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Petroleum systems of the West African salt basins: a review.

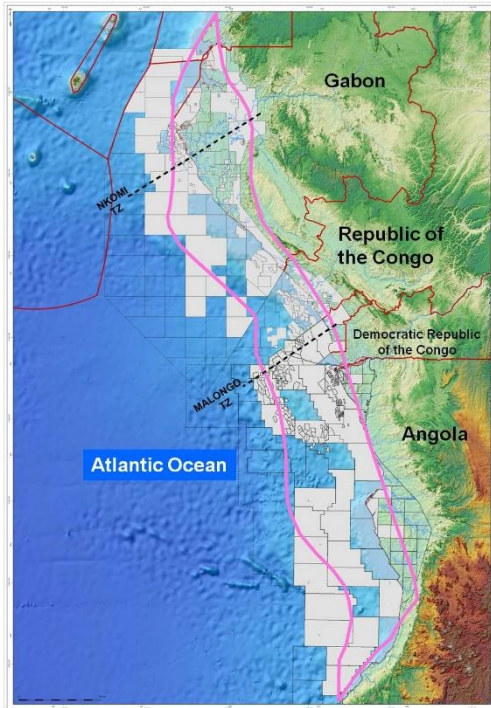
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The West African margin of the South Atlantic Ocean (Fig. 1) is characterized by the existence of Aptian evaporitic (halite, anhydrite, other salts) ductile series (pink outline on Fig.1) deposited essentially on the margin of Gabon (Ezanga Formation), Congo (Loémé Formation) and Angola (Loémé Formation) [1].

The evaporites separate two major intervals classically labelled as pre-salt and post-salt sections. In both intervals, more than 10 source-rock layers (types I, II and III kerogens) are now identified and more than 20 different reservoir prone sections (petroleum play concepts) have been successfully delineated. This rather ideal setting for hydrocarbon exploration is however counterbalanced by the existence of very complex hydrocarbon (HC) migration pathways, especially for the post-salt sections (superimposed or separated sources and reservoirs), as well as trapping-sealing mechanisms.

HC Migration and petroleum trap locations are quite complex in relation with the evaporite distribution.

Figure 1: West Africa salt Basins location

Gravity sliding and concomittent contractional tectonics, initiated during Albian time led to different evaporite deformation domains, which are from proximal to distal: undeformed in a stable proximal area, slightly to highly deformed in the extensional domain, thin to absent in the translational domain (raft detachments), highly deformed and often very thick in the compressional domain. Each domain gives a very specific set of possible HC migration pathways for expelled hydrocarbons as well as diverse petroleum settings of trap sizes and petroleum habitats.

Three different “mega” Petroleum Systems, depending on the origin of hydrocarbons and the position of the hosting reservoir in the stratigraphic record, can be characterized.

Such understanding allows to explain the distribution of hydrocarbon fields for the mature areas of the onshore and the conventional offshore but also to better assess or re-assess the challenges for the exploration of the deep and ultra deep offshore areas.

This presentation will more specifically focus on the Northern area of the evaporitic basins, on the margin section comprised between the Nkomi transverse fault system (Central Gabon) and the Malongo transverse fault system (Cabinda province of Angola), as illustrated on Fig. 1. The different plays of the West Africa salt Basins will be reviewed and the three different Petroleum Systems will be presented and analysed. Each Petroleum System will be illustrated with recent exploration and development successes (Diaman-1B discovery in Gabon, Moho Field in Congo ...).

References:

[1] Chaboureau A.-C. et al. (2013) Tectonophysics 604: 191-223

