

A provenance study of Upper Jurassic hydrocarbon source rocks of the Flemish Pass Basin and Central Ridge, offshore Newfoundland, Canada

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A number of hydrocarbon discoveries have been made recently in the Flemish Pass Basin and Central Ridge, offshore Newfoundland, Canada, but only limited geological information is available. This provenance study is aimed at providing new mineralogy, geochronology, and geochemistry datasets on Upper Jurassic source and reservoir rocks from this area. The primary goal was to determine the provenance and paleodrainage patterns of the Upper and Lower Kimmeridgian Source Rock members, and Upper and Lower Tempest Sandstone Member reservoirs of the Rankin Formation. The provenance results thus help define where thicker sequences of hydrocarbon source rocks and reservoir units are located in the region.

Sixty lithology samples from conventional core and cuttings of both mudstones and sandstones were acquired, processed, and analyzed from four wells: Baccalieu I-78, Panther P-52, South Tempest G-88, and Lancaster G-70. A combination of detrital zircon U–Pb geochronology, whole-rock geochemistry, and SEM-MLA analysis of heavy mineral concentrates were used to decipher provenance. Based on these data, the Upper and Lower Kimmeridgian Source Rocks are composed of detritus from the Avalon Zone and Central Mobile Belt, along with the underlying basement. These source regions are not overly indicative of a drainage orientation, as they exist both northeast and west of the study area. Therefore, it is possible that detritus would have been derived from both areas, and thicker sequences of these units are likely to be present in either the western, or, northeastern portions of the Flemish Pass Basin and Central Ridge. The Upper and Lower Tempest Sandstone members are characterized by material from the Avalon Zone; however, some of the detritus in these units is interpreted to be derived from Iberia to the east. Thus, the Tempest Sandstone members were likely derived at least in part from the east, which infers thicker sequences of this unit are likely present towards the eastern edges of the Central Ridge and Flemish Pass Basin.

Knowledge of where these units are thickest should be an important consideration for petroleum exploration in the region. In addition, the Upper Tempest Sandstone contains Mesozoic zircon grains, which constrain the depositional age of this unit, and not found in samples from the other units.