Fluid inclusion Signatures of North Atlantic Conjugate Marginal Basins, Eastern Canada and Western Ireland: Aspects of Fluid Dynamics in Sedimentary Basins

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Fluid inclusion studies of oil prospective basins can contribute to models of aqueous and hydrocarbon fluid dynamics in sedimentary basin environments. Geofluid studies of the Porcupine basin and of eastern Newfoundland and Labrador basins illustrate the application of such studies to frontier oil exploration in the conjugate marginal basins of the North Atlantic.

Porcupine basin studies of detrital quartz and authigenic cement hosted fluid inclusions show that basinal aqueous fluids trapped in cements are consistently of low to moderate salinity (<10 eq. wt.% NaCl). Migration of at least two chemically distinct hydrocarbon fluids occurred, post cementation, as lateral flow along Jurassic sandstones.

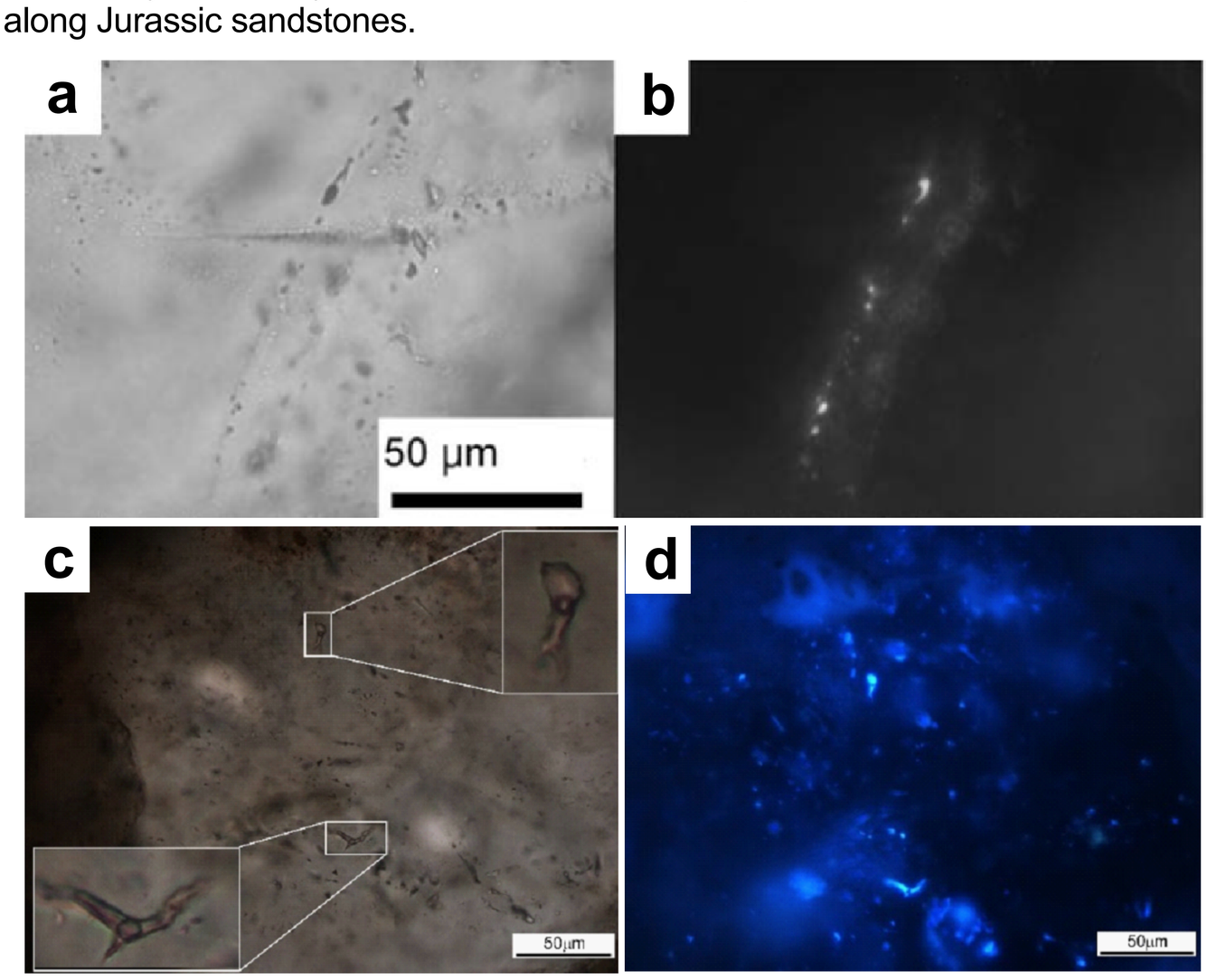

Fig 2. Photomicrographs showing HCFI and aqueos inclusions from Porcupine and Saglek Basins. a: (Porcupine Basin) trail of HCFI in detrital quartz grain; b: same view as (a) showing fluorescing HCFI; c: (Saglek Basin) HCFI inclusions in authigenic quartz cement; d: same view as (c) showing blue fluorescence.

Cement hosted primary aqueous fluids in Jurassic sandstones were trapped at temperatures (~70-120°C) and at deeper levels. Post cementation migration of aqueous fluids that occurred at high temperatures (up to 175°C) maybe associated with plume related activity during the opening of the North Atlantic. Similar studies of offshore Newfoundland and Labrador reveal the presence of hydrocarbon bearing fluid inclusions in the Cretaceous Markland Formation.

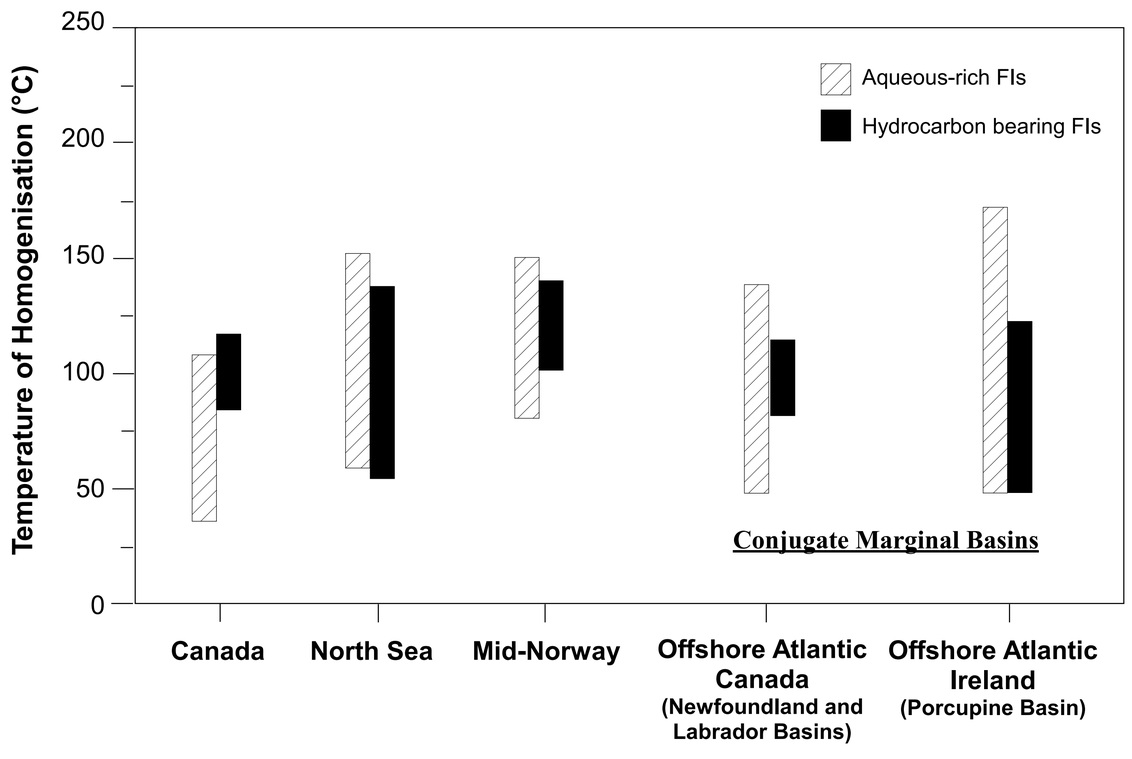

Fig 4. Comparison of T_H values for aqueous and hydrocarbon bearing fluid inclusions in conjugate marginal basins north Atlantic with other basins.

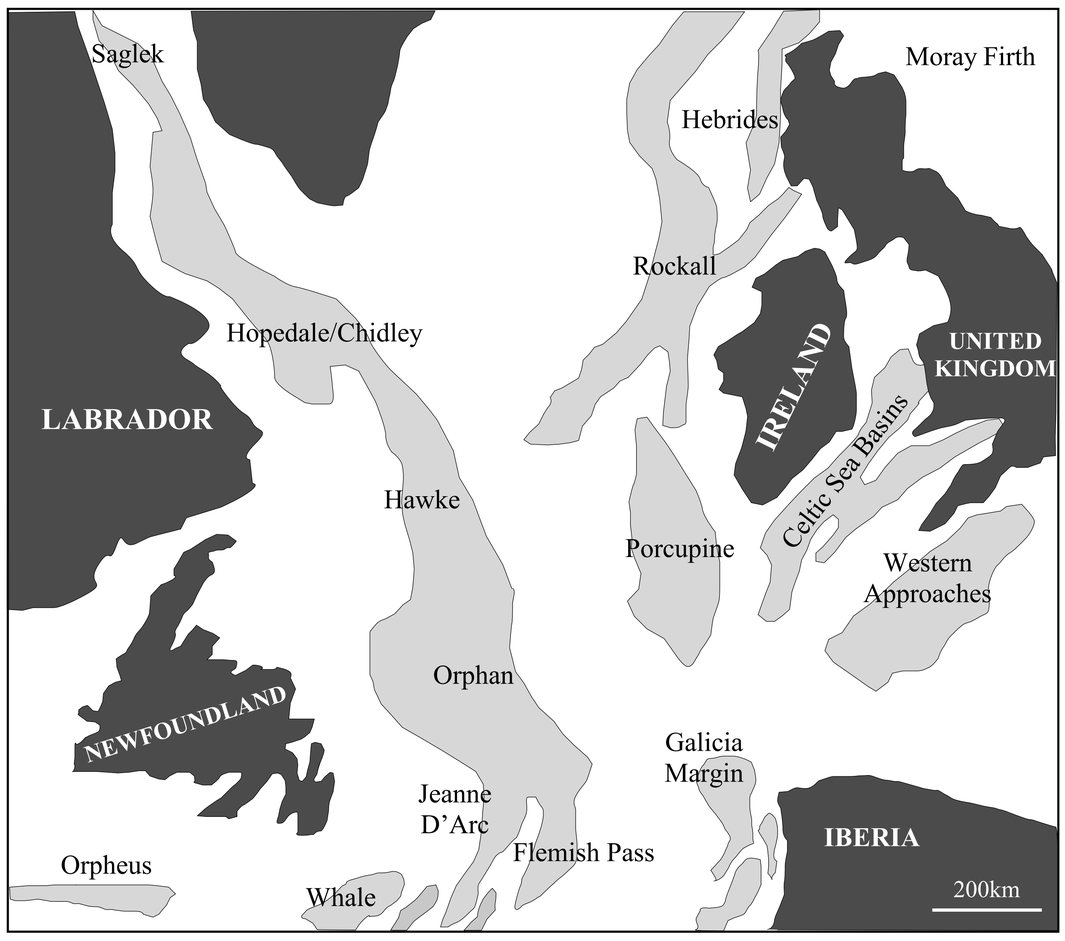

Fig 1. Map of the North Atlantic showing conjugate marginal basins (modified from Silva *et al*., 2015).

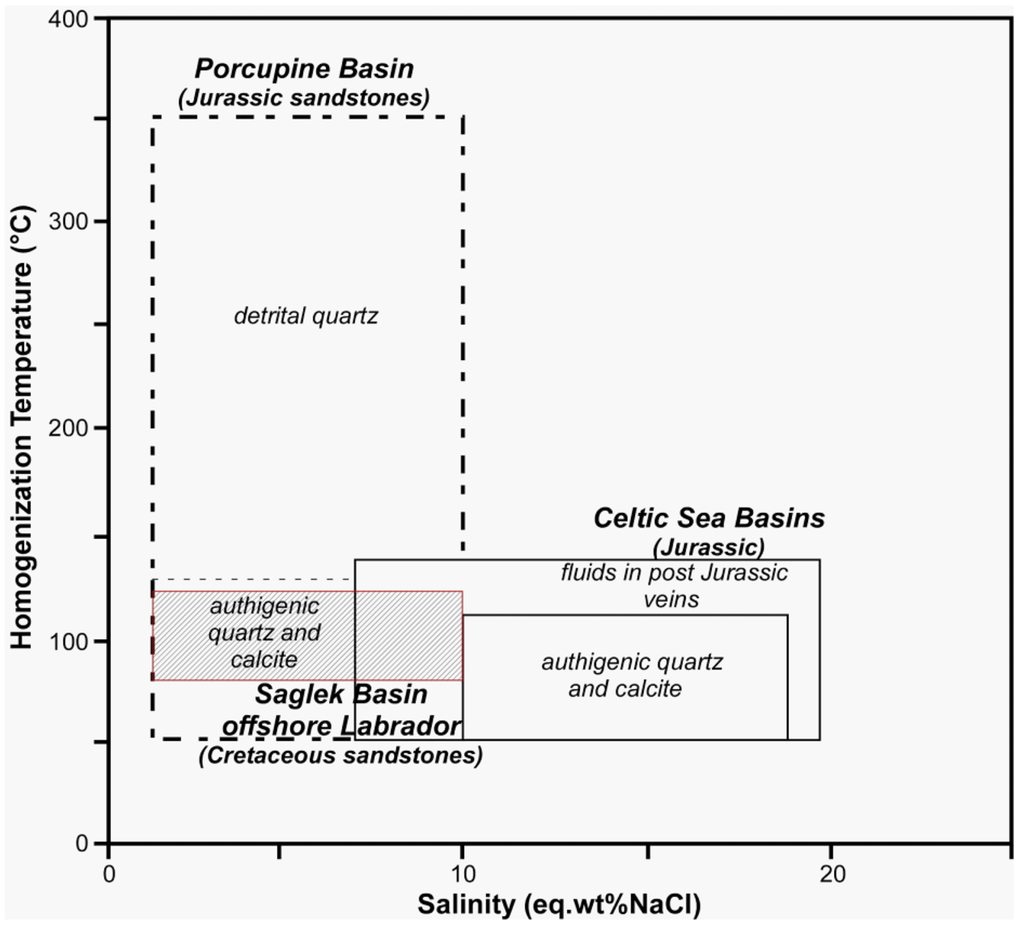

Fig 3. T_H-salinity fileds defined by FIs from conjugate margnal basin in the North Atlantic, *i.e.* Porcupine and Saglek Basins (Celtic Sea Basin also shown) (adapted from Feely and Parnell, 2003).

They yield temperatures of homogenisation of ~80°C and display blue fluorescence under UV light, indicating trapping of a high maturity oil with an API gravity of ~40-45°. Aqueous fluid inclusions were trapped between 80ºC and 120ºC, salinities are < 10 eq. wt.% NaCl. These inclusions represent low temperature (<120ºC) and low salinity (<10 eq.wt.% NaCl) fluids, typical of basinal fluids and similar to those recorded in the Porcupine Basin. Monophase aqueous inclusions occur in trails crosscutting detrital quartz grains in all conjugate marginal basins and indicate fluid trapping temperatures of <50ºC.

References

Feely, M., Parnell, J., 2003. Fluid inclusion studies of well samples from the hydrocarbon prospective Porcupine Basin, offshore Ireland. J.Geochemical Exploration, 78-79, p 55-59.

Silva, R.L., Wong, C., Wach, G., 2015. Source Rocks and Petroleum Systems of the Scotian Basin. Canadian Society of Exploration Geophysicists, 40, N8. 22-27.

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