

Hydrocarbon and aqueous fluid inclusion signatures in well cuttings from Newfoundland and Labrador's offshore basins

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Fluid inclusion (FI) studies play an important role in the understanding of fluid dynamics within sedimentary basins and can help to constrain the fluid migration history of a basin by providing information on the chemistry of the fluids, temperature and pressure conditions within the basin and relative timing of hydrocarbon and aqueous fluid migration events.

Fluid signatures of quartz-hosted FI were obtained from 167 samples of well cuttings taken from seven legacy wells in the Newfoundland and Labrador offshore basins. The basins are part of a series of conjugate sedimentary basins formed by the rifting and seafloor spreading that began in the Late Triassic, leading to the opening of the Atlantic Ocean. The sampled wells are (D.# = CNLOPB well identifier number): (1) Saglek Basin: Gilbert F-53 (D.64), Skolp E-07 (D.55), and Ogmund E-72 (D.70); (2) Hopedale Basin: Snorri J-90 (D.47), and Herjolf M-92 (D.53); (3) East Orphan Basin: Margaree A-49 Well (D.384); and (4) South Whale Basin: Lewis Hill G-85 Well (D.283).

Five FI types are recognised that are either primary, pseudosecondary, or secondary in origin. Type 1, Type 2 and Type 3 are aqueous FI and occur in all wells. Type 4 and Type 5 are hydrocarbon-bearing FI and are present in some samples from the Gilbert, Herjolf, and Margaree wells. Ultra-violet light microscopy of the hydrocarbon-bearing FI reveals an API gravity that ranges from ~30°–35° (yellow/ green fluorescence) to 45°–50° (blue/white fluorescence) suggesting the trapping of medium to light oils.

Type 1 two-phase (Liquid + Vapour = L+V; L>V) aqueous FI predominate in all well samples, homogenize to the liquid phase (~60°C to 150°C) and have salinities of <10 eq.wt.% NaCl. Furthermore, Type 1 define two populations in some wells (Population A: 80°C to 120°C; Population B: 120°C to 160°C) suggesting cyclical temperature fluctuations during the development of the Saglek, Hopedale and East Orphan basins. Coeval trapping of hydrocarbon and aqueous FI, e.g., the Gilbert well, facilitated the generation of isochores for both fluid types indicating the trapping of oil and aqueous fluids at ~380 to 460 bars and at temperatures of ~110°C.

Finally, these results will be combined with ongoing FI studies of other wells and discussed to provide insight into petroleum system development within frontier regions of Newfoundland and Labrador's offshore. This insight can be used to de-risk elements of the petroleum system within assessment regions where little data exists.