

The Prospectivity of Offshore Sierra Leone Using Newly Acquired 3-D Data

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The Liberia-Sierra Leone Basin is one of the few remaining unexplored deepwater basins offshore West Africa. Recent deepwater 3D surveys indicate the presence of widely distributed channelised sand fairways with underlying mature source rocks of the Turonian-Cenomanian and Albian. Well control is limited to two wells drilled on the shallow shelf during the 1980s. The Venus discovery in September 2009 is the first deepwater test in offshore Sierra Leone. It opens up new oil plays and confirms the existence of a working hydrocarbon system.

The Sierra Leone margin is a shelf to basin system bounded by major transform fault zones related to the opening of the Atlantic. Normal and strike-slip faulting created pull-apart basins active until the middle Cretaceous followed by passive margin deposition of late Cretaceous and early Tertiary sediments. Depositional environments were lacustrine and fluvio-deltaic until middle Albian when the first marine incursion deposited shallow to open marine sediments with episodes of anoxic conditions through to middle Tertiary. Rifting and subsidence controlled Pre-Cenomanian sedimentation whilst erosion, sea level changes and subsidence were the main controlling elements from the Cenomanian onwards. Interpretation of the seismic data shows clear evidence of channel and fan developments on the slope separated by regional shale seals throughout the late Cretaceous.

Source rocks from Albian to Turonian have expelled hydrocarbons along faults and through permeable formations. Plays include Albian-Aptian clastics in rotated fault blocks and syn-transform structures (Albian Baobab field in Cote d'Ivoire), possible middle Cretaceous carbonates and Senonian to late Cretaceous low-stand channel and fan sand systems (Senonian Jubilee field in Ghana).

Identified leads supported by AVO analysis suggests that offshore Sierra Leone offers exciting exploration potential.