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West Africa Pre-salt Lacustrine Carbonates

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Summary

During the Early Cretaceous rifting, the central segment of South Atlantic was characterized by a complex paleomorphology dominated by large lacustrine basins, that were filled by clastic and carbonate sediments and finally covered by restricted marine evaporites. These thick sequences constitute important hydrocarbon plays successfully explored in both eastern and western margins of South Atlantic. The carbonate bodies growth on paleo-highs constitutes giant fields in the Brasil offshore; in the African margin the success was lower, with good reservoirs in the Lower Congo Basin (Angola, Cabinda), and lower explorative results in the Kwanza Basin.

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These lacustrine carbonates have peculiar facies associations represented mainly by microbialites and coquinas, while subaerial travertine are rare. Two main dolomitization events may have occurred in these carbonates: early diagenetic and late burial (hydrothermal) ones. While the early dolomitization did not affect the pore system, the hydrothermal dolomitization enhanced the porosity and permeability of the reservoir especially when the so-called “zebra dolomite” were produced. The hydrothermal dolomitization was favored by the presence of deep-seated extension faults, bounding the paleo-highs, which were re-activated during burial, permitting the diagenetic fluid flow.

Two West Africa case histories, representative of the two different dolomitizations and relevant reservoir quality are illustrated. The integration of sedimentological, geochemical and petrophysical analyses with the structural setting and seismic interpretation highlighted the interplay of structural evolution, facies and diagenesis and the poro-perm modifications.

These two examples suggest that the understanding of the distribution of deep faults, though a detailed seismic /structural analysis may help in the prediction of the diagenetic effects and resulting reservoir properties. The approach can be carried out in both exploration and reservoir development phases.

