

# Petroleum systems of coastal North Carolina: what we know, what we think we know, and the range of uncertainty in the interpretation of geochemical data

PAUL J. POST<sup>1</sup>, JEFFREY C. REID<sup>2</sup>, AND JAMES L. COLEMAN JR.<sup>3</sup>

1. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Resource Evaluation, 1201 Elmwood Park Blvd., New Orleans, Louisiana 70123-2394, USA
2. North Carolina Geological Survey, 1612 Mail Service Center, Raleigh, North Carolina 27699-1612, USA
3. Coleman Geological Services, 130 Wesley Forest Dr., Fayetteville, Georgia 30214, USA

As part of a regional analysis of oil and gas occurrences in eastern North Carolina, the North Carolina Geological Survey initiated a comprehensive geochemical project using samples and cores from the Esso Hatteras Light #1 (HL#1), and Mobil State of North Carolina #3 (NC#3) wells. These were two of at least 19 exploration wells drilled in coastal North Carolina where oil/gas shows were reported. The study objective was to determine if the shows were *in situ* or represented migrated hydrocarbons.

The wells are located in a local depression on an otherwise elevated regional basement complex extending from the Cape Fear Arch on the south to the Fort Monroe High on the southern flank of the Salisbury Embayment on the north. In the downdip, adjacent U.S. Atlantic OCS, sea-surface hydrocarbon seepage slicks are identified on satellite synthetic aperture radar images and hydrocarbon-related diagenetic zones and “chimneys” interpreted on seismic data indicate vertical hydrocarbon migration. Geochemical sampling and analyses concentrated on intervals where hydrocarbons were reported in the two wells. Biomarkers in aggregated samples appear to originate from marine shale source rocks at immature/early maturity levels of thermal maturity. Oleanane suggests the hydrocarbons are Cretaceous or Jurassic age. Analytical data indicate sampled intervals are too thin, organically lean, and immature to source commercial hydrocarbons in either conventional or resource plays in coastal North Carolina. However, possible occurrences of mobile hydrocarbons were detected in Tertiary strata (~815 ft./~248 m) and solid bitumen and migra-bitumen were reported from Cretaceous rocks.

The sporadic nature of the bitumen, lack of viable source rock, and low level of thermal maturity suggest these bitumen occurrences probably lie on a migration pathway(s) rather than being *in situ*. Better potential may exist offshore in deepwater Assessment Units interpreted by the Bureau of Ocean Energy Management.