

Thermal Maturity of the U. S. Atlantic Coastal Plain, Maryland to North Carolina, Based on Legacy Exploration and Stratigraphic Test Wells

MaryAnn Love Malinconico¹

¹Dept. of Geology and Environmental Geosciences, Lafayette College, Easton, PA 18042, lovem@lafayette.edu

On the US mid-Atlantic Coastal Plain, numerous deep exploration wells were drilled from 1944 to the early 1970's, many prior to the advent or common use of vitrinite reflectance or other maturity indicators in the petroleum industry. The goal of the current study is to collect downhole vitrinite reflectance data from several mid-to-late 20th-century exploration and stratigraphic test wells, in order to fill the void in maturity information on the ocean edge of the coastal plain from New Jersey to North Carolina. The goals are to test 1) hypotheses on the coastal plain/ Outer Continental Shelf (OCS) depth to the oil window (0.6%), 2) if thermal trends are regionally similar, 3) whether maturity data can be useful in problems of pre-Cretaceous Mesozoic stratigraphy, and 4) provide a background framework for regional studies, such as the Chesapeake Bay Impact Structure.

Data is available from six wells in Maryland (Standard Oil of New Jersey Maryland Esso #1 at Ocean City, Socony-Vacuum J. T. Bethards #1, Ohio Oil Hammond #1), Virginia (E. G. Taylor #1-G), and North Carolina (Mobil #3, Standard Oil of New Jersey Hatteras Light Esso #1). A similar downhole reflectance trend is found among all wells, with 0.4%Ro at about 5000-5500 ft (1600 m), 0.45%Ro at ~7000 ft (2100 m). Hatteras Light Esso #1 is the deepest and easternmost of all coastal plain wells and has a reflectance of 0.60% at 9805 ft (2990 m) (basement depth 9853 ft). The calculated reflectance values from equilibrated downhole temperature data through coastal plain sediments (0-4455 ft) from the VPI Crisfield deep geothermal test hole, Maryland Delmarva peninsula, follow a similar trend. Offshore, the Baltimore Canyon COST B-2 well, on the continental shelf edge, had measured vitrinite reflectance of 0.57% at 9910 ft (3020 m) and 0.62% at 10660 ft (3250 m) (Smith et al., 1976), comparable to the Hatteras #1 data, suggesting a similar regional maturity gradient on the coastal plain and continental shelf.

In four wells, Taylor (VA), Hammond (MD), Bethards (MD), and Hatteras (NC), sediments just above basement were initially (drill site or early publications), based on lithology, assigned to the Triassic. Reflectance data from this study through those intervals for Taylor, Bethards, and Hatteras are linearly continuous with shallower data so cannot be used to make any determination on stratigraphic age or unconformities; no measurable vitrinite was found in oldest sediments in Hammond. However, Malinconico and Weems (2010) concurred with a variety of other published palynological and paleontological studies on these wells that deepest strata in the Maryland/Virginia wells are Lowest Cretaceous or Upper Jurassic, and Upper Jurassic in Hatteras #1.