

Hydrocarbon Prospectivity of Offshore Senegal; Unlocking the Door to a New Deepwater Petroleum Province

Martin, Louise ¹; Effimoff, Igor ³; Medou, Joseph O. ²; Laughland, Matthew ⁴ (1) International Exploration, Hunt Oil Company, Woking, United Kingdom. (2) Petrosen, Dakar, Senegal. (3) First Australian Resources Ltd, Houston, TX. (4) International Exploration, Hunt Oil Company, Dallas, TX.

The Senegalese portion of the greater MSGBC Basin, located offshore and south of the Dakar peninsula and north of Gambia, is under-explored. This study identifies the elements of a petroleum system and points to the exploration potential of the untested, deepwater portion of the Senegalese basin margin. 3D seismic data (2050 km²) acquired in 2007 reveal the existence of a long-lived carbonate platform and associated incised canyons with genetically related down-slope debris aprons/turbidites. Seismic interpretation and multidisciplinary geologic studies indicate that the offshore region can be subdivided into two main para-sequences: the Pre-Senonian unconformity section and the syn-post Senonian unconformity section. The pre-Senonian age section includes the long-lived carbonate platform of Jurassic to Cenomanian age. Uplift and subaerial exposure of the platform during Late Cretaceous time led to karstification and erosion that we believe are key to development of fracture-related permeability in the carbonate reservoir. Uplift was likely associated with differential rotation induced by withdrawal of Triassic age salt in the southern MSGBC. Erosion is marked by the Senonian age unconformity that is easily recognizable on seismic and yields seismic evidence of karstified topography. In contrast, the syn-post Senonian age section consists mainly of stacked Santonian age fans with multiple stacked amplitudes on seismic, and an overlying Tertiary age succession. Detailed rocks physics and attribute analysis indicate that the turbidites are a mixed lithology of reworked carbonate material and paralic siliciclastic sediments. The paralic sands were transported from the shelf into the basin through incised valleys that also are clearly observable on seismic. 3D basin modeling was used to determine the timing of generation and spatial extent of the petroleum kitchen for the well-documented Turonian age source shale that was deposited along the west African margin. Generation began during Maastrichtian time and continues through present-day, and the down-slope debris aprons and turbidites, as well as the karstified carbonate platform, are located either within or adjacent to the present-day kitchen. Drawing on analogues from recent discoveries in Late Cretaceous age turbidites offshore Ghana, we believe that the Senegalese offshore basin is an exciting new deepwater province along the northwest African margin.