

The New Finds of this Century in Offshore Northern and East Africa: Challenging the Paradigms

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Prior to the discovery of the Tamar Field offshore Israel in 2009, the offshore margins extending from Guinea Bissau in Northwest Africa clockwise through to Mozambique in East Africa were regarded as one of the world's largest exploration 'graveyards', with only small areas of success having been defined offshore Tunisia and west Libya and in the Nile Delta. Since then the region has seen a renaissance, placing it clearly as the world's most successful recent exploration province, with some 250 Tcf (circa 43 Billion Barrels oil equivalent) discovered in the last seven years. In 2015, the two largest discoveries in the world came from this region. The figure below shows discoveries in the last 3 years, which includes for 2015, two of the three largest global discoveries at Zohr and Tortue. Note most of the Rovuma reserves were found prior to this.

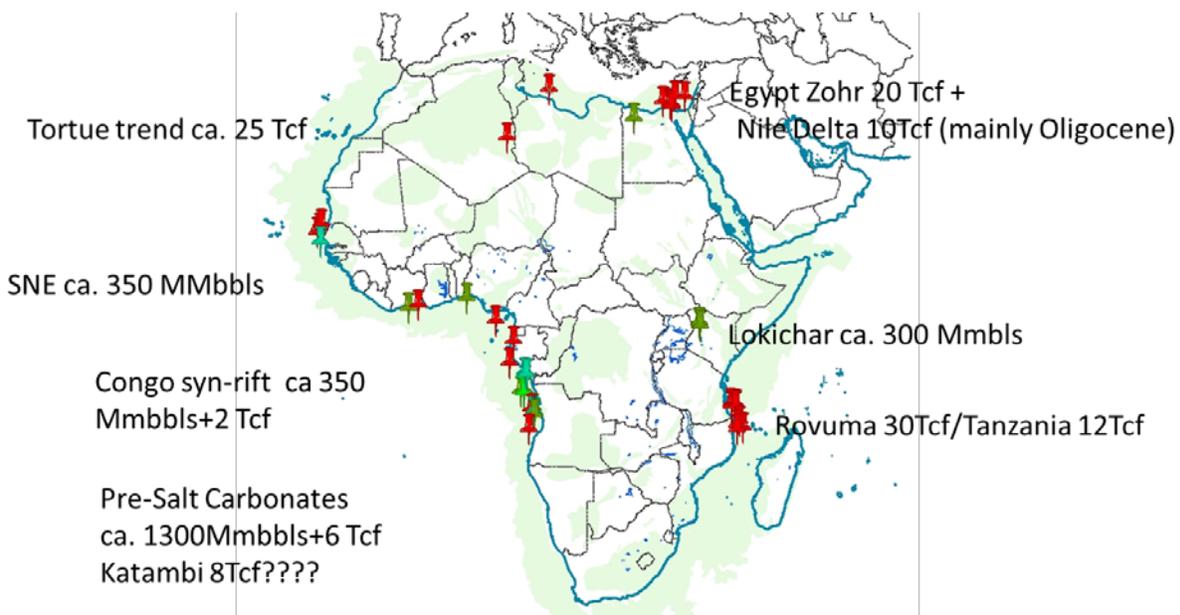


Figure 1 : African Frontier Discoveries in 2013-16 period

This talk looks at the regional geology that underpins the recent discoveries, including a review of the various petroleum systems and the exploration history leading to the major discoveries. Many aspects of the new plays have been unusual, for instance the largest trap in the Rovuma Basin (Figure 2) lies on the

downthrown side of toe thrusts with a reservoir heavily influenced by contourite currents and updip of a kitchen in a currently active graben.

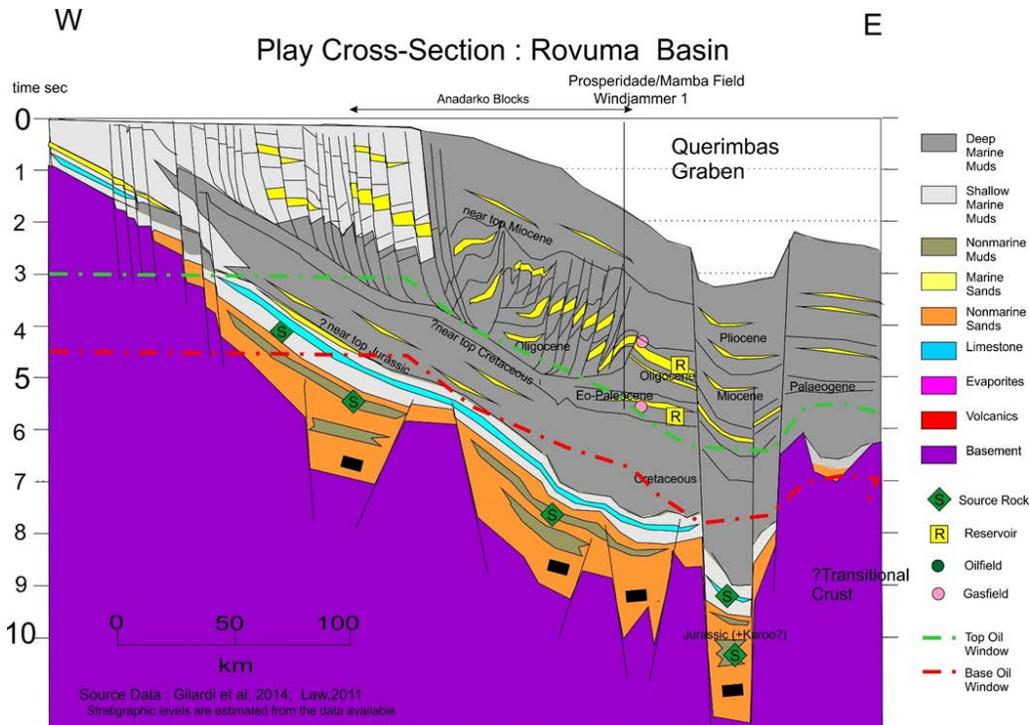


Figure 2 : Play cross_section through the largest new petroleum province, the Rovuma Basin of Mozambique

Another somewhat unusual trap type found is the largest oil discovery at SNE in Senegal, which appears to largely a subcrop trap within unusually wide deep marine sands at the base of progrades (Figure 3). The largest global discovery in 2015 lay in a Miocene (and probably older) pinnacle reef at Zohr offshore Nile Cone, over a high trend bypassed by two major clastic lobes of the prodelta, within an area characterized by extreme lithological variations.

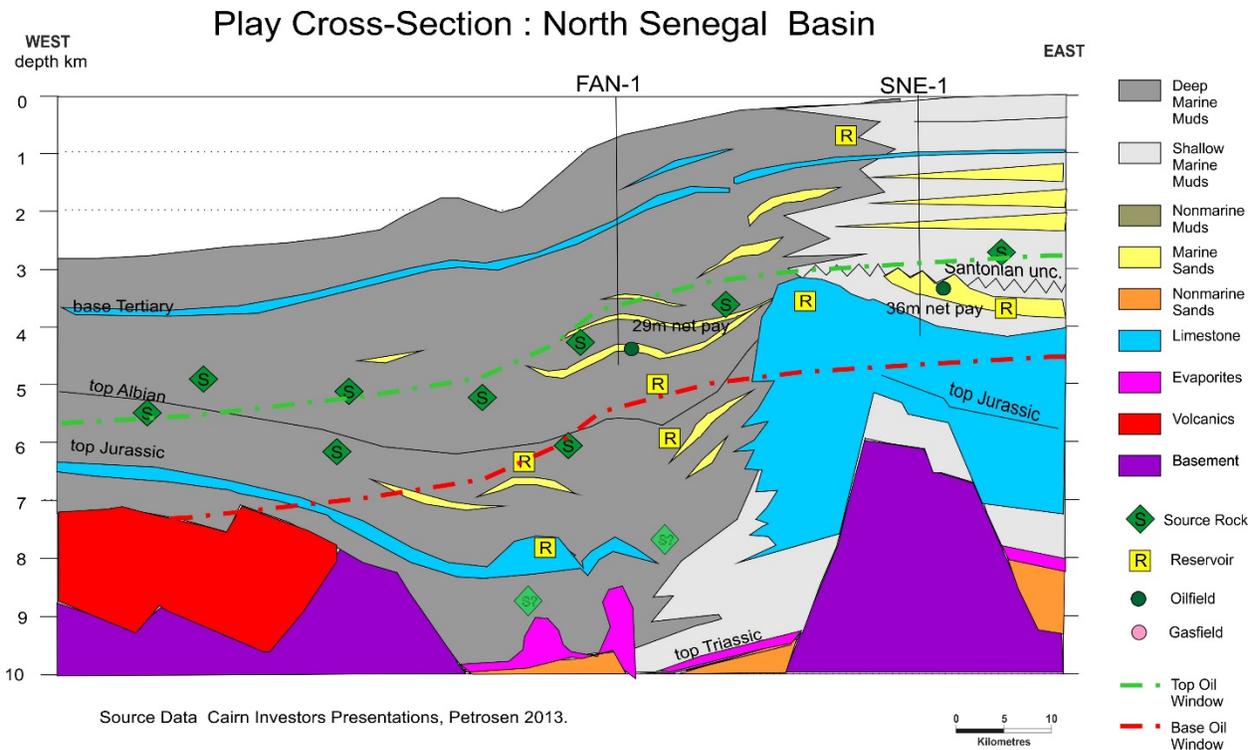


Figure 3 : Play cross-section through the SNE discovery, Senegal

With the exception of the SNE discovery, the key question to be asked is ‘where is the oil?’. One paradigm that seems to have been shattered is that heat flow should fall towards oceanic crust : instead geothermal gradients in excess of 40 deg C/km seem to be associated with many of the new discoveries close to the continent-ocean boundary. With so much gas now established, it will take a considerable time for markets to be found and almost all new ventures must now focus on liquids. The margins still contain many frontier basins and plays which are reviewed on this basis. The key is likely to lie in mapping diminished overburdens to the deep Jurassic source rocks that are the probable sources to many of the discoveries.