1D thermal model of South Venture O-59, Sable Subbasin, Scotian Basin, Nova Scotia, Canada*

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The Sable Subbasin is one of foursubbasins within the Scotian Basin, and comprises Mesozoic and Cenozoic sediments deposited unconformably on a Paleozoic basement. South Venture gas field, discovered in 1983 with the South Venture O-59 well, is one of six producing fields in the subbasin and is adjacent to the Venture gas field. Producing reservoirs at South Venture trap gas in a four-way dip closure in the hanging wall of a down-tobasin, listric, growth fault. Reservoirs comprise normally pressured, marginal marine sandstones in the Valanginian-Berriasian section of the Missisauga Formation. Beneath producing reservoirs, the 0-59 well penetrated increasingly overpressured, non-commercial intervals of poor quality sandstones, siltstones and shales which recovered gas to surface and exhibit source rock potential in cuttings (Lower Missisauga Member (Missisauga Formation) and Mic Mac Formation). Previous studies indicate in these intervals total organic carbon ranges from 0.5–4%, kerogens are mostly type IIB, and maturity is high (~0.8–~2.0 % R_O).

Our objective is to test the hypothesis that this interval at South Venture provides a recent (potentially ongoing) source of hydrocarbons (HC) and overpressure generation, which could provide a significant control on the distribution of excess pressure in the adjacent commercial reservoirs of the Venture Field (juxtaposed across the intervening listric fault). The producing reservoirs in South Venture are stratigraphically higher and extend northwards above the producing reservoirs of the Venture Field, but are wet due to an absence of structural closure. The underlying commercial reservoirs at Venture exhibit 'stepped excess pressure' pattern from hydrostatic to 'leak-off' pressures and are also trapped in a hanging wall anticline, but are confined due to local deposition in a growth fault-controlled expansion trend.

Petroleum system modelling (PSM) of South Venture O-59 provides an understanding of the burial history, timing of thermal maturation and HC generation from source rocks. This information is used to determine the critical moment and transformation ratio of organic matter to hydrocarbons. Preliminary PSM results suggest that the thermal history of the area is a main control on the timing of hydrocarbon generation. Ongoing modelling aims to reconcile the apparent divergence between a MacKenzie (standard) heat flow model, measured well temperatures, and vitrinite reflectance data. A satisfactory fit between measured and modelled data is achieved when a late Cretaceous to Paleogene thermal event is added to the heat flow model. In this PSM, transformation ratios increase significantly during this interval, indicating a potential hydrocarbon generation event.

Winner of the AGS Rupert MacNeill Award for best undergraduate student oral presentation

Atlantic Geology, 2016, Volume 52
Atlantic Geoscience Society Abstracts 42nd Annual Colloquium & General Meeting 2016
doi: 10.4138/atlgeol.2016.004