

Prospectivity of the Mauritanian margin: Reservoir fairways revealed through a mega-regional 3D dataset

Introduction

The Mauritania-Senegal margin has experienced significant exploration success with the discovery of the world-class Greater Tortue-Ahmeyim (GTA), Sangomar and BirAllah fields in the last 10-11 years, establishing it as one of Africa's most exciting hotspots for exploration and development.

Historically, exploration drilling along the margin typically focused on the inboard Cenozoic salt-related plays (e.g. Chinguetti, Banda, Tiof, Tevet), and Upper Cretaceous to Paleogene clastic targets on the shelf (e.g. Aigrette, Pelican, Lamatin, Fregate wells). As exploration stepped out into the deepwater, the focus shifted to target Mid to Upper Cretaceous deep-marine clastics (e.g. at GTA in 2015). Despite this major discovery and additional large discoveries at Orca-1 and Marsouin-1, the majority of the deepwater and ultra-deepwater remains largely untested.

The Mauritanian margin contains vast amounts of remaining potential within both untested plays and undrilled structures in existing plays. These include Cenozoic salt-draped channels in the inboard Miocene salt basin, syn-rift plays in the sub-salt units (analogous to similar plays offshore Morocco), analogues to the Sangomar and FAN fields in Senegal and Jurassic carbonate or mixed clastic-carbonate targets situated within the extensive platform area. Deepwater to ultra-deepwater plays include Mid to Upper Cretaceous channel and fan systems and mixed contourite-turbidite deposits.

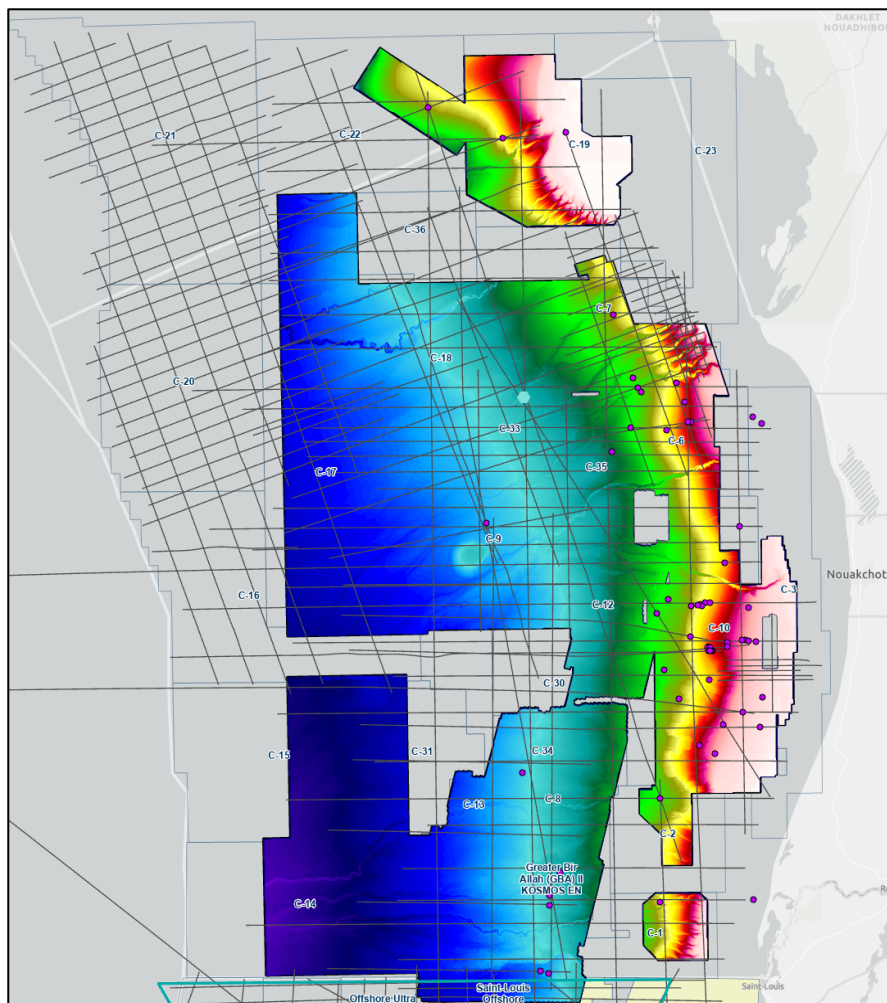


Figure 1 Mauritania 2D and 3D seismic data library, overlain with seabed map in TWT. Modern day canyon systems drain from the shelf-edge and transport sediments hundreds of kilometres outboard.

Geological Setting

Along the offshore Mauritanian margin, and across the border into Morocco, Triassic salt developed prior to the opening of the Atlantic Ocean. The tectono-stratigraphy of the shallow coastal basin has been influenced by allochthonous salt displacement throughout the Cretaceous, creating a range of structural traps. Above the Triassic rift section, an extensive bank of shelfal carbonates developed in the Mesozoic, spanning the length of the Mauritania, Senegal, Gambia, Guinea-Bissau and Republic of Guinea (Guinea-Conakry) Basin (MSGBC Basin). These carbonates have influenced the position of the shelf-break and clastic input points to the deepwater throughout the Mid to Upper Cretaceous.

Previous studies (Gillbard and Bellingham, 2022) have identified several major clastic systems entering the Mauritania offshore basin, depositing deltaic facies on the shelf and their associated down-slope channel and fan systems since the carbonate platform was drowned during the Lower Cretaceous. The full extent of these depositional fairways and their connection to the feeder systems on the shelf, has hitherto not yet been revealed due to their regional scale and historical lack of available multiclient 3D data in the outboard. The secret to unravelling the reservoir play fairways lies in understanding the relationship between the input river deltas and sediment bypass pathways, and the influence of the underlying platform and Triassic-rift sections.

Mega-regional interpretation of clastic systems

Over 80,000 km² of 3D seismic data have recently been made available as multi-client datasets offshore Mauritania. These data have been amplitude balanced, phase-matched and merged with ~19,000 km² of reprocessed 3D data to create a seamless 3D cube of ~90,000 km², complemented by regional 2D (Figure 1). Interpretation and analysis of these integrated 2D and 3D seismic datasets covering Mauritania's offshore from the coastal basin to the ultra-deepwater has enabled mega-regional scale mapping of these giant clastic systems and improved our understanding of their relationships with major tectono-stratigraphic units including the carbonate platform, autochthonous salt, and syn-rift section. Integrating this regional knowledge with known trap trends, this study offers insights on the Cretaceous and Tertiary potential offshore Mauritania, tracing the outboard fairways in detail with contiguous 3D.

Three main river systems provided clastic input to the Mauritanian margin, from south to north these include the Senegal River, Nouakchott River and Nouadhibou River. We observe a switch in major depo-centres from south to north during the Cretaceous and into the Tertiary (Figure 2), and identify the main bypass routes for present-day sediment transport to the deep and ultra-deepwater.

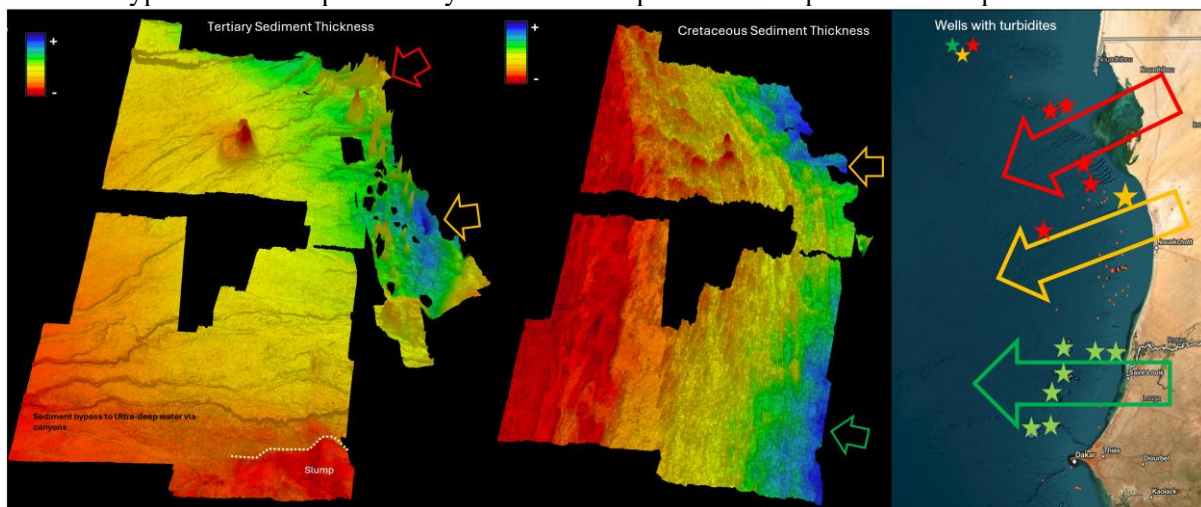


Figure 2 (a) Tertiary and (b) Cretaceous sediment thickness maps across the Mauritanian margin; (c) The sediment influx to the offshore is provided by three main river systems (red, orange, green arrows), after Winter et al. 2025.

The Lower to Mid Cretaceous system focused deposition in the southern and central parts of the basin and was fed by the Senegal River with the highest influx during the Aptian-Albian. Significant shelf-bypass is known to have occurred during this period, with the deposition of large sand bodies in the deepwater as proven in multiple well penetrations (e.g. Tortue, Marsouin, Hippocampe). From the Mid Cretaceous, the main depocentre began to shift northward along the margin in response to increased input from the Nouakchott River, and from the Late Cretaceous to Present day the Nouadhibou River was the most active. Seismic attributes such as spectral decomposition and RMS amplitude extractions reveal the distribution and morphological characteristics of these depositional fairways. These systems are characterised by unique features such as widespread sediment waves, with evident slope-bypass in the southern and central regions, giving way to fan-channel complexes in the north (Figure 3). The combination of sediment waves and bypass channels indicate the presence of mixed turbidite-contourite systems during the Cretaceous.

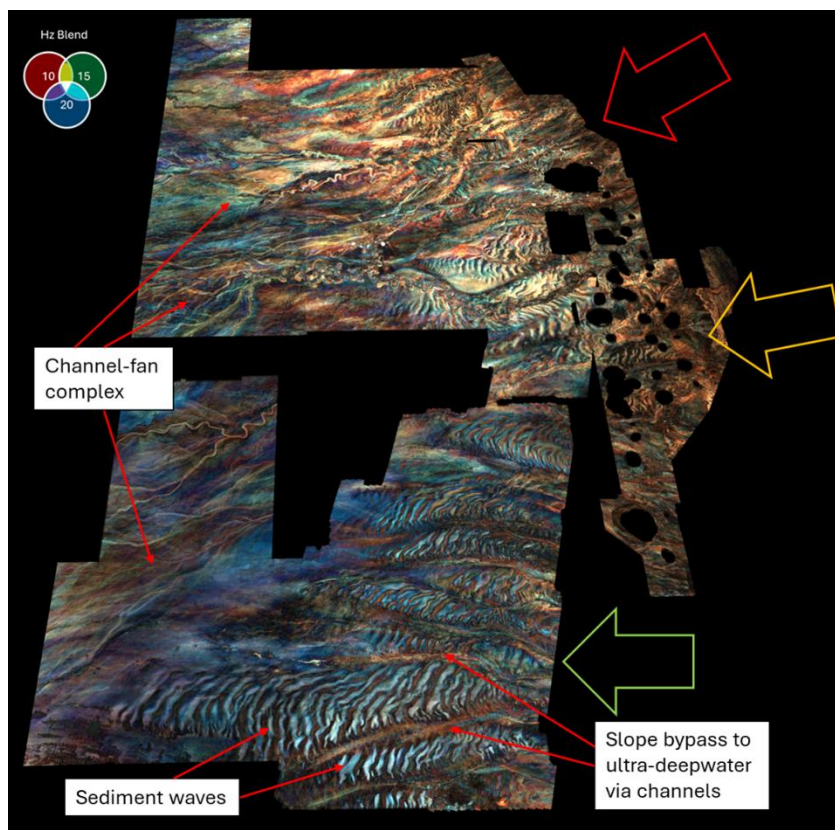


Figure 3 Spectral decomposition of Cenomanian-Turonian depositional systems, highlighting sediment waves, channel-fan complexes and areas of slope bypass to the ultra-deepwater via channels.

Refining the structural framework

Structural analysis provides valuable insights into the tectono-stratigraphic evolution of the Mauritanian margin, whilst detailed attribute mapping on 3D allows for comparison with the numerous proven and untested plays of the MSGBC basin. This mega-regional 3D dataset has allowed us to build on our existing knowledge of the structural framework derived from regional 2D, integrated with an inboard 3D dataset, refining our understanding of the interplay between the autochthonous Triassic salt and overlying Mesozoic carbonate platform. Regional mapping across the inboard salt basin and shelf margin has provided insight into the timing and nature of salt movements, along with the identification of untested structural and stratigraphic traps within the Neogene clastic systems. A volcanic seamount was identified in the north of the deepwater basin, creating topographic relief in the overlying units in addition to crestal faulting. This structure has influenced the path of meandering channel systems in the surrounding area, deflecting the channels to bypass the structure (Figure 4).

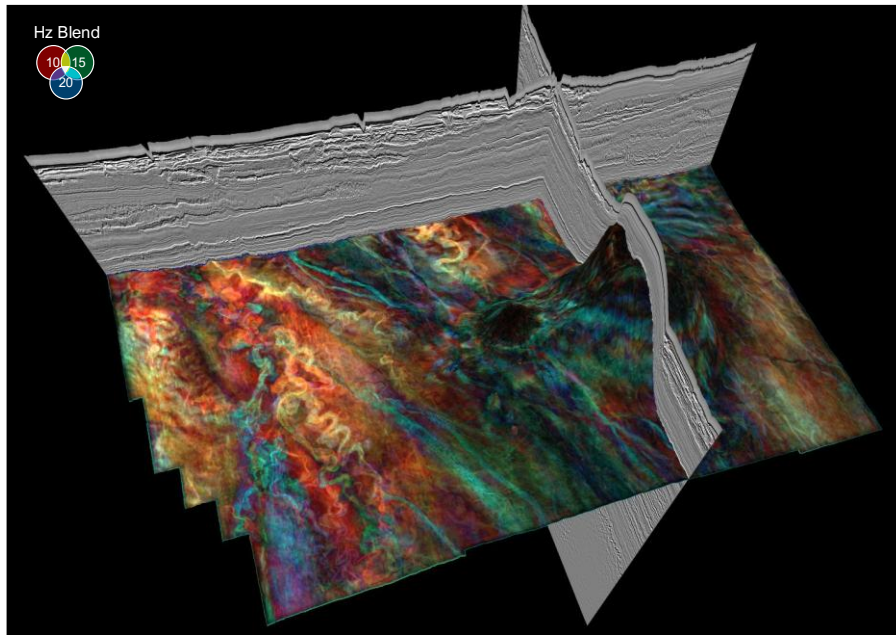


Figure 4 Upper Cretaceous channel systems bypassing a structural high in the northern deepwater basin.

Conclusions

Extensive mapping across a mega-regional 3D dataset has culminated in a complete interpretation of the stratigraphy from Triassic to present day along the entire Mauritanian margin. The results of this study have improved our understanding of the complex relationships between the autochthonous salt, the carbonate platform and their controls on the development of feeder systems on the shelf. We can link the sediment pathways from these input systems down-slope into the deep and ultra-deepwater clastic play fairways. Structural analysis provides valuable insight into the margins tectonostratigraphic history and detailed attribute evaluation allows us to link the existing discoveries to the multiple proven and untested plays offshore Mauritania.

The mega-regional scale of the dataset allows for demarcation of the giant clastic input systems which dominated the margin throughout the Cretaceous, where we can observe the main depocentre shifting progressively northward. The prospectivity of the Mauritanian margin can be defined by distinct geographical domains where specific plays are present, e.g. the Neogene salt-related clastic plays, Mesozoic carbonate plays and Triassic syn-rift plays are restricted to the inboard coastal basin. The vast Cretaceous deepwater clastic systems can be readily traced from their entry points at feeder canyons on the shelf outboard to the deep and ultra-deepwater domains. Understanding these spatial and temporal relationships allows for greater confidence in future exploration, de-risking reservoir distribution and trap timing within proven and untested plays.

Acknowledgements

We would like to thank our partners, the Ministry of Energy and Petroleum, Islamic Republic of Mauritania, for sharing this study.

References

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