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Petroleum System Analysis of the Deepwater Mauritania/Senegal Basin

Henderson, T.[1]

[1]Kosmos Energy, Tracey Henderson <thenderson@kosmosenergy.com>

The Greater Tortue and Marsouin discoveries Kosmos Energy LLC made in 2015 have opened a new Cretaceous petroleum system in deepwater off Mauritania and northern Senegal. This petroleum system's potential had been underexplored because of the following misassumptions:

1. The proven source, the Cenomanian and Turonian mudstones, in this deepwater area was most likely immature, and the Albian source quality was suspect as it had not proven effective within the salt province.
2. The basin, aside from the salt province, was undeformed—thus lacking trapping geometries.
3. The salt province was the primary depocenter for Cretaceous sediments.

However, more extensive petroleum systems analysis revealed three working source rocks in the basin: the Cenomanian-Turonian, Upper Albian, and a deeper source interpreted to be Apto-Barremian. These sources are evidenced by both rock penetrations and hydrocarbons. Prior to basin entry the presence of these sources was inferred from seismic facies and manifested by oil extract biomarker signatures from wells onshore Senegal.

Trapping geometries in the deepwater portion of the basin result from transpression caused by changes in plate rotation from the Santonian through the Lower Miocene. This transpression formed North- South and Northeast-Southwest anticlines along faults which are rooted both in Mesozoic rift faults, and along Proterozoic crustal boundaries. Anticlines with counter-regional dip, imaged on regional 2D seismic data, suggested the presence of deepwater trapping geometries.

The basin has a robust Cretaceous clastic sediment supply from entry points associated with both the Senegal River and the Nouakchott River. Onshore wells evidence the volume of sand being delivered into the basin and this, supported by 2D and 3D seismic facies interpretation, shows a strong tidal dominated distribution of the sand into the deepwater.

In combination, these petroleum system elements have defined a new play, which is present across the basin's entire deepwater region. The Greater Tortue and Marsouin discoveries have proven one structural trend in this play fairway, located where the Upper and Lower Cretaceous lower slope turbidite reservoirs are draped over transpressional anticlines and sourced by a deeper source rock, interpreted to be Apto- Barremian. Future exploration drilling will focus on similar reservoir-trap pairs located in the basin's northern and southern trapping fairways where the Upper Albian and Cenomanian-Turonian oil-prone source rocks are modelled to be mature.