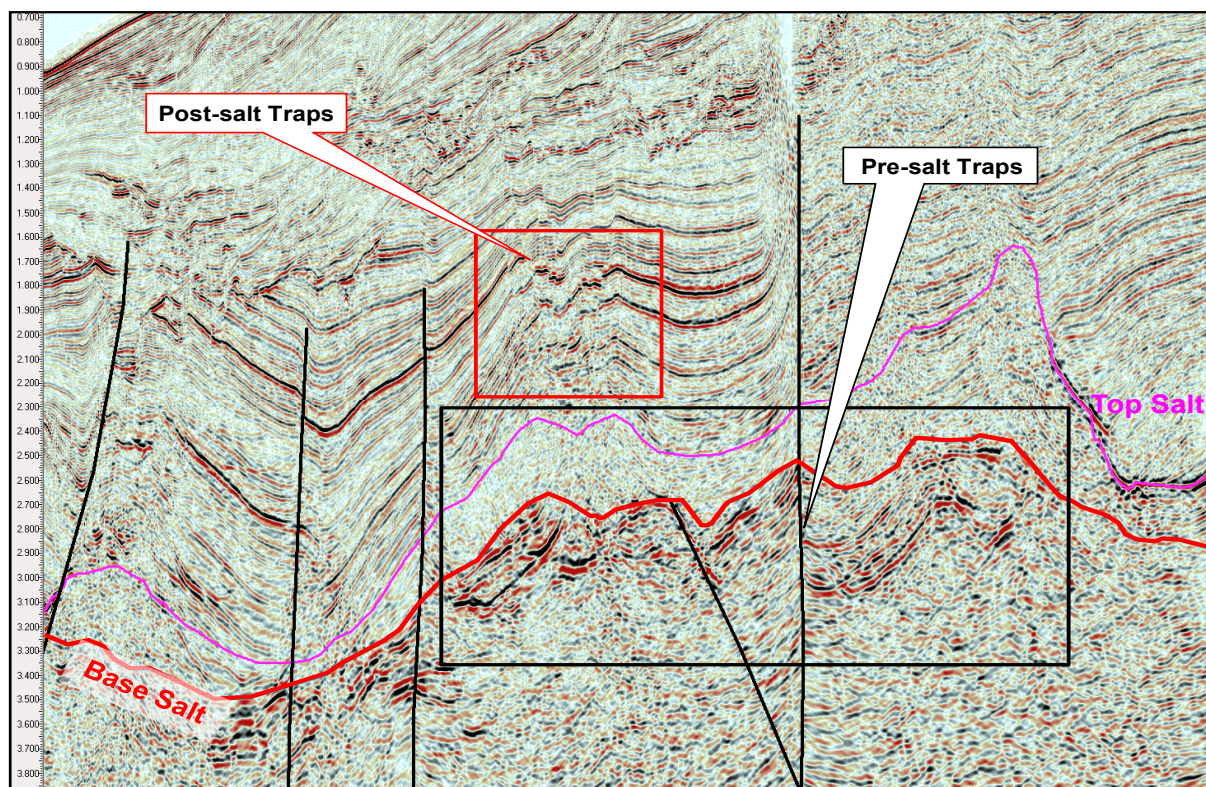


Figure 4 Pre-salt and post-salt hydrocarbon trapping styles, offshore Gabon.

Conclusions

The pre- and post-salt prospectivity of the South Gabon Basin can be summarised as:

- ❖ Post-salt existing discoveries are primarily related to closures over salt features.
- ❖ There is potential to find stratigraphic and/or structural traps in pre-salt sediments that have the potential to contain significant quantities of hydrocarbons. The majority of these targets are to be located within the Gamba and Dentale Formations and may be stacked.
- ❖ Potential carbonate traps with brighter seismic amplitude character above salt domes may indicate additional hydrocarbon potential.
- ❖ Well developed channel and fan systems identified can be considered potential reservoir targets in the Gabon offshore area. These channels can be identified in the deep water post-salt section.

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Key References

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