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Gravity tectonics in western African passive continental margin in drift stage and its implication in petroleum exploration

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Africa passive continental basins are rich in oil and gas. The petroleum reserve in these basins took up 56 per cent of the total petroleum reserve in all Africa basins. The western African passive continental margin from Cote D'Ivoire to Southwest African had typical basins like Niger Delta and Aptian salt basins. This margin underwent two or three tectonic stages, an early rift, a middle transition and a late drift. Gravity tectonics occurred in drift stage and played very important roles in the reservoir and trap formations.

According to the structural development in drift stage, three groups of passive margin basins were determined in Africa. The first group was of little deformation, being a simple continental slope. The early Cretaceous was rift stage and late Cretaceous-Cenozoic was drift stage. The Cote D'Ivoire Basin, Benin Basin and Namibe Basin lay in this group. The second group was of medium deformation like Douala Basin, Rio Muni Basin and Southwest African Coastal Basin. The late Jurassic-Barremian was a rift stage, the middle Aptian a transition and the Albian-Cenozoic a drift stage. In the second group, an embryonic gravity sliding system developed consisting of a leading edge contractive belt, a middle transitional belt and a trailing edge extensional belt. The third group was of extensive deformation with a mature gravity sliding system like the Niger Delta, Gabon Coastal Basin, Lower Congo Basin and Kwanza Basin [1, 2]. Niger Delta underwent a Cretaceous-Paleocene rift and an Eocene-present drift. The rest three basins underwent a late Jurassic-Barremian rift, a middle Aptian transition and an Albian-Cenozoic drift.

The structural development or deformation degree was controlled by the effectiveness of detachments. It in turn depended on the rock type, thickness, distribution and hydrocarbon generation. In the Niger Delta, the detachment was the Akata thick shale with over pressures caused by hydrocarbon generation [3]. The detachments in some Aptian salt basins like Gabon Coastal, Lower Congo and Kwanza basins were Aptian thick salt layers [4]. Where the detachments were thin or absent, the deformation intensity was either medium like the Southwest African Coastal Basin and other Aptian basins like Douala and Rio Muni basins or poor like the Cote D'Ivoire and Namibe basins. The gravity tectonics affected sedimentation and trap formation in the drift sequences. Due to various sliding speeds and the impacts of pre-existing pre-salt tectonic trends, tectonic lineaments developed perpendicular to the coastal line to be channels controlling the sediments influx. The passive margin parallel slope break belts related to normal and reverse faults controlled the sandstone distribution.

Separate salt or mud diapirs controlled sandstone distribution as well. Traps occurred in extensional, transitional and contractive belts in a gravity sliding system. Drape anticlines and sandstone lens developed in drift sequence in simple slopes like in the Cote D'Ivoire basin. The connections between

channels/fans and faults controlled the oil and gas accumulation. This oil and gas findings in gravity sliding systems or continental slopes may be inspirations for further petroleum exploration in Douala Basin, Rio Muni Basin and Southwest African Coastal Basin.

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