The use of integrated fluid-inclusion studies in constraining the petroleum charge history at Parson's Pond, western Newfoundland

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Hydrocarbon exploration in western Newfoundland has been ongoing for nearly 200 years, with small quantities of oil being produced in the 19th and 20th century from the Port au Port Peninsula and the Parson's Pond area. However, relatively little is known about the relative timing of petroleum migration and potential migration pathways. Further understanding of syn- and post-diagenetic petroleum and aqueous fluid flow has important implications for new exploration strategies, particularly at Parson's Pond where oil and gas shows have been recorded in allochthonous sandstones and underlying carbonate reservoirs in the autochthon.

This project integrates fluid-inclusion petrography and microthermometry of petroleum, gas-bearing and aqueous inclusions with fluorescence microspectroscopy of inclusion oils, in order to determine nature and relative timing of oil and gas migration events at Parson's Pond.

Fluid-inclusion studies were undertaken on 58

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core and cuttings samples in three wells in the Parson's Pond area. Petroleum, gas, wet gas and aqueous bearing fluid inclusions were identified in all three wells, which revealed a complex hydrocarbon charge history at Parson's Pond, with multiple petroleum charge events of multiple compositions. Petroleum and gas bearing fluid inclusions in the allochthonous cover rocks are restricted to calcite and quartz vein material. This indicates that petroleum and gas migration at Parson's Pond is fracture-controlled, and no hydrocarbons were present during the cementation of the essentially tight sandstones of the Lower Head Formation and Cow Head Group. In addition, these data indicate that hydrocarbons were generated at multiple times during progressive burial and heating, and the distribution of petroleum and gas-bearing inclusions with depth suggests that deeper levels are gas-prone, with petroleum confined to relatively shallow depths. The scarcity of hydrocarbon inclusions in autochthonous carbonates indicates that no hydrocarbons were present during hydrothermal dolomitization, and any potential hydrocarbon charge events must have postdated dolomitization (and associated porosity enhancement).