Petroleum Systems of the Scotian Basin and Its Implications of Finding Oil and Gas within deepwater Sable and Shelburne Subbasins, Offshore Nova Scotia

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The success at Marathon et al. Annapolis G-24 well and failures in finding 30m gas-condensate charged sands within Early Cretaceous sediments and the failure in finding hydrocarbons in other four recently (2001-2004) drilled wells has definitely triggered reevaluation of the petroleum systems within deepwater Scotian basin. Our preliminary analysis of the selected gas-charged zones within various deepwater wells (example: gas/condensates charged sediments from the Annapolish G-24 well) in Scotian Basin suggests presence of similar hydrocarbon families of the Scotian shelf and shelfbreak region (condensates from the Venture field). Earlier petroleum systems work in the shelf and shelf-margin region of the Scotian Basin by Mukhopadhyay et al (2003, 2000, 1995) on the discovered petroleum has indicated four major families of hydrocarbons.

A modified recent approach of the petroleum system risk assessment within the southeast and south of Sable and Shelburne subbasins of the Scotian Basin, Eastern Canada has predicted the presence of four to six viable petroleum systems within turbidite fans and other salt-related reservoirs. It also predicted the possible hydrocarbon saturation in the “hot spots”, evaluation of “oil’ versus “gas” zones, and the volume of possible expelled hydrocarbons within various sectors. This type of evaluation will reveal the controlling factors, test sensitivities, analyze and minimize risks, improve predictions of hydrocarbon saturation in the “hot spots”, and allow prediction of hydrocarbon volumes in complex reservoir systems before drilling.

Although limited data is available within deepwater Sable and Shelburne subbasins (within 500m-2100m water depth), our analysis encompasses the formation, timing, and fluidity of several large allochthonous salt canopies that are closely connected to source rock anoxicity, bypassing of turbidite sands (in early Tertiary and middle Cretaceous); and the survival of hydrocarbons within various play types. Early mobilization of Jurassic salt forming large canopies (especially within Cretaceous and Tertiary sediments of the Sable Slope) possibly originated from increased sedimentation rate and abundant hydrocarbon migration. Organic-rich amorphous organic facies that have anoxic signatures are likely to be present in intervals within local “microbasins”. These “microbasins”. The higher heatflow within deepwater Sable Subbasin have primarily developed in association with rapid salt diapirism forming mainly gas and condensate charged reservoirs. The presence of pockmarks and other geochemical and petroleum system modeling anomalies in various parts of the Scotian Slope indicates probable gas seepage.

Current studies indicate that the dispersal of turbidite sands in Eocene/Miocene or Mid-Cretaceous may possibly be charged with three petroleum system hydrocarbons (gascondensate, light oil-gas and heavy oil-gas) within the Sable (beyond 2500m water depth) and Shubenacadie-Shelburne Slopes (beyond 1500m) of the Scotian Basin. Late Jurassic sands could also be major targets for gas charged reservoirs within the central Scotian Slope.