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Cretaceous to Paleogene Deep Water Depositional Systems, Block 2, Offshore Tanzania

C. Siversen* (Statoil ASA), E. Schomacker (Statoil ASA), T. Coffey (Statoil ASA)

Summary

Presentation discussing Late Cretaceous to Paleogene depositional systems mapped in Block 2, Tanzania. These include slope channels, lobes and contourite drift deposits. Several reservoir levels penetrated during the exploration drilling phase will be discussed. These include slope channels, lobes and contourite drift deposits.

Oil and gas exploration is continually challenged to find new prolific basins to replace diminishing global hydrocarbon reserves. The presence of working hydrocarbon systems onshore East Africa and a good potential for sandstone reservoirs offshore contributed to making offshore East Africa an area of significant focus for oil and gas exploration over the last 10 years. Exploration activity in the frontier acreage offshore Tanzania (Blocks 1, 2, 3 and 4) and northern Mozambique (Areas 1 and 4), has resulted in significant gas discoveries. Over the past 5 years, Statoil drilled 14 exploration wells in Block 2, offshore Tanzania, with partner ExxonMobil, and made 8 gas discoveries. The drilling campaign proved seven reservoir zones in Block 2 which span from Miocene to Early Cretaceous (Albian) in age.

The Mesozoic and Cenozoic deposits encountered in Block 2 were deposited in a passive margin setting with some transform movement along fracture zones. The north-south oriented 'Seagap' strike-slip fault running through Block 2, is interpreted to have been periodically active and measures up to seven kilometres of displacement since Early Cretaceous times. The depositional setting in Block 2 has been relatively consistent since the Early Cretaceous (Albian). The stepped slope environment has been host to slope channels of varying magnitude and intraslope lobes. The input of coarse sediments into the basin has been strongly influenced by changes in relative sea level. Relative sea level lows allowed sands to be transported from the hinterland, across the narrow shelf and into the basins. Strong bottom currents are interpreted since the Cenomanian due to the presence of large and aerially extensive sediment wave fields and sediment drifts. These bottom current deposits influenced the position and migration of sand-rich deposits on the slope. The Seagap fault also controlled the distribution and migration of depositional systems, in addition to forming large structural traps for hydrocarbon accumulations.

For this presentation, the stratigraphic record from Albian to Eocene is divided into three periods. The first period records the deposition of a sandstone-rich unit during the Late Albian to Cenomanian. Broad slope channels are mapped coming from the west and turning northwards at the Seagap fault. This sandstone unit, called the Saffron system, is dominated by thick, amalgamated sandstones which host several gas accumulations in Block 2. Erosionally confined, wide and low sinuosity channels with time evolve into narrower, highly sinuous channels which aggrade and migrate westward across the Seagap fault. An increase in the influence of the Seagap fault on sedimentation is interpreted towards the end of the Saffron system (Cenomanian).

The second period is the Late Cretaceous, which is represented by a dominantly mudstone-rich succession with several sandy slope channel/lobe systems suggesting fluctuations in relative sea level. The Horseradish unit, which is Turonian to Santonian in age, consists of a thick sequence of dominantly thin- to medium-bedded, heterolithics deposited in slope channel deposits and, in the area east of the Seagap fault, in the troughs between sediment waves. The position of the slope channel in the western area of Block 2, which is the main conduit for sediments to the basin at the time, is strongly controlled by large sediment drifts.

The muddy Late Cretaceous sequence is abruptly terminated by the third period, the sandstone-rich Vanilla system (Paleocene to Eocene). The Vanilla system is represented by several slope fans which are subsequently eroded by large, sinuous, west-east orientated submarine canyons. The Vanilla unit is characterised by thick-bedded, amalgamated sandstones with a wide range in sediment calibre. This sandstone unit corresponds to a eustatic sea level fall during the Paleocene. Channels mapped within the canyons exhibit an interplay between the direction of migration of large sediment drifts and the aggradation and migration of slope channels. The southernmost Vanilla canyon system, mapped on 2D seismic, is interpreted to aggrade and migrate 10's of kilometres southward into Block 1. The Seagap fault had little influence on sedimentation during this period.

Block 2 deposits from Early Cretaceous to Paleogene are interpreted as deep marine slope deposits. The sandstone reservoirs described from this period occur as slope channel and lobe deposits. Relative sea level is interpreted as the primary control on sediment input to the basin and sediment distribution is influenced by local tectonic activity and bottom current deposits.