Seismic characterization and hydrocarbon prospectivity of USA Atlantic offshore Late Triassic–Early Jurassic rift basins

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Between 1890 and 1989, at least 87 wells were drilled in onshore, eastern USA. Late Triassic–Early Jurassic rift basins to explore for conventional oil, gas, and coalbed methane. Although no wells were commercially successful, occasionally, indications of oil and gas were encountered. Surface, subsurface, and seismic data document the components of petroleum systems in many of the recognized basins. No wells successfully drilled similar seismically identified rift basins in the USA Atlantic offshore. However, the onshore data provide valuable information to evaluate the offshore rift basins.

In evaluating onshore exploration, we considered possible causes of economic failure and whether they had commonly shared or possibly unique contributing factors as well as implications for offshore U. S. Atlantic Late Triassic–Early Jurassic rift basin prospectivity. Data interpretation data suggests most offshore and onshore rift basins are genetically similar in setting, synrift fill, and amount of interpreted eroded synrift. Macgregor in 1995 examined 105 rift basins worldwide and identified three broad categories of rifts and success.

All U.S. onshore and offshore Late Triassic–Early Jurassic rift basins except one appear to have undergone regional inversion, uplift, and erosion. Observations and modeling suggest that where significant (+5000 ft. / 1.5 km), these processes removed the sag phase of basin development and the shallowest synrift traps and/or seals. They also reduced reservoir pressures, devolitizing any trapped oils, potentially flushing the original shallower reservoirs with natural gas and other light hydrocarbons. Inversion and uplift would also reduce pressure in any remaining reservoired petroleum. Consequently, in regionally inverted rifts, potentially all conventional petroleum was lost. In locally inverted rifts, late synrift and sag phase hydrocarbon traps may be less affected. Data from the work of Macgregor in 1995 suggested that these locally inverted rifts are excellent exploration targets.

Seismic data suggests the Yarmouth rift basin in the northern Georges Bank Basin, has experienced less inversion and subsequent erosion (~2,000 ft. / 0.6 km), preserving a sag phase of basin development. Might that unique, preserved sag phase of basin development make this basin a candidate for a conventional petroleum discovery?

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