Extending play fairways in the southern part of the Lower Congo basin

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Abstract

The southern Lower Congo Basin has been left behind in the exploration race with the very limited amount of drilling and exploration activity hampered by lack of good quality seismic data. It is an area that can still be considered pure exploration territory.

Drilled wells with information on source rock presence and temperature information are key to understand the maturity and effectiveness of the petroleum system. The area of interest, Block 34, is limited to only one such well penetration, N'demba-1, a dry hole which penetrated multiple immature post-salt source units. The well is not necessarily representative for such a large area as evidenced by significant generated hydrocarbons in the vicinity of the block.

Geophysical interpretation and attribute analysis of TGS' MultiClient 3D seismic data over the southern part of the Lower Congo Basin (Figure 1), where it transitions to the Kwanza Basin, has helped to delineate major play fairways and extend the mapping of key source rock intervals documented in various wells in nearby blocks. The southernmost part of the Congo fan is characterized by Oligo-Miocene channels which are affected by salt tectonics showing amplitude anomalies against salt walls or in correspondence of turtle structures related to salt withdrawal.

Published play fairway maps provide limited detail across the southernmost portion of the basin; however, new interpretation work over Block 34 has verified and extended the existing understanding of the post-salt Tertiary sequences. Attribute analysis within the Tertiary interval identifies well-defined NE–SW-trending channel complexes, corroborating the principal sediment transport direction observed on play fairway maps to the north of the area of interest.

The Mid-Upper Miocene interval is characterized mainly by weakly confined channel complexes while in the Lower Miocene and Oligocene sections the character changes and confined channel complexes become more prevalent (Fig. 2). These are the dominant reservoir systems that have proven to be so successful to the northeast in Block 17.

Post-salt source rock maturity in the area has been modelled to be variable, but complex geology, challenging imaging on legacy data and the lack of well control upholds significant uncertainty in this element. Only two wells provide this well control over an area of 5925 sq km, N'demba-1 as mentioned previously, and N'gandu-1, a shallow well that discovered gas with TD in the Oligocene.

Broadening the area of interest to integrate additional wells, further post-salt source rocks have been observed in the deeper Albian section along with rich, oil-prone source rocks in the pre-salt. These have also been proven to be active south of Block 34 with the discovery of hydrocarbons a Ohanga-1 and Ombovo-1 in Block 35, and Pandora-1 in Block 19. Potential charge contribution of these can only be established with improved imaging, to identify potential salt windows and migration pathways.

Given the positive results in surrounding blocks, it is of upmost importance to be able to properly model the maturity of the various source rock levels through the southern Lower Congo Basin, to ensure valuable resources in this prolific basin are not overlooked. Legacy time migrated seismic data has its limitations in this area, and the latest broadband depth reprocessing of data over blocks 33 and 34 aims to reduce uncertainties and revitalize this area.

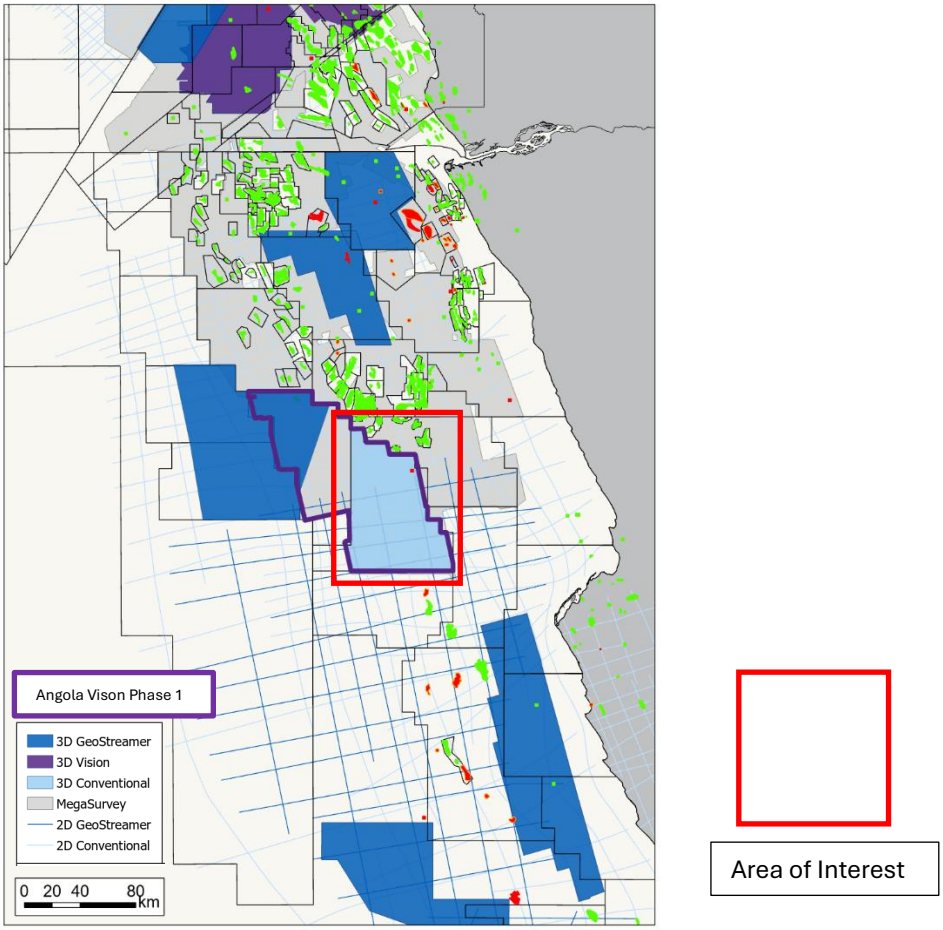

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Figure 1: Seismic data coverage over the area of interest in the southern Lower Congo Basin

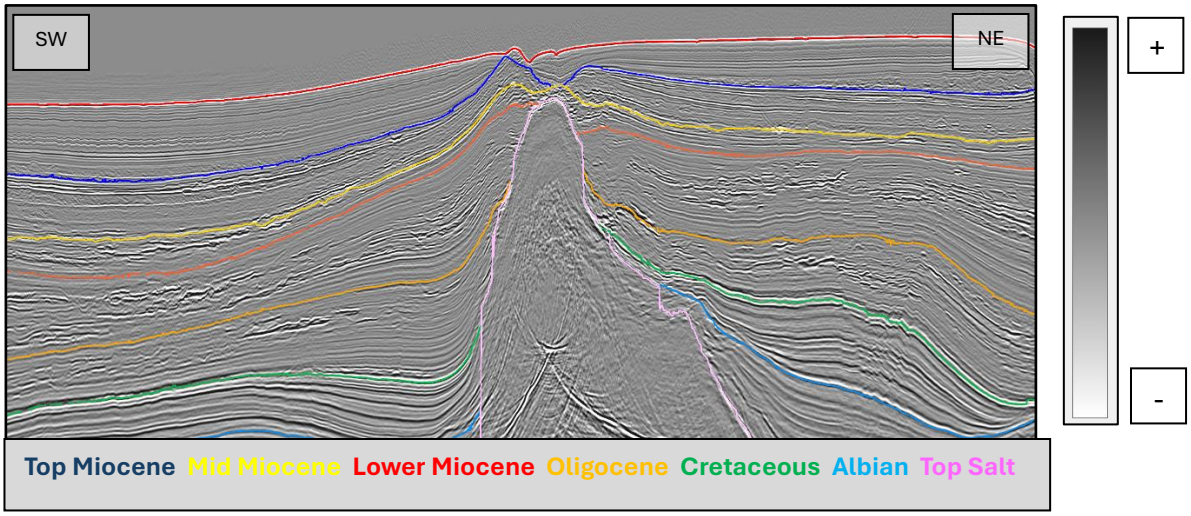

Fig.2: Seismic section displaying sedimentary features in the Oligo-Miocene sequence.